



Kenya Climate Smart
Agriculture Project

Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Maize Value Chain

VOLUME I



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DISCLAIMER

The information presented in this inventory of Technologies, Innovations and Management Practices (TIMPs) book is for advisory use only. Users of this book should verify site specific details that relate to their agro-climatic zones from their area agricultural extension officers.

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FOREWORD

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) with the implementation of the project's Component 2 on 'Strengthening Climate-Smart Agricultural Research and Seed Systems'. The component activities are geared towards the development, validation, adoption and delivery of context specific climate smart agriculture (CSA) technologies, innovation and management practices (TIMPs). It is also responsible for development of sustainable seed production and distribution systems of priority agricultural value chains to enhance availability and access improved seeds, animal breeds and fingerlings by target beneficiaries. Against this background, KALRO and her National Agricultural Research System (NARS) partners have developed, validated and availed CSA TIMPs for dissemination and adoption. This document provides a detailed inventory of TIMPs that have been developed in Maize Value Chain.

Extensive information from research and background data has been used to develop this TIMPs inventory. To disseminate the TIMPs, a Training of Trainers (ToT) manual has been developed. The design of the manual takes into consideration the delivery system, partners and their roles, duration of training and logical flow of the modules. The training modules have uniform outline that ensures every aspect of the TIMPs are fully covered in way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. The use of this TIMPs inventory is expected to contribute to achievement of the envisaged KCSAP's project 'Triple Wins' of increased productivity, enhanced resilience and reduction of greenhouse gases emissions. Thus, this TIMPs inventory is to be used in conjunction with the respective Maize ToT Manual.

Finally, I am greatly indebted to the value chain leaders and all those who participated in the preparation of this inventory of TIMPs. It is expected to herald new ways of delivering training content that will enable realization of the project objectives and aspirations.

Eliud K. Kireger, PhD, OGW
Director General, KALRO

PREFACE

The Kenya Climate-Smart Agriculture Project (KCSAP) is a Government of Kenya project with support from both the World Bank and the government. The project runs for five years and implemented in 24 counties, mainly in the arid and semi-arid lands (ASALs), at an approximate cost of KES 25 billion. The project development objective (PDO) is “to increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response.” This objective is to be achieved through the implementation of five key components, which are: 1) Upscaling Climate-Smart Agricultural Practices, 2) Strengthening Climate-Smart Agricultural Research and Seed Systems, 3) Supporting Agro-weather, Market, Climate, and Advisory Services, 4) Project Coordination and Management and 5) Contingency Emergency Response.

Component 1 involves facilitating the empowering of farmers and communities to adopt technologies, innovations and management practices (TIMPs) to achieve the Climate Smart Agriculture (CSA) triple-wins of; increased productivity, enhanced resilience (adaptation), and reduced Greenhouse gas (GHG) emissions (mitigation). Component 2 is tasked with the responsibility of providing the TIMPs. Therefore, it supports the development, validation, and adoption of context specific CSA TIMPs to target beneficiaries under Components 1 and 3.

To catalyze uptake of TIMPs, Kenya Agricultural and Livestock Research Organization (KALRO) in conjunction with partners in the National Agricultural Research Systems (NARS) and Consultative Group for International Agricultural Research (CGIAR) compiled inventories of TIMPs for the prioritized value chains. The crop-based value chains are 19 and include roots and tubers (cassava, potato), pulses (dry beans, green gram and pigeon peas), vegetables (tomato, onion, indigenous vegetables, kale and cabbage), cereals (sorghum, millet, maize, teff) nuts (cashew nut), fruits (banana, mango, water melon) and fibre (cotton). Those that are animal production based are five (5) and include apiculture, indigenous chicken (meat and eggs), dairy (cattle and camel), red meat (cattle, sheep and goats) and aquaculture. Also, there are three (3) cross cutting themes on pastures and fodder, natural resource management, and animal health. The TIMPs have been categorized into those ready for upscaling and those requiring validation. Furthermore, gaps that required further research and development of TIMPs have been identified. Training of Trainers’ (ToT) manuals focusing on TIMPs that are ready for upscaling for each of the value chains have been subsequently developed to form the basis of training county extension staff, service providers and lead farmers. Those trained are in turn expected to cascade the training to beneficiaries in the targeted smallholder farming, agro-pastoral and pastoral communities in the 24 project counties of Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.

KALRO, having the responsibility of implementing the activities under Component 2, has been instrumental in using its information resources and those of partners and collaborators to come up with the inventories of TIMPs and corresponding ToT manuals. Use of these information resources coupled with the accompanying training and contribution of the other project components will go a long way in enabling KCSAP to meet its development objectives.

The National Project Coordination Unit is grateful to all who participated in the development and production of this TIMPs inventory for Maize Value Chain. It is my hope that counties and other users will put this resource to good use as they transform and reorient their agricultural systems to make them more productive and resilient while minimizing GHG emissions under the new realities of the changing climate.

John Nginyangi

National Project Coordinator

Kenya Climate-Smart Agriculture Project

ABBREVIATIONS AND ACRONYMS

AAK	Agrochemical Association of Kenya
AATF	African Agricultural Technology Foundation
AEZ	Agroecological Zone
AFA	Agriculture and Food Authority
AIP	Agricultural Innovation Platforms
CA	Conservation Agriculture
CABI	Centre for Agriculture and Bioscience International
CBO	Community Based Organisation
CCPs	Critical Control Points
CGIAR	Consultative Group for International Agricultural Research
CIG	Common Interest Group
CIMMYT	International Centre for Research in maize and Wheat
FAO	Food and Agriculture Organisation
FAW	Fall Armyworm
FBO	Farmer Based Organization
FFBS	Farmer Field and Business School
FFS	Farmer Field School
FPEAK	Fresh Produce Exporters Association of Kenya
FSMS	Food Safety Management System
GAP	Good Agricultural Practice
GHP	Good Horticultural Practice
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis Critical Control Points
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ICM	Integrated Crop Management
ICRAF	International Centre for Research in Agroforestry (World Agroforestry Centre)
IITA	International Institute of Tropical Agriculture
ILRI	international Livestock Research Institute
IPM	Integrated Pest Management
iSDA	Innovative Solution for Decision Agriculture
ITK	Indigenous Technical Knowledge
KALRO	Kenya Agricultural and Livestock Research Organization
KCSAP	Kenya Climate-Smart Agriculture Project
KEPHIS	Kenya Pant Heath Inspectorate Service
MLND	Maize Lethal Necrosis disease
MoALFC	Ministry of Agriculture, Livestock, Fisheries and Cooperatives
MSV	Maize Streak Virus
NARI	National Agricultural Research Institute
NGO	Non-Governmental Organization
OPV	Open Pollinated Variety
PCPB	Pest Control Products Board
QPM	Quality Protein maize
RELMA	Regional Land Management Unit
STAK	Seed Traders Association of Kenya
TIMPs	Technologies, Innovation and Management Practices
ToT	Training of Trainer
VMG	Vulnerable and Marginalized Group
WEMA	Water Efficient Maize for Africa

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1 DEFINITION OF TERMS AND SUMMARY TABLES OF MAIZE TECHNOLOGIES, INNOVATIONS AND MANAGEMENT PRACTICES (TIMPS)

1.1 DEFINITION OF TERMS

Technology: This is an output of a research process which is beneficial to the target clientele (mainly farmers for KCSAP's case), can be commercialized and can be patented under intellectual property rights (IPR) arrangements. It consists of research outputs such as tools, equipment, genetic materials, breeds, farming and herding practices, gathering practices, laboratory techniques, models etc.

Management practice: This is a recommendation on a practice that is considered necessary for a technology to achieve its optimum output. It includes different agronomic practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation and watering regimes), crop protection for crops and feed rations and disease control for livestock.

Innovation: This is a modification of an existing technology for an entirely different use from the original intended use. (e.g., fireless cooker modified to be used as a hatchery).

1.2 SUMMARY OF INVENTORY OF TIMPS IN THE MAIZE VALUE CHAIN

The inventory process identified. TIMPs comprising **116** technologies **20** innovations and **57** management practices, distributed among the 6 sub-themes, as indicated in table 1.

Table 1: Summary of maize TIMPs

Commodity/ value chain	Sub-Theme	Technologies	Innovations	Management Practices
Maize	Improved maize varieties	79	0	0
Maize	Maize seed system	0	3	0
Maize	GAPs and Food Safety	1	0	2
Maize	Agronomic management practices	0	0	9
Maize	Soil fertility management	0	1	3
Maize	Soil & water management	9	0	2
Maize	Irrigation and drainage	1	0	0
Maize	Agroforestry systems	0	0	1
Maize	Maize Crop health	3	0	15
Maize	Weed Management	2	1	9
Maize	Harvesting and Postharvest management	10	0	3
Maize	Maize Value addition	3	14	0

Maize	Mechanization of maize production activities	8	1	0
Maize	Maize Farming Business and marketing	0	0	8
Maize	Elements of Agricultural Policies	0	0	5
Total		116	20	57

1.3 SUMMARY OF STATUS OF TIMPS IN MAIZE VALUE CHAIN

The inventory process resulted in a total of **149** TIMPs that are ready for up scaling, **37** TIMPs that require validation and **5** TIMPs that require further research in the sub-themes, as indicated in Table 2.

Table 2: Number of TIMPs ready for upscaling, require validation or further research

Commodity/ value chain	Sub-Theme	Technologies	Innovations	Management Practices
Maize	Improved maize varieties	79	0	0
Maize	Maize seed system	0	3	0
Maize	GAPs and Food Safety	1	0	2
Maize	Agronomic management practices	0	0	9
Maize	Soil fertility management	0	1	3
Maize	Soil & water management	9	0	2
Maize	Irrigation and drainage	1	0	0
Maize	Agroforestry systems	0	0	1
Maize	Maize Crop health	3	0	15
Maize	Weed Management	2	1	9
Maize	Harvesting and Postharvest management	10	0	3
Maize	Maize Value addition	3	14	0
Maize	Mechanization of maize production activities	8	1	0
Maize	Maize Farming Business and marketing	0	0	8
Maize	Elements of Agricultural Policies	0	0	5
Total		116	20	57

1.4 INVENTORY OF MAIZE TIMPS BY CATEGORY AND STATUS

Table 3: Inventory of maize TIMPs by Category and Status

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.2 Improved maize varieties	2.2.1 Coastal Lowlands		
	Coast composite maize	Technology	Ready for upscaling
	WSQ104 (OPV)	Technology	Ready for upscaling
	KH500Q	Technology	Ready for upscaling
	Shukran-16	Technology	Ready for upscaling
	PH4	Technology	Ready for upscaling
	PH1	Technology	Ready for upscaling
	WE2111	Technology	Ready for upscaling
	MTPEH0701	Technology	Ready for upscaling
	MTPEH0702	Technology	Ready for upscaling
	MTPEH0703	Technology	Ready for upscaling
	MTPEH200804	Technology	Ready for upscaling
	MTPEH200805	Technology	Ready for upscaling
	2.2.2 Medium Altitude - Dry		
	KCB (Katumani Composite B)	Technology	Ready for upscaling
	KDH6 SBR	Technology	Ready for upscaling
	KH414-03 SBR	Technology	Ready for upscaling
	KDH414-11 (Ukamez 6)	Technology	Ready for upscaling
	KDH414-12 (Ukamez 7)	Technology	Ready for upscaling
	WE2109	Technology	Ready for upscaling
	2.2.3 Medium Altitude - Moist		
	WE2101	Technology	Ready for upscaling
	WE2104	Technology	Ready for upscaling
	WE2107	Technology	Ready for upscaling
	WE2108	Technology	Ready for upscaling
	WE5206	Technology	Ready for upscaling
	WE5230	Technology	Ready for upscaling
	EMB225	Technology	Ready for upscaling
	EMB226	Technology	Ready for upscaling
	KH500-40E	Technology	Ready for upscaling
	KH500-39E	Technology	Ready for upscaling
	KH500-56A	Technology	Ready for upscaling
	KH500-Q	Technology	Ready for upscaling
	2.2.4 Medium Altitude Transitional		
	WE2106	Technology	Ready for upscaling
	WE3104	Technology	Ready for upscaling
	WE3106	Technology	Ready for upscaling
	WE5107	Technology	Ready for upscaling
	WE5113	Technology	Ready for upscaling
	WE5138	Technology	Ready for upscaling
	WE5205	Technology	Ready for upscaling
	WE5210	Technology	Ready for upscaling
	WE5213	Technology	Ready for upscaling

	WE5218	Technology	Ready for upscaling
	WE5227	Technology	Ready for upscaling
	KH500-13E	Technology	Ready for upscaling
	KH500-51A	Technology	Ready for upscaling
	KH500-52A	Technology	Ready for upscaling
	KH500-53A	Technology	Ready for upscaling
	KH500-54A	Technology	Ready for upscaling
	KH500-55A	Technology	Ready for upscaling
	2.2.5 Highlands		
	KH600-11D	Technology	Ready for upscaling
	KH600-23A	Technology	Ready for upscaling
	High Altitude Composite (HAC)	Technology	Ready for upscaling
	KH600-14E	Technology	Ready for upscaling
	KH600-15A	Technology	Ready for upscaling
	KH600-16A	Technology	Ready for upscaling
	KH600-17A	Technology	Ready for upscaling
	KH600-18A	Technology	Ready for upscaling
	KH600-19A	Technology	Ready for upscaling
	KH600-20A	Technology	Ready for upscaling
	KH600-21A	Technology	Ready for upscaling
	KH600-22A	Technology	Ready for upscaling
	KH600-23A	Technology	Ready for upscaling
	KH600-25A	Technology	Ready for upscaling
	KH600-26A	Technology	Ready for upscaling
	KH600-27A	Technology	Ready for upscaling
	H614D	Technology	Ready for upscaling
	H626	Technology	Ready for upscaling
	H625	Technology	Ready for upscaling
	H6213	Technology	Ready for upscaling
	H6218	Technology	Ready for upscaling
	H6210	Technology	Ready for upscaling
	H629	Technology	Ready for upscaling
	H628	Technology	Ready for upscaling
	H624	Technology	Ready for upscaling
	2.2.6 Special Kit - MLN		
	WE5135	Technology	Ready for upscaling
	WE5139	Technology	Ready for upscaling
	WE5140	Technology	Ready for upscaling
	KATEH16-02	Technology	Ready for upscaling
	KATEH16-03	Technology	Ready for upscaling
2.3 Maize seed system	2.3.1 Improved Farmer Saved Seed-System	Innovation	Requires validation
	2.3.2 Quality Declared Seed system	Innovation	Requires validation
	2.3.3 Maize Formal Seed System	Innovation	Ready for upscaling
2.4 Good Agricultural Practices and	2.4.1 Good Agricultural Practices (GAP) for maize	Management practice	Ready for upscaling

Food Safety Management Systems	2.4.2 Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for maize Value Chain in Kenya	Management practice	Ready for upscaling
	2.4.3 Aflasafe KE01™	Technology	Ready for upscaling
2.5 Agronomic management practices	2.5.1 land preparation	Management practice	Ready for upscaling
	2.5.2 Maize variety (seed) selection	Management practice	Ready for upscaling
	2.5.3 Planting Spacing	Management practice	Ready for upscaling
	2.5.4 Intercropping	Management practice	Ready for up-scaling with some aspects requiring further research
	2.5.5 Weeding	Management practice	Ready for upscaling
	2.5.6 Basal Fertilizer application	Management practice	Ready for upscaling
	2.5.7 Top dressing fertilizer	Management practice	Ready for upscaling
	2.5.8 Timely harvesting	Management practice	Ready for upscaling
	2.5.9 Crop rotation	Management practice	Ready for upscaling
2.6 Soil fertility management	2.6.1 Integrated soil fertility management	Management practice	Requires validation
	2.6.2 Integrated manure management	Management practice	Further research
	2.6.3 Rapid soil testing services	Innovation	Requires validation
	2.6.4 Low cost composting technology	Management practice	Requires validation
2.7 Soil and water management	2.7.1 Conservation agriculture	Management practice	Ready for up-scaling
	2.7.2 Zai pits	Technology	Ready for up-scaling
	2.7.3 Contour bunds	Technology	Ready for up-scaling
	2.7.4 Bench terraces	Technology	Ready for up-scaling
	2.7.5 Fanya Juu terraces	Technology	Ready for up-scaling
	2.7.6 Grass strips	Technology	Requires validation
	2.7.7 Stone lines	Technology	Requires validation
	2.7.8 Tied ridges	Technology	Requires validation
	2.7.9 Retention Ridges	Technology	Ready for up-scaling
	2.7.10 Mulching	Technology	Further research
	2.7.11 Intercropping	Management practice	Further research
2.8 Irrigation and drainage management	2.8.1 Furrow irrigation system	Technology	Ready for up scaling

2.9 Agroforestry systems	2.9.1 Agroforestry for soil fertility	Management practice	Requires validation
2.10 Maize Crop Health	2.10.1 Integrated management of Fall Army Worm	Management Practice	Ready for upscaling
	2.10.2 Integrated management of Bollworm (<i>Heliothis armigera</i>)	Management Practice	Ready for upscaling
	2.10.3 Integrated management of Stem Borer	Management practice	Ready for upscaling
	2.10.4 Integrated management of Aphids (<i>Rhopalosiphum maydis</i>)	Management practice	Require validation
	2.10.5 Integrated Pest Management of African Army worm	Management Practice	Ready for upscaling
	2.10.6 Integrated Management of soil pests Cut worms (<i>Agrotis</i> spp)	Management Practice	Ready for upscaling
	2.10.7 Integrated management of Maize weevils	Management Practice	Ready for upscaling
	2.10.8 Integrated management of larger grain borer	Technology	Require validation
	2.10.9 Integrated management of thrips (<i>Frankliniella</i> spp.) in maize	Management Practice	Ready for upscaling
	2.10.10 Integrated Management of maize Lethal Necrosis disease (MLND) affecting maize	Management Practice	Ready for upscaling
	2.10.11 Integrated	Management	Ready for upscaling
	management of maize Common Rust (<i>Puccinia sorghi</i>)	Practice	
	2.10.12 Integrated management of maize Common Smut disease	Management Practice	Ready for upscaling
	2.10.13 Integrated Management of common maize head smut diseases	Management Practice	Ready for upscaling

	2.10.14 Integrated Management of Downy mildew (<i>Perenosclerospora</i> sp.) disease of maize	Management Practice	Ready for upscaling
	2.10.15 Integrated Management of Gray leaf spot (<i>Cercospora spp</i>) of mize	Management Practice	Ready for upscaling
	2.10.16 Integrated Management of maize Streak Virus (MSV) disease affecting mize	Management Practice	Ready for upscaling
	2.10.17 Integrated Management of Aspergillus Ear rot (<i>Aspergillus spp</i>) in mize	Management Practice	Ready for upscaling
	2.10.18 Integrated Management of Fusarium Ear Rot (<i>Fusarium spp.</i>) in mize	Management Practice	Ready for upscaling
	Scouting for pests in maize fields	Management Practice	Ready for upscaling
2.11 Weed Management	2.11.1 Maize Integrated Weed Management	Management Practice	Requires Validation
	2.11.2 Integrated management of striga in maize	Management Practice	Requires Validation
	2.11.3 Cover cropping for mize weed management	Management Practice	Requires Validation
	2.11.4 Mulching for weed management in maize	Management Practice	Requires Validation
	2.11.5 Herbicide (Chemical) Weed Control	Technology	Requires Validation
	2.11.6 Herbicide resistant maize	Technology	Ready for upscaling
	2.11.7 Solarisation Bed Weed Control	Management Practice	Requires Validation
	2.11.8 Mechanical Weed control in maize	Innovation	Ready for upscaling
	2.11.8 Stale seed bed for Weed Control	Management Practice	Requires Validation
	2.11.9 Crop Rotation to control weeds in mize	Management Practice	Ready for upscaling

	2.11.9 Use of herbicides	Management Practice	Ready for upscaling
2.12 Harvesting and Postharvesting	2.12.1 Maturity indices	Management practice	Requires validation
	2.12.2. Stooking maize during arvesting	Management practice	Ready for upscaling
	2.12.3 Drying of maize cobs (the mize cib)	Technology	Ready for upscaling
	2.12.4 Drying of maize cobs (tarpaulins)	Technology	Validation
	2.12.5 Threshing/shelling of maize Hand threshers Motorised threshers	Technology	Requires validation
	2.12.6 Drying of grain after threshing Sun drying Solar rump drying Greenhouse solar driers Electric driers DehyTray	Technology	Requires validation
	2.12.7 Hygrometers for moisture content determination in maize	Technology	Ready for upscaling
	2.12.8 Subjective methods for Grain moisture content determination in maize	Management practice	Ready for upscaling
	2.12.9 Winnowing	Technology	Requires validation
	2.12.10 Hermetic storage bags Purdue Improved Crop Storage (PICS) bags Agro-Z GrainPro	Technology	Ready for upscaling
	2.12.11 Metal silo	Technology	Requires validation
	2.12.12 Maize stores	Technology	Requires validation
2.13 Value Addition	2.13.1 Corn Starch	Innovation	Requires validation
	2.13.2 Tortillas	Innovation	Requires validation
	2.13.3 Ogi	Innovation	Requires validation
	2.13.4 Popcorn	Innovation	Ready for Upscaling
	2.13.5 Maize beer	Technology	Requires validation
	2.13.6 Maize oil	Technology	Requires validation
	2.13.7 Maize candy	Innovation	Requires validation
	2.13.8 Corn sauce	Innovation	Requires validation
	2.13.9 Corn Syrup	Innovation	Requires validation
	2.13.10 Maize Crackies	Innovation	Ready for Upscaling
	2.13.11 Maize Sausages	Innovation	Requires validation
	2.13.12 Maize Kebab	Innovation	Requires validation
	2.13.13 Maize Mandazi	Innovation	Ready for Upscaling
	2.13.14 Maize Cake	Innovation	Ready for Upscaling

	2.13.15 Maize Cookies	Innovation	Ready for Upscaling
	2.13.16 Masa	Innovation	Requires validation
	2.13.17 Nixtamalization	Technology	Requires validation
2.14 Mechanization of maize production activities	2.14.1 Power tiller	Technology	Ready for upscaling
	2.14.2 Four Wheeled Tractor 50Hp	Technology	Ready for upscaling
	2.14.3 Mouldboard plough	Technology	Ready for upscaling
	2.13.4 Harrow	Technology	Ready for upscaling
	2.14.5 Planter	Technology	Requires Further Research
	2.14.6 Motorized sprayer	Technology	Ready for upscaling
	2.14.7 Power Weeder	Technology	Requires Further Research
	2.14.8 Maize harvester	Technology	Ready for upscaling
	2.14.9 Maize Sheller	Innovation	Ready for upscaling
2.15 Maize Farming Business and marketing	2.14.1 Models for market-oriented production of maize	Management practices	Ready for upscaling
	2.15.2 Building a business plan	Management practices	Ready for upscaling
	2.15.3 Marketing as a group - collective marketing	Management practices	Ready for upscaling
	2.15.4 Profitability analysis – performance of maize agro-enterprise	Management practices	Ready for upscaling
	2.15.5 Scaling up plan	Management practices	Requires validation;
	2.15.6 Contracted production model	Management practices	Requires validation;
	2.15.7 Maize entrepreneurship model	Management practices	Requires validation;
	2.15.8 Internet/mobile marketing	Management practices	Requires validation;
2.16. Elements of Agricultural Policies	2.16.1. National Agricultural Framework related to maize	Management practices	Ready for upscaling
	2.16.2 Policy options and objectives related to Maize farming	Management practices	Ready for upscaling
	2.16.3 Instruments of policy related to maize	Management practices	Ready for upscaling
	2.16.4 Policy cycle for policy issues and implementation	Management practices	Ready for upscaling
	2.16.5 Policy validation cycle for policy customization	Management practices	Ready for upscaling

2 DETAILED MAIZE VALUE CHAIN TIMPS

2.1 SUITABILITY MAP FOR MAIZE GROWING IN KENYA

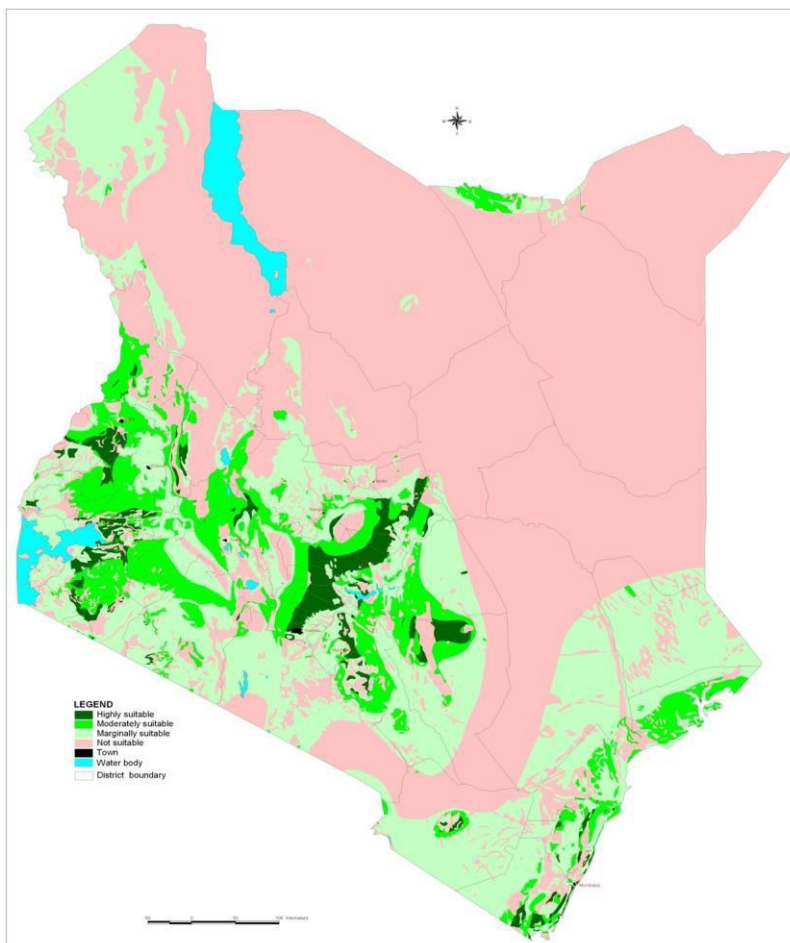


Figure 1: Suitability map of Kenya

2.2 IMPROVED MAIZE VARIETIES

2.2.1 Coastal Lowlands

2.2.1.1 Coast Composite Maize

TIMP Name	Coast composite maize (CCM)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, high temperature (heat wave) stress during pollination stage of maize plant causing up to 100% yield loss and yield losses in the range of 10% to 75% due to common leaf rust (<i>Puccinia sorghi</i>).
What is it? (TIMP description)	Coast composite maize is an open pollinated heat tolerant variety with yield potential of 16-21 bags of 90 kg, per acre that has resistance to common leaf rust. The medium maturity (110-120 days) variety has shiny flint kernels, a good husk cover and is suitable for cultivation under rainfed and irrigated conditions. Coast composite maize crop and ears 
Justification	Seventy percent of small-scale farmers in the coastal lowlands of Kenya cultivate unimproved low yielding maize varieties that are susceptible to common rust resulting to yield losses especially during outbreaks. Being a heat tolerant variety of medium maturity that is resistant to common leaf rust make CCM a good bet for growing in the coastal lowlands where it is well adapted to, even with climate variability. The variety's good husk cover and suitability for rainfed and irrigated conditions enables it to be promoted for growing with supplemental irrigation where rains may be irregular with climate change.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Agricultural service providers.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and

	exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform in coastal Kenya; • Availability, accessibility and affordability of certified seeds, • Good seed system to ensure quality, diversification of maize food products through value addition, • Strong partnership linkages, good marketing models and pathways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• KALRO Seeds for production of early generation and certified seeds; • Seed companies for certified seed production and distribution; • Agro dealers selling of certified seed; • Agricultural extension service providers (Public and private) to participate in dissemination; • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River
Counties where TIMP will be upscaled	Tana River
Challenges in dissemination	• High cost of seeds, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on CCM by agricultural extension service providers (Public and private), • Limited maize value added products.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, NGOs, marketers and processors, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, promote value addition and consumption of value-added products for increased maize production, • Facilitate continuous maintenance of early generation seed by KALRO breeders, licensed seed merchants to produce certified seed, • Initiate community-based maize seed production,

	• Avail information on CCM to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and upscaling	• CCM is an already “a climate change ready crop” due to its heat stress tolerance adaptation ability. • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in coast region hence the need to capacity build them, enabling policy and policy review from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production per acre KES 23,000
Estimated returns	Gross returns per acre KES 40,000; Profits per acre KES 17,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on PH4 • Develop gender friendly training materials with illustrations to enhance communication, Target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition

	channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of CCM, • Conduct demonstrations in their maize farms
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security

E: Case studies/profiles of success stories

Success stories from previous similar projects	Coast composite commands high adoption in coastal region of Kenya. Farmers prefer it to other maize varieties due its ability to produce higher yields even with minimal inputs. The cob size for the variety is long hence preferred for green maize marketing since it takes fewer cobs to fill the sack than other varieties grown in the region
Application guidelines for users	References - Maize: What variety do I grow in coastal Kenya. Leaflet - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)

Ready for upscaling

G. Contacts

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Lead organizations/scientists	KALRO-ICRI-Mtwapa
Partner organizations	County governments, CBOs

Research gaps

1. Being an open pollinated variety recurrent selection needs to be done to improved the population

2.2.1.2 WSQ104

TIMP Name	WSQ104
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Unavailability of maize varieties improved for high protein content to address the problem of high protein deficiency in infants and school going children.
What is it? (TIMP description)	WSQ104 is a QPM maize variety that contains nearly twice as much lysine and tryptophan, amino acids that are essential for humans  and monogastric animals but are limiting amino acids in normal maize grains. QPM is a product of conventional plant breeding, a good example of biofortification and not genetically modified. The variety WSQ104 is an open pollinated variety of extra early maturity (90 -105 days) with a yield potential of 15 bags of 90kgs per acre and has tolerance to drought. Kernels are white flint type. It is suitable for areas from 0 to 1200 m above sea level. WSQ104 (Source: Musila R.)
Justification	Maize is a staple food and a major source of protein in the coastal lowlands of Kenya where protein related malnutrition deficiency are high especially among infants, school going children's and pregnant women. WS104Q is a quality protein improved maize variety that is early maturing and drought tolerant and therefore make it a variety of choice in the coastal lowlands of Kenya which experiences frequent droughts during the maize growing seasons and also as a source of protein for infants, school going children, pregnant women and people living with HIV/AIDS.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Agricultural service providers.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural

	shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform in coastal Kenya, • Seed availability, accessibility and affordability, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • Strong partnership linkages, • Good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• Western seed company for certified seed production and distribution, • Agro dealers for certified seed distribution, market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, agricultural • Extension service providers (Public and private) to participate in dissemination, financial institutions (banks, donors, credit facilitators) for financial solution.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyanga and Embu.
Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	• Unavailability of certified seed for WS104Q in the market, • High cost of seeds, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on WS104Q by agricultural extension service providers (Public and private), • Limited maize value added products at household level, • Labour intensity in planting, weeding, harvesting, limited use of recommended agronomic practices, • Limited access to rural finance for maize production
Suggestions for addressing the challenges	• Encourage Western Seed Company to produce certified seed for WS104, • Research to develop heat tolerant QPM high yielding superior varieties, • Establish qpm innovation platforms that involves farmers, national and county governments, seed merchants, ngos,

	marketers and processors, • Information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value added QPM products for increased QPM production, • Facilitate continuous maintenance of early generation seed, initiate community-based production of QPM since it is an OPV, avail information on QPM to agricultural service providers for dissemination to farmers,
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP.
Social, environmental, policy and market conditions necessary for development and upscaling	• Creation of awareness on nutritional value of QPM, • Need a policy to enforce production of QPM varieties in order to address related malnutrition issues in Kenya, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • Maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time, enabling policy and policy review from time to time such as implementation of mandatory cultivation of biofortified maize.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production per acre KES 23,000
Estimated returns	Gross returns per acre KES 40,500; Profits per acre KES 17,500
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due

	to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on WSQ104 • Develop gender friendly training materials with illustrations to enhance communication, Target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of PH4, • Conduct demonstrations in their maize farms
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Through the DONATA project WSQ104 was successfully promoted in Kilifi County in 2010. However, unavailability of seed has been a major drawback to adoption of this technology in the coast region of Kenya,
Application guidelines for users	References • Musila <i>et al.</i>, Quality Protein maize (QPM). Leaflet • Kimenye L. and McEwan M. (eds). 2014. Scaling up, Dissemination and Adoption of Agricultural Technologies using Innovation Platforms—Lessons from Eastern and Central Africa. ASARECA (Association for Strengthening Agricultural Research in Eastern and

	Central Africa), Entebbe
F: Status of TIMP readiness (1-ready for upscaling, 2- requires validation; 3- requires further research)	Ready for upscaling
G. Contacts	
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Lead organizations/scientists	CIMMYT Kenya
Partner organizations	Western Seed Company, NGOs, County governments, CBOs

Research Gaps

1. Improve the variety for storability.

2.2.1.3 KH500Q

TIMP Name	KH500Q
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Unavailability of maize varieties improved for high protein content to address the problem of high protein deficiency in infants and school going children, malnutrition disorders in regions where maize is a major staple food.
What is it? (TIMP description)	KH500Q is a QPM maize variety that contains nearly twice as much lysine and tryptophan, amino acids that are essential for humans and monogastric animals but are limiting amino acids in normal maize grains. QPM is a product of conventional plant breeding, a good example of biofortification and not genetically modified. The variety KH500Q is a three-way cross maize hybrid with yield potential of 36 bags of 90 kgs per acre, drought tolerant, resistant to grey leaf spot, northern leaf blight and maize streak virus (MSV). It has a good husk cover and a white dent grain texture. Matures in about 90 – 120 days.
Justification	KH500Q is a quality protein maize advantageous over normal maize in that it contains twice the amount of essential amino acids (lysine and tryptophan) required for growth but usually insufficient in humans and mono-gastric animals such as poultry and pigs. Under smallholder farmer conditions, increasing dietary protein in maize is similar to raising income, because families benefit from enhanced nutrition without additional field work or spending scarce money on animal sources of protein such as meat and milk. Cultivation of KH500Q by smallholder farmers in the mid altitude and coastal lowlands of Kenya will result to a yield increase of 20% more than the non –drought tolerant maize varieties grown in the region. It will also deliver co –benefits for resistance to MSV and enhanced nutrition in

	terms of protein.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed companies, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform in coastal Kenya, • Seed availability, accessibility and affordability, good seed system to ensure quality, • Diversification of maize food products through value addition, strong partnership linkages, • Good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• KALRO Seeds- Embu and other seed companies for certified seed production and distribution, • Agro dealers for certified seed distribution, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, • Agricultural extension service providers (Public and private) to participate in dissemination, financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	Kirinyanga, Embu
Counties where TIMP will be upscaled	All KCSAP counties where KH500Q is adapted including Tana River
Challenges in dissemination	• Unavailability of certified seed for WS104Q in the market, • High cost of seeds, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on WS104Q by agricultural extension service providers (Public and private), • Limited maize value added products at household level, • Labour intensity in planting, weeding, harvesting, • Limited use of recommended agronomic practices, • Limited access to rural finance for maize production.
Suggestions for addressing	• Facilitate continuous maintenance of early generation seed

the challenges	for KH500Q by KALRO – Embu breeders, • KALRO Seeds – Embu to produce certified seed, • License private seed merchants to produce certified seed, • Establish QPM innovation platforms that involves farmers, • National and county governments, seed merchants, • NGOs, marketers and processors, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value added QPM products for increased QPM production, • Initiate community-based maize seed production, • Avail information on KH500Q to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP.
Social, environmental, policy and market conditions necessary for development and upscaling	• Creation of awareness on nutritional value of QPM, • Need a policy to enforce production of QPM varieties in order to address related malnutrition issues in Kenya, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre- harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, • Consumption and marketing, maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time such as implementation of mandatory cultivation of biofortified maize.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production per acre KES 25,000
Estimated returns	Gross returns per acre KES 90,000; profits per acre KES 65,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels

	• Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers'
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on PH4 • Develop gender friendly training materials with illustrations to enhance communication, target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of KH500Q, • Conduct demonstrations in their maize farms
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for improved maize demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Through the DONATA project KH500Q was successfully promoted in Embu, Kirinyanga and Murang'a counties in 2010, However, unavailability of seed has been a major drawback to adoption of this technology in the coast region and other counties where it is suitable. Success stories of adoption of QPM maize and its impacts can be found in Ethiopia and Ghana
Application guidelines for users	References - Musila <i>et al.</i> , Quality Protein maize (QPM). Leaflet - Kimenye L. and McEwan M. (eds). 2014. Scaling up, Dissemination and Adoption of Agricultural Technologies using Innovation Platforms—Lessons from Eastern and Central Africa. ASARECA (Association for Strengthening

	Agricultural Research in Eastern and Central Africa), Entebbe
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	Ready for upscaling
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Lead organization/scientists	KALRO Embu
Partner organizations	CIMMYT Kenya, MOALF, County governments

Research gaps

1. Improve KH500Q for storability.

2.2.1.4 Pwani Hybrid 4 (PH4)

TIMP Name	Pwani Hybrid 4 (PH4)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, high temperature (heat wave) stress during pollination stage of maize plant causing up to 100% yield loss.
What is it? (TIMP description)	A maize hybrid of medium maturity (120-150 days) with average yield potential of 24 bags of 90 kgs per acre, tolerant to heat stress and partial resistance to maize streak virus. May be grown under rainfed and irrigation conditions. 
Justification	The heat tolerance and medium maturity traits in PH4 make it ideal for cultivation in the coastal lowlands of Kenya. Under heat stress and terminal drought conditions the variety gives a yield increase of 20% more than the other commercial maize varieties grown in the region. It also delivers co –benefits for resistance to most of the leaf and ear diseases prevalent in the region. The variety also does well under irrigated areas especially in Tana River. This translates to increased food

	security and improved livelihoods of small-scale farmers in the coast region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed companies, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform; • Availability, accessibility and affordability of certified seeds, good seed system to ensure quality, Diversification of maize food products through value addition, • Strong partnership linkages, • Good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• Kenya seed company for certified seed production and distribution, • Agro dealers for certified seed distribution, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • Agricultural extension service providers (Public and private) to participate in dissemination, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River
Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	• Inadequate certified seed for PH4, • High cost of seeds, lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, limited information on PH4 by agricultural extension service providers (Public and private), • Limited maize value added products.
Suggestions for addressing the challenges	• Facilitate continuous maintenance of early generation and certified seed by Kenya seed company, • Establish innovation platforms that involves farmers, • national and county governments,

	• seed merchants, NGOs, marketers and processors, information on good agronomic practices for maize production, • mechanize small-scale maize production, • promote marketing models that encourage collective production and marketing, promote value addition and consumption of value-added products for increased maize production, • Provide information on PH4 to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the technology
Social, environmental, policy and market conditions necessary for development and upscaling	• Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • Maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time, • Enabling policy and policy review from time to time such as implementation of mandatory cultivation of biofortified maize.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 25,000 per acre
Estimated returns	Gross returns KES 90,000 per acre. Benefits KES 65,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization

	• Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on PH4 • Develop gender friendly training materials with illustrations to enhance communication, target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of PH4, • Conduct demonstrations in their maize farms.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	PH4 has successfully been adopted in the coastal regions of Kenya.
Application guidelines for users	References • Maize: What variety do I grow in coastal Kenya. Leaflet • Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	The Deputy Institute Director, KALRO-ICRI-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organizations/scientists	KALRO-ICRI-Mtwapa
Partner organizations	Kenya Seed Company, MOALF, County governments

Research Gaps

1. Improve the variety for resistance to fall armyworm

2.2.1.5 Pwani Hybrid 1 (PH1)

TIMP Name	Pwani Hybrid 1 (PH1)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties and yield losses due to drought resulting from erratic and unreliable rainfall.
What is it? (TIMP description)	A maize hybrid with medium maturity (90 – 120 days), an average yield potential of 18 bags of 90 kgs per acre, tolerant to drought and resistant to most leaf and ear diseases, excellent husk cover and tolerant to lodging. May be grown under rainfed and irrigation conditions. 
Justification	The earliness and drought tolerant traits in PH1 make it a variety of choice for cultivation in coastal lowlands of Kenya where it is well adapted. Under terminal drought conditions the variety gives a yield increase of 10% more than the other commercial maize varieties grown in the region. It also delivers co –benefits for resistance to most of the leaf and ear diseases prevalent in the region. The variety also does well under irrigated areas especially in Tana River. This translates to increased food security and improved livelihoods of small-scale farmers in the coast region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform, • Availability, accessibility and affordability of certified seeds,

	• good seed system to ensure quality, • Diversification of maize food products through value addition, • Strong partnership linkages, good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• Kenya seed company for certified seed production and distribution, • agro dealers for certified seed distribution, market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, agricultural extension • Service providers (public and private) to participate in dissemination, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River
Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	Inadequate certified seed for PH1, high cost of seeds, lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, limited information on PH4 by agricultural extension service providers (Public and private), limited maize value added products.
Suggestions for addressing the challenges	• Facilitate continuous maintenance of early generation and certified seed by Kenya seed company, • Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, • Marketers and processors, information on good agronomic practices for maize production, • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • Provide information on PH1 to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and

	adoption and this can be facilitated through innovation platforms, • availability, accessibility and affordability of • Certified seed and other inputs during and after promotion is key to adoption of the technology
Social, environmental, policy and market conditions necessary for development and upscaling	• Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • Maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time such as implementation of mandatory cultivation of biofortified maize.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of production per acre KES 23,000
Estimated returns	Gross returns per KES 45,000; Profits per acre KES 22,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women and youth may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on PH1 • Develop gender friendly training materials with illustrations to enhance communication, • Target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of PH1 • Conduct demonstrations in their maize farms.

VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for improved maize demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	PH1 has successfully been adopted in the coastal regions of Kenya.
Application guidelines for users	References - Maize: What variety do I grow in coastal Kenya. Leaflet - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
G. Contacts	
Contacts	Deputy Institute Director: KALRO-ICRI-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organizations/scientists	KALRO-ICRI-Mtwapa
Partner organizations	Kenya Seed Company, MOALF, County governments

Research Gaps

1. Applied research to develop, validate and promote improved climate smart maize varieties

2.2.1.6 Shukran-16 (CKH08069)

TIMP Name	Shukran-16 (CKH08069)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties and yield losses of up to 100% due to drought at reproductive stage and at the end of the season resulting from erratic and unreliable rainfall.
What is it? (TIMP description)	It is a three-way cross hybrid with yield potential of 25 – 30 bags of 90 kg per acre, tolerant to drought and foliar diseases, medium maturity (120 days). Suitable for coastal lowlands (CL) 2, 3 and 4. Year of release 2017.

	
Justification	Drought is important factor limiting maize production in the coastal region of Kenya. The drought tolerance traits in Shukran 16 make it a variety of choice for cultivation in coastal lowlands of Kenya where it is well adapted. Under reproductive drought conditions the variety gives a yield increase of 20% more than the other commercial maize varieties grown in the region. Continued wide adoption of the available drought tolerant varieties has the potential to boost maize productivity thus reducing poverty and food insecurity in the region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed companies, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform in coastal Kenya; • Availability, accessibility and affordability of certified seeds, • good seed system to ensure quality, diversification of maize food products through value addition, • strong partnership linkages, good marketing models and path ways, • active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• CIMMYT provision of nuclear seed, • KALRO Seeds Mtwapa for production of breeder and basic seed, • Licensed seed companies and KALRO Seeds Mtwapa for seed production and distribution,

	• Agro dealers for certified seed distribution, Farmers/farmer groups to adopt and produce, • Agricultural extension service providers (Public and private) to participate in dissemination, • National and county governments for policy, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River
Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	• Unavailability of early generation and certified seed of Shukran16 for promotion and dissemination, • lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • unorganized marketing channels, limited information on KH500Q by agricultural extension service providers (Public and private), • limited maize value added products.
Suggestions for addressing the challenges	• Facilitate continuous maintenance of early generation seed for Shukran16 by KALRO – Mtwapa breeders, • KALRO Seeds Mtwapa to produce certified seed, license private seed merchants to produce certified seed, • Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, marketers and processors, • Information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value added maize products for increased maize production, , initiate community-based maize seed production, Provide information on Shukran-16 to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key

	to adoption of the technology.
Social, environmental, policy and market conditions necessary for development and upscaling	• It is an already “a climate change ready crop” due to drought stress tolerance. • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, harmonious gender consideration in research, • Consumption and marketing, maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time, enabling policy and policy review from time to time such as implementation of mandatory. • Cultivation of climate smart maize varieties.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 23,000 per acre
Estimated returns	Gross cost of production KES 45,000 per acre; Profits KES 22,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on Shukran-16 • Develop gender friendly training materials with illustrations to enhance communication, • Target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of Shukran-16 • Conduct demonstrations in their maize farms.

	• SMEs for production of Shrukran-16 value added products
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for QPM maize demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Conduct demonstrations in their maize farms, • empower the VMGs by connecting them to financial sources, • SMEs for production of QPM confectionary products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	Ready for upscaling
G. Contacts	
Contacts	Deputy Institute Director: KALRO-ICRI-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organizations/scientists	KALRO-ICRI-Mtwapa
Partner organizations	CIMMYT-Kenya, MOALF, County governments.

Research Gaps

1. Funding to research, validation and promotion of improved climate smart maize hybrids and composites

2.2.1.7 WE2111

TIMP Name	WE2111
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Yield loss of up to 100% resulting from drought at reproductive stage and at the end of the season, and yield loss due to major maize leaf diseases such as northern leaf blight, maize streak virus

	and grey leaf spot.
What is it? (TIMP description)	WE2111 is a three-way hybrid with yield potential of 4.7 to 8.7 t/ha, matures in 4.5 to 5 months. It is tolerant drought and resistant to major leaf diseases such as northern corn leaf blight, gray leaf spot, maize streak virus. It has white grains with dent like texture. Year of release 2015. 
Justification	Being a drought tolerant variety of medium maturity that is resistant to northern leaf blight, maize streak virus and grey leaf spot make WE2111 a good bet for growing in the coastal lowlands. Under reproductive drought conditions the variety gives a yield increase of 20 % more than the other commercial maize varieties grown in the region. Wide adoption of WE2111 will enhance maize productivity thus reducing poverty and food insecurity in coastal lowlands of Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, seed companies, Seed dealers, Researchers, Extension service, consumers
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform in coastal Kenya; • Availability, accessibility and affordability of certified seeds, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • Strong partnership linkages, • Good marketing models and path ways, • Active involvement of public and private agricultural service providers.'
Partners/stakeholders for scaling up and their roles	• KALRO Seeds for production of early generation and certified seeds;

	- Seed companies for certified seed production and distribution; - Agro dealers selling of certified seed; agricultural extension service providers (Public and private) to participate in dissemination; - Financial institutions (banks, donors, credit facilitators)
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	- Linkage with seed companies to produce certified seed, - Maintenance of breeder seed - Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, - Promote the varieties, - Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, - Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	- Seed production by KALRO Seed Unit assisted by contract farmers, - Continuous maintenance of breeder seed by the breeder
Lessons learned in upscaling if any	- The technology is environmentally friendly and conforms to the market requirement, - Creation of awareness through demonstrations and farmer workshops helps in adoption of the varieties, - Availability of market is important.
Social, environmental, policy and market conditions necessary for development and upscaling	- Creation of awareness on nutritional and livestock importance of the variety, - Harmonious gender consideration in research, - Consumption and marketing, it is cultivated mainly by women hence the need to capacity build them, - Enabling policy and policy review from time to time, implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 25,000 per acre
Estimated returns	Gross returns KES 65,000 per acre; Profits KES 40,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	- Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth - Women may be disadvantaged through lack of access to land to engage in maize cultivation - High cost of seed and other inputs where small-scale farmers lack funds to acquire - Slow information and awareness flow to female farmers due to low academic levels - Women may not have time to attend dissemination meetings due to their domestic roles - Training materials and strategies on maize varieties may not

	be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth employment during pre and post-harvest activities, • Reach more women groups with information on WE2111 • Develop gender friendly training materials with illustrations to enhance communication, target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of WE2111, • Conduct demonstrations in their maize farms. • Sell of green maize by men, women and youth, • Men can use the maize stovers as animal feed for livestock,
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling, 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 Machakos. Mob: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	Center Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Mob: 020 2024751, Email:

	kalro.mtwapa@kalro.org
Partner organizations	CIMMYT - Kenya, AATF, MOALF, County governments

Research gaps

1. Funding to research, validation and promotion of improved climate smart maize hybrids and composites

2.2.1.8 MTPEH0701

TIMP Name	MTPEH0701
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties and maize postharvest losses as a result of large grain borer and maize weevils
What is it? (TIMP description)	A three-way cross hybrid of medium maturity (120-150 days) and a yield potential of 26 bags per acre, resistant to large grain borer and maize weevil. Suitable for coastal lowlands (CL) 2, 3 and 4. Year of release 2012.
Justification	Maize post-harvest losses due to storage pests such as large grain borer and maize weevil account for 20 to 30 %. MTPEH0701 is resistant to large grain borer and maize weevil and therefore ideal variety for cultivation in the coastal lowlands where these storage pests are prevalent.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seeds companies, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, training workshops, Seminars, Meetings, Farmer field days, Agricultural shows and exhibitions, Training workshops and seminars, Public and private agricultural extension services, Farmer to farmer extension, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• A platform for interaction of maize value chain stakeholder, • seed availability and accessibility, • good seed system to ensure quality, diversification of maize food products through value addition, • well organized farmer groups and networks, good marketing models and path ways, • active involvement of public and private agricultural service providers during dissemination and ToT trainings.

Partners/stakeholders for scaling up and their roles	• CIMMYT provision of nuclear seed, • KALRO Seed Unit – Mtwapa for production of breeder and basic seed, • Licensed seed companies and KALRO Seed Unit – Mtwapa for certified seed production and distribution, • Agro dealers for certified seed distribution, • Farmers/farmer groups to adopt and produce, • agricultural extension service providers (Public and private) to participate in dissemination, • National and county governments for policy, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River
Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	• Unavailability of early generation and certified seed of MTPEH0701 by KALRO Seeds Mtwapa due to financial constraints, • no seed company has been licensed to produce certified seed, high cost of seeds, • lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • unorganized marketing channels, limited information on MTPEH0701 by agricultural extension service providers (Public and private), • limited maize value added products.
Suggestions for addressing the challenges	• Facilitate continuous maintenance of early generation seed for MTPEH0701 by KALRO – Mtwapa breeders, • KALRO Seeds Mtwapa to produce certified seed, • License private seed merchants to produce certified seed, Establish innovation platforms that involves farmers, • National and county governments, seed merchants, ngos, marketers and processors, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added maize products for increased maize production, • Avail information on MTPEH0701 to agricultural service provides for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform,

	• Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the technology'
Social, environmental, policy and market conditions necessary for development and upscaling	• Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, • Consumption and marketing, maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time, such as implementation of mandatory cultivation of climate smart maize varieties.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 25,000 per acre
Estimated returns	KES 65,000 per acre. Benefits KES 40,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on MTPEH0701 • Develop gender friendly training materials with illustrations to enhance communication, target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production,

	• Train women and youth to be part of the ToT team for promotion of MTPEH0701, • Conduct demonstrations in their maize farms.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Conduct demonstrations in their maize farms, • SMEs for production of maize value-added products
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Deputy Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organizations/scientists	KALRO Mtwapa
Partner organizations	CIMMYT, MOALF, County governments,

Research gaps

1. Funding to research, validation and promotion of improved climate smart maize hybrids and composites

2.2.1.9 MTPEH0702

TIMP Name	MTPEH0702
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties and maize postharvest losses as a result of large grain borer and maize weevils.

What is it? (TIMP description)	A three-way cross hybrid with a yield potential of 26 bags of 90 kgs per acre, of medium maturity (120-150 days) and resistant to large grain borer and maize weevil. Suitable for coastal lowlands (CL) 2, 3 and 4. Year of release 2012.
Justification	Maize post harvest losses due to storage pests such as large grain borer and maize weevil account for 20 to 30 %. MTPEH0702 is resistant to large grain borer and maize weevil and therefore ideal variety for cultivation in the coastal lowlands where these storage pests (large grain borer and maize weevils) are prevalent.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform; • Availability, accessibility and affordability of certified seeds, • good seed system to ensure quality, diversification of maize food products through value addition, • strong partnership linkages, good marketing models and path ways, • active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• CIMMYT provision of nuclear seed, KALRO Seeds Mtwapa for production of breeder and basic seed, • Licensed seed companies and KALRO Seeds Mtwapa for certified seed production and distribution, • Agro dealers for certified seed distribution, • Farmers/farmer groups to adopt and produce, • agricultural extension service providers (Public and private) to participate in dissemination, • National and county governments for policy, • Financial institutions (banks, donors, credit facilitators) for financial solutions, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River

Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	• Unavailability of early generation and certified seed of MTPEH0702 by KALRO Seeds Mtwapa due to financial constraints, • No seed company has been licensed to produce certified seed. High cost of seeds, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Limited information on MTPEH0702 by agricultural extension service providers (Public and private), • Limited maize value added products.
Suggestions for addressing the challenges	• Facilitate continuous maintenance of early generation seed for MTPEH0702 by KALRO-Mtwapa breeders, • KALRO Seed Unit –Mtwapa to produce certified seed, license private seed merchants to produce certified seed, • Establish innovation platforms • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, promote value • Addition and consumption of value added maize products for increased maize production, avail information on MTPEH0702 to agricultural service providers for dissemination to farmers.
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the technology.
Social, environmental, policy and market conditions necessary for development and upscaling	• Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, • Consumption and marketing, maize is cultivated mainly by women in coast region hence the need to capacity build them, enabling policy and policy review from time to time such as implementation of mandatory cultivation of climate smart maize varieties. • Harmonious gender consideration in research, consumption and marketing. • It is cultivated mainly by women in coast region hence the need to capacity build them.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 25,000 per acre
Estimated returns	KES 65,000 per acre. Benefits KES 40,000
Gender issues and concerns in	• Labour intensity in planting, weeding, threshing which

development, dissemination, adoption and scaling up	are mostly done by women and youth, • Land ownership mainly by men who have no interest in maize, • Financial empowerment where majority of small-scale farmers lack funds to acquire inputs, • Slow information and awareness flow to female farmers due to academic levels, • Women and youth may not be able to reach far way markets or have bargaining power, • Lack of youth opportunities in maize value chain, • Training materials and strategies are not favourable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as small-scale mechanization of maize production operations, • Empower women and youth to acquire land and other supplies of production, • Reach more women groups with information on MTPEH0702, • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Make gender friendly training materials with illustrations to enhance communication, • Train women and youth to be part of the tot team for promotion of MTPEH0702, conduct demonstrations in their maize farms, • Smes for production of MTPEH0702 value added products
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization for small-scale farmers, • Dissemination methods and documents that are not always easy to understand or access, • Low bargaining power for their maize produce because it is sold at farm gate price, • Limited access to markets, • Financial constraints
VMG related opportunities	• Affordable small-scale mechanized equipments for maize cultivation, • Make friendly training materials with illustrations to enhance communication, • Train VMG to be part of the tot team for promotion of maize, • Conduct demonstrations in their maize farms, empower the vmgs by connecting them to financial sources, • Smes for production of maize value-added products.
E: Case studies/profiles of success stories	

Success stories from previous similar projects	None
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G. Contacts	
Contacts	Deputy Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org
Lead organizations/scientists	KALRO twapa
Partner organizations	CIMMYT, MOALF, County governments

Research Gaps

1. Funding to research, validation and promotion of improved improved climate smart maize hybrids and composites

2.2.1.10 MTPEH0703

TIMP Name	MTPEH0703
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties and yield losses caused by spotted stem borers <i>C. partellus</i> in the coastal lowlands of Kenya.
What is it? (TIMP description)	A three-way cross hybrid with a yield potential of 26 bags of 90 kgs per acre, of medium maturity (4-5 months) and resistant to spotted stem borers. Suitable for coastal lowlands (CL) 2, 3 and 4. Year of release 2012.
Justification	Stemborers are one of the most important pests of maize. maize yield losses due stem borers in the coastal lowlands of Kenya are estimated at 15–21%. MTPEH0703 is resistant to spotted stem borers and therefore ideal variety for cultivation in the coastal lowlands where these spotted stem borers are prevalent.

B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform; • Availability, accessibility and affordability of certified seeds, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • Strong partnership linkages, good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• CIMMYT provision of nuclear seed, KALRO Seeds Mtwapa for production of breeder and basic seed, • Licensed seed companies and KALRO Seeds Mtwapa for certified seed production and distribution, • Agro dealers for certified seed distribution, Farmers/farmer groups to adopt and produce, • Agricultural extension service providers (Public and private) to participate in dissemination, • National and county governments for policy, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	Kilifi, Kwale, Lamu and Tana River
Counties where TIMP will be upscaled	Kilifi, Kwale, Lamu and Tana River
Challenges in dissemination	• Unavailability of early generation and certified seed of MTPEH0703 by KALRO Seed Unit Mtwapa due to financial constraints, • no seed company has been licenced to produce certified seed. • High cost of seeds, lack of maize innovation platforms to facilitate interaction of farmers with relevant

	stakeholders, • unorganized marketing channels, limited information on MTPEH0703 by agricultural extension service providers (Public and private), limited maize • value added products.
Suggestions for addressing the challenges	• Facilitate continuous maintenance of early generation seed for MTPEH0703 by KALRO-Mtwapa breeders, • KALRO Seeds Mtwapa to produce certified seed, license private seed merchants to produce certified seed, • Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, marketers and processors, • Information dissemination on good agronomic practices for maize production, mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, promote value • Addition and consumption of value added maize products for increased maize production, • Avail information on MTPEH0703 to agricultural service providers for dissemination to farmers,
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility • Affordability of certified seed and other inputs during and after promotion is key to adoption of the technology',
Social, environmental, policy and market conditions necessary for development and upscaling	• Food safety/health concerns: recommend use of Aflasafe KE01 a pre-harvest biocontrol agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time such as implementation of mandatory cultivation of climate smart maize varieties.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 25,000 per acre
Estimated returns	KES 65,000 per acre. Benefits KES 40,000
Gender issues and concerns in	• Maize varieties are labour intensive mainly in planting, weeding,

development, dissemination, adoption and scaling up	shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on MTPEH0703 • Develop gender friendly training materials with illustrations to enhance communication, target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of MTPEH0703, • Conduct demonstrations in their maize farms.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for	Reference
users	- Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)		Ready for upscaling
G. Contacts		
Contacts	Deputy Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org	
Lead organizations/scientists	KALRO Mtwapa	
Partner organizations	CIMMYT, MOALF, County governments	

Research gaps

1. Funding to research, validation and promotion of improved improved climate smart maize hybrids and composites

2.2.1.11 MTPEH200804 (KH125 -02- MDR)

TIMP Name	MTPEH200804
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties and yield losses resulting from maize streak virus and grey leaf spot
What is it? (TIMP description)	A 3-way cross hybrid with average yield potential of 26 bags of 90 kgs per acre, of medium maturity (120 days), resistant to maize streak virus and gray leaf spot. It has a white cob. Suitable for coastal lowlands (CL) 2, 3 and 4 Year of release 2012.
Justification	Due to climatic change maize streak virus is becoming a major constraint to maize production and can cause up to 100% yield losses in the coastal lowlands of Kenya. Being medium maturing variety that is resistant to maize streak virus makes MTPEH200804 a good bet for growing in the coastal lowlands zones where it is well adapted to, even with climate variability. Wide adoption of the MTPEH200804 will enhance maize productivity in the coastal lowlands thus reducing food insecurity in the region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed companies, Seed dealers, Researchers, Extension service, consumers
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart

	Farmer and Seeds of Gold), Magazines and Newspapers articles.
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform; • Availability, accessibility and affordability of certified seeds, good seed system to ensure quality, • Diversification of maize food products through value addition, strong partnership linkages, good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • Ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed for MTPEH200804, high cost of seeds, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on MTPEH200804 by agricultural extension service providers (Public and private), • Limited maize value-added products.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of MTPEH200804 by KALRO breeders, license seed merchants to produce certified seed, • Information dissemination on good agronomic practices for maize production, mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value added

	• Products for increased maize production, avail information on MTPEH200804
Lessons learned in up scaling if any	• MTPEH200804 is environmentally friendly and conforms to the market requirement, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • Accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the timp.
Social, environmental, policy and market conditions necessary for development and up scaling	• Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • Maize is cultivated mainly by women in coast region hence the need to capacity build them, enabling policy and policy review from time to time, • Enabling policy and policy review from time to time such as implementation of mandatory cultivation of climate smart improved maize varieties.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 70,000 and thus net benefit KES 45,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on MTPEH20080,

	• Develop gender friendly training materials with illustrations to enhance communication, Target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of MTPEH20080, • Conduct demonstrations in their maize farms.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Train VMG to be part of the FFBS ToT team for promotion of MTPEH200804, • conduct demonstrations in their maize farms.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 Machakos. Mob: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO, c/o Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

2.2.1.12 MTPEH200805 (KH125-03-SG)

TIMP Name	MTPEH200805
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low maize yields, frequent droughts, stem borers and gray leaf spot.
What is it? (TIMP description)	A stay green three-way cross hybrid of medium maturity (120 days) with yield potential of 5 - 6.4 t/ha, tolerant to drought and resistant to stem borers and gray leaf spot. Year of release 2012.
Justification	Stemborers are one of the most important pests of maize in the coast lowlands of Kenya. Maize yield losses due stem borers in the region are estimated at 15–21 %. Being a stemborer resistant variety of medium maturity that is tolerant to drought and resistant to gray leaf make MTPEH200805 a good bet for growing in the dry mid altitude zones where it is well adapted to, even with climate variability. Wide adoption of the MTPEH200805 will enhance maize productivity in the coast lowlands thus reducing food insecurity in the region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, Farmer field days, Agricultural shows and exhibitions, Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather information Apps), Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles
Critical/essential factors for successful promotion	• Formation of a maize value chain multistakeholder platform in coastal Kenya; • Availability, accessibility and affordability of certified seeds, • Good seed system to ensure quality, diversification of maize food products through value addition, • Strong partnership linkages, good marketing models and path ways, • Active involvement of public and private agricultural service providers.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce,

	• County governments, central government e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • Ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed for MTPEH200805, • High cost of seeds, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, low adoption of Recommended agronomic practices, • Limited information on MTP200805 by agricultural extension service providers (Public and private), limited maize value added products
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of seed, • Information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, avail information on MTPEH200805 to agricultural service provides for dissemination to farmers,
Lessons learned in up scaling if any	• MTPEH200805 is environmentally friendly and conforms to the market requirement, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms,

	• Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, maize is cultivated mainly by women in coast region hence the need to capacity build them, • Enabling policy and policy review from time to time, • Enabling policy and policy review from time to time such as implementation of mandatory cultivation of climate smart improved maize varieties.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre ranged between KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on MTPEH200805 • Develop gender friendly training materials with illustrations to enhance communication, target women and youth groups during FFBS for effective training of farmers on maize production • Well organized gender friendly markets and marketing system, • Apply enterprising mechanized, marketing and value addition channels for the youth, • Use the FFBS strategy for effective training of women and youth farmer groups on maize production, • Train women and youth to be part of the ToT team for promotion of MTPEH200805, • Conduct demonstrations in their maize farms.

VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Train VMG to be part of the FFBS ToT team for promotion of MTPEH200805, • conduct demonstrations in their maize farms.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	1-ready for upscaling
G. Contacts	
Contacts	Deputy Institute Director: KALRO-Mtwapa, P.O. Box 16, 80109, Mtwapa. Phone: 020 2024751, Email: kalro.mtwapa@kalro.org Institute Director, KALRO-Katumani, P.O. Box 340-90100 Machakos. Mob: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani and KALRO Mtwapa.
Partner organizations	CIMMYT Kenya, MOALF, County governments

2.2.2 Medium altitude – Dry

2.2.2.1 KCB (Katumani Composite B)

TIMP Name	KCB (Katumani Composite B)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains
What is it? (TIMP)	An open pollinated variety with yield potential of 16 to 21 (90kg)

description)	bags per acre, drought escaping and early maturity (85-95 days)
Justification	Katamani Composite B(KB) is an early maturing variety that is resistant to stem borers and this makes it a good bet for growing in the dryland mid altitude zones of Kenya where it is well adapted to, even with climate variability. Wide adoption of the Katamani Composite B will enhance maize productivity in the dryland mid altitude zones of Kenya thus reducing food insecurity in the region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • County and central government support, funding to research, validate and promote new maize varieties.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and International Research Organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County government, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy awareness and dissemination, • Ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), • Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu

Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
-Challenges in dissemination	• Seed companies disinterest in maize OPVs, financial constraints for seed bulking, • seed processing, packaging and storage, and maintenance of early generation seed by KALRO Seed Unit at KALRO Katumani, • lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders, • low adoption of recommended agronomic practices, unorganized marketing channels, high cost of seeds.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, marketers and processors, • Information dissemination on good agronomic practices for maize production, mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • Facilitate continuous maintenance of early generation seed by KALRO breeders, license seed merchants to produce certified seed, • Initiate community-based maize seed production, avail information on KCB to agricultural service providers for dissemination to farmers,
Lessons learned in up scaling if any	• Katumani Composite B (KCB conforms to the market requirements, in the dryland mid altitude zones, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP.
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing,

	• Need to build their capacity and create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, • Field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, and the implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre KES 25,000
Estimated returns	Per acre returns approximately KES 40,000 and thus net benefit KES 15,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Katumani Composite B (KCB) maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on Katumani Composite B (KCB) maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on Katumani Composite B (KCB) maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the Katumani Composite B (KCB) maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the Katumani Composite B (KCB) maize variety

	• Target ToT farms for KCB maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased Katumani Composite B (KCB) maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-Requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.2.2 KDH6 SBR

TIMP Name	KDH6 SBR
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains, and that the unimproved varieties are susceptible to stem borers and low nitrogen in the soil.
What is it? (TIMP description)	A three-way cross hybrid of medium maturity (90-120 days) with yield potential of 5 t ha ⁻¹ , tolerant to drought and low nitrogen in the soil and resistant maize stem borers. Year of release 2008.
Justification	KDH6 SBR is a drought tolerant variety of medium maturity that is resistant to maize stem borers make it a good bet for growing in the dryland mid altitude zones of Kenya where it is well adapted to, even with climate variability. The variety's

	tolerance to low soil nitrogen enables it to be promoted for growing in soil with low soil fertility and where farmers do not apply fertilizer to their maize crop. Wide adoption of KDH6 SBR will enhance maize productivity in the dryland mid altitude zones of Kenya thus reducing food insecurity in the region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, seminars, meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – Agricultural programs, promotional materials (posters/brochures/leaflets, manuals), web material's, mobile phones –SMS, farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs).
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Development of good and implementation of good agronomic practices for maize, • Identification of agro ecological and climate requirements for cultivation, seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, well organized farmer groups and networks, • Good marketing models and path ways, county and central government support, funding to research, • Validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination. • Ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, • Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, No seed company has been licensed to produce certified seed, unavailability of early

	generation seed, low adoption of recommended agronomic practices, unorganized marketing channels, high cost of seeds, limited information on KDH6S SBR by agricultural extension service providers (Public and private), limited maize value added products.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, NGOs, marketers and processors, • information dissemination on good agronomic practices for maize production, • mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, promote value addition and consumption of value-added products for increased maize production, • facilitate continuous maintenance of early generation seed by KALRO breeders, • license seed merchants to produce certified seed, avail information on KDH6S SBR to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• KDH6S SBR conforms to the market requirements, in the dryland mid altitude zones, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP.
Social, environmental, policy and market conditions necessary for development and up scaling	• KDH6S SBR is an already “a climate change ready crop” due drought stress tolerance adaptation ability. • Need to have a policy on quality declared seed to allow production of the KDH6S SBR maize seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity and create an enabling policy, • policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and

	TV advertisements to enable awareness on the benefits of the TIMP, and the implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 45,000 and thus net benefit KES 20,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KDH6-SBR maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KDH6-SBR maize variety may not be favorable to women farmers.
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KDH6-SBR maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KDH6-SBR maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KDH6-SBR maize variety • Target ToT farms for KDH6-SBR maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms

	Increased KDH6-SBR maize production will lead to enhanced food security.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.2.3 KH414-03 SBR

TIMP Name	KH414-03 SBR
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved stem borer susceptible maize varieties, and grain yield losses upto 100% because of infestation by these pests in the dry mid altitude zones of Kenya
What is it? (TIMP description)	A three - way cross hybrid with of medium maturity (90-120 days) with yield potential of 4 tons/ha, tolerant to stem borers. Year of release 2008.
Justification	Stemborers are one of the most important pests of maize in the dry mid altitude zones of Kenya. Maize yield losses due stem borers in the region are estimated at 15–21 %. KH414-03 SBR is resistant to stem borers and therefore ideal variety for cultivation in the dry mid altitude zones of Kenya where stem borers are prevalent.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies.
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars,

	Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • County and central government support, funding to research, • Validate and promote new maize varieties.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • Ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed for KH414-03 SBR, • High cost of seeds, lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on kh414-03 sbr by agricultural extension service providers (public and private), limited maize value added products.

Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, • Ngos, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of KH414-03 SBR by KALRO breeders, • License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, avail information on KH414-03 SBR to agricultural service providers for dissemination to farmers.
Lessons learned in up scaling if any	• KH414-03 SBR conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated • Through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the KH414-03 SBR maize seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity and create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, and the implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 45,000 and thus net benefit KES 20,000

Gender issues and concerns in development, dissemination, adoption and scaling up	• KH414-03-SBR maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH414-03-SBR maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH414-03-SBR maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KH414-03-SBR maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH414-03-SBR maize variety • Target ToT farms for KH414-03-SBR maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH414-03-SBR maize production will lead to enhanced food security.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.2.4 KDH414-11 (Ukamez 6)

TIMP Name	KDH414-11 (Ukamez 6)
Category (i.e. technology, innovation or management practice)	Technology 
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A early maturing (90 – 100 days) three-way cross hybrid with yield potential of 4.6 - 7.5 t ha ⁻¹ , drought tolerant and resistant to major leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus. Year of release 2017.
Justification	Frequent droughts occurring at reproductive stage and at the end of the season is a major constraint to maize production in the mid altitude dry areas of Kenya. In some instances, it results to 100% crop failure. Being a drought tolerant variety of early maturity that is resistant to major maize leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus make Ukamez 6 a good bet for growing in the mid altitude dry areas where it is well adapted to, even with climate variability.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies.
Approaches to be used in	Farmer field and business Schools (FFBS), agricultural

dissemination	Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, good seed system to ensure quality, diversification of maize food products through value addition, well organized farmer groups and networks, good marketing models and path ways, involvement of public and private agricultural service providers for sustainability of the TIMP, county and centralgovernment support, funding to research, validate and promote new maize varieties.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed for Ukamez 6, • High cost of seeds, lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on Ukamez 6 by agricultural extension service providers (Public and private), limited maize value added products

Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, • national and county governments, seed merchants, NGOs, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of Ukamez 6 by KALRO breeders, • License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • Provide information on KH414-11 SBR (Ukamez 6) to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• Ukamez 6 conforms to the market requirements, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the KH414-11 SBR (Ukamez 6) maize seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • harmonious gender consideration in research, consumption and marketing, • it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity and create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, and the implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit

	KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KDH414-11-SBR (Ukamez 6) maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KDH414-11-SBR (Ukamez 6) maize variety may not be favorable to women farmers.
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KDH414-11-SBR (Ukamez 6) maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KDH414-11-SBR (Ukamez 6) maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KDH414-11-SBR (Ukamez 6) maize variety • Target ToT farms for Ukamez 6 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KDH414-11-SBR (Ukamez 6) maize production will lead to enhanced food security.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya

Application guidelines for users	Reference - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.2.5 KDH414-12 (Ukamez 7)

TIMP Name	KDH414-12 (Ukamez 7)
Category (i.e. technology, innovation or management practice)	Technology  Ukamez 7
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A stay green, drought tolerant, early maturing (90-100 days) three-way cross hybrid with yield potential of 4.3 - 7.8 t ha ⁻¹ , resistant to major leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus. Year of release 2017.
Justification	Frequent droughts occurring at reproductive stage and at the end of the season is a major constraint to maize production in the mid altitude dry areas of Kenya. In some instances, it results to

	100% crop failure. Being a drought tolerant variety of early maturity that is resistant to major maize leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus make Ukamez 7 a good bet for growing in the mid altitude dry areas where it is well adapted to, even with climate variability. Good for livestock feed due to its stay green trait.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media –Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied and adaptive Research to test, • Validate and release improved varieties, • A platform for interaction of maize value chain stakeholders, • Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, • Good Marketing Models and path ways, • County and central government • Support, funding to research, validate and promote new maize varieties.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. The International Food Policy Research Institute (IFPRI), to provide variety, seed and production information, • Market players to create a demand and pull production, Farmers/farmer groups to adopt and produce, • County governments, central governments (chiefs, Agricultural Extension [Formal and informal] for policy, • Awareness and dissemination, • Ngos (Africa Harvest, Farm Africa) to take up maize for farmer organizing and mobilization, • Seed companies for quality seed multiplication, financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already	None

promoted if any	
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • continuous maintenance of breeder seed by the breeders
Lessons learned in up scaling if any	• KH414-11 SBR (Ukamez 6) conforms to the market requirements, in the dryland mid altitude zones, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the KH414-11 SBR (Ukamez 6) maize seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, • There is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit

	KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KDH414-12-SBR (Ukamez 7) maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KDH414-12-SBR (Ukamez 7) maize variety may not be favorable to women farmers.
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KDH414-12-SBR (Ukamez 7) maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KDH414-12-SBR (Ukamez 7) maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KDH414-12-SBR (Ukamez 7) maize variety • Target ToT farms for KDH414-12-SBR (Ukamez 7) maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KDH414-12-SBR (Ukamez 7) maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya

Application guidelines for users	Reference - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	c/o FCRI, Center Director KALRO-Kabete, Kabete, P.O. Box 14733-00800;
	Tel: 020-2024644635, Email cd.narl@kalro.org
Lead organizations/scientists	KALRO-Kabete, Kabete, Centre Director, James Karanja
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies namely Agri-seedCo, Ultravetis, KSU, QBS e.t.c.

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.2.6 WE2109

2.1.1 TIMP Name	WE2109
Category (i.e. technology, innovation or management practice)	Technology  
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob drought tolerant, medium maturing (4.5 – 5 months) three-way cross hybrid with yield potential of 4.8 to 9.2 t ha ⁻¹ , resistant to major leaf diseases such as northern leaf blight, gray

	leaf spot and maize streak virus. Has a good husk cover and grains are white with dent-like texture. It is also recommended for growing in the coastal lowlands Kilifi, Kwale and Lamu regions. Year of release 2015.
Justification	WE2109 is drought tolerant and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. These attributes make WE2109 the best bet variety for growing in mid altitude dry areas and parts of the coastal lowlands where frequent droughts and the aforementioned maize diseases cause yield losses in range of 10% to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and pathways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, • Validate and promote new maize varieties.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • Ngos e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing, mobilization and to take up maize, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions.

C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE2109, • High cost of seeds, inadequate funds for promotion of WE2109, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on WE2109 by agricultural extension service providers (Public and private), limited maize value added products
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, • National and county governments, seed merchants, ngos, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of WE2109 by KALRO breeders, • License seed merchants to produce certified seed, • Information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • Provide information on WE2109 to agricultural service providers for dissemination to farmers.
Lessons learned in up scaling if any	• WE2109 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the WE2109 maize seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest

	and in storage, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in medium altitude moist region hence the need to build their capacity and create an enabling policy, • Policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 65,000 and thus net benefit KES 40,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE2109 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2109 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE2109 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE2109 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized

	equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE2109 maize variety • Target ToT farms for WE2109 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE2109 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	References WEMA Annual reports 2014-2018. Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katamani@kalro.org
Lead organizations/scientists	KALRO Katamani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

- Funding to research, validation and promotion of improved maize varieties

2.2.3 Medium Altitude – Moist

2.2.3.1 WE2101

TIMP Name	WE2101
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob three-way cross hybrid with average yield potential of 6.9 t ha⁻¹, matures in 4.5 months, resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2015.
Justification	WE2101 is drought tolerant and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. These attributes make WE2101 the best bet variety for growing in mid altitude regions of Kenya where the aforementioned maize diseases cause yield losses in range of trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements

	- for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, well organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, • Validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT to provide early generation seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, • Agricultural extension (formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa harvest, seed traders association (stak), cereal growers association, farm africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, financial institutions (banks, donors, credit facilitators) for financial solution.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE2101, • High cost of seeds, inadequate funds for promotion of WE2101, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on WE2101 by agricultural extension service providers (Public and private), • Limited maize value-added products.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, NGOs, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of WE2101 by KALRO breeders, • License seed merchants to produce certified seed, • Information dissemination on good agronomic practices for maize production,

	• Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • Provide information on WE2101 to agricultural service providers for dissemination to farmers.
Lessons learned in up scaling if any	• WE2101 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • Improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE2101 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access

	• Slow information flow, and lack of awareness for most female farmers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2101 maize variety may not be favorable to women farmers.
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE2101 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE2101 maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE2101 maize variety • Target ToT farms for WE2101 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE2101 maize production will lead to enhanced food security.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	

Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.3.2 WE2104

2.1.1 TIMP Name	WE2104
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob three-way cross hybrid with average yield potential of 7.16 t ha^{-1}, matures in 4.5 months. Resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2015. 
Justification	WE2104 is drought tolerant and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. These attributes make WE2104 best bet variety for growing in mid altitude regions of Kenya where the aforementioned maize diseases cause yield losses in range of trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies.

Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web materials, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, • Validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, • Awareness and dissemination, ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE2104, • high cost of seeds, inadequate funds for promotion of WE2104, • lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • unorganized marketing channels, • low adoption of recommended agronomic practices, limited information on WE2104 by agricultural extension service providers (Public and private), • limited maize value added products.

Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, NGOs, marketers and processors, facilitate continuous maintenance and production of early generation seed of WE2104 by KALRO breeders, • license seed merchants to produce certified seed, • information dissemination on good agronomic practices for maize production, • mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • promote value addition and consumption of value-added products for increased maize production, provide information on WE2104 to agricultural service providers for dissemination to farmers.
Lessons learned in up scaling if any	• WE2104 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP.
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit

	KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE2104 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2104 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE2104 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE2104 maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE2104 maize variety • Target ToT farms for WE2104 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE2104 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya

Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.3.3 WE2107

2.1.1 TIMP Name	WE2107
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and suffer grain yield losses of upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob three-way cross hybrid with average yield potential of 7 t ha⁻¹, matures in 4.5 months. Resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2015.
Justification	WE2107 is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. These attributes make WE2107 best bet variety for growing in mid altitude regions of Kenya where the aforementioned maize

	diseases cause yield losses in range of trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (naris) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central government e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, • Awareness and dissemination, ngos to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, • Farm Africa for farmer organizing and mobilization, seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu

Challenges in dissemination	• Unavailability of certified seed of WE2107, • High cost of seeds, inadequate funds for promotion of WE2107, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, • Low adoption of recommended agronomic practices, • Limited information on WE2107 by agricultural extension service providers (Public and private), • Limited maize value added products
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, ngos, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of WE2107 by KALRO breeders, • License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • Provide information on WE2107 to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• WE2107 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in medium altitude moist region hence the need to build their capacity

	• Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE2107 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2107 maize variety may not be favorable to women farmers.
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE2107 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE2107 maize variety
VMG issues and concerns in development, dissemination, adoption and scaling up	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs

	• Target VMG for ToT training and promotion of the WE2107 maize variety • Target ToT farms for WE2107 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE2107 maize production will lead to enhanced food security
VMG related opportunities	• WE2107 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2107 maize variety may not be favorable to women farmers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	References - WEMA Annual reports 2014-2018. - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

- Funding to research, validation and promotion of improved maize varieties

2.2.3.4 WE2108

2.1.1 TIMP Name	WE2108
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and suffer grain yield losses of upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A three-way cross hybrid with average yield potential of 6.9 t ha⁻¹, matures in 4.5 months. Resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2015. 
Justification	WE2108 is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. These attributes make WE2108 best bet variety for growing in mid altitude regions of Kenya where the aforementioned maize diseases cause yield losses in range of trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web materials, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality,

	• Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, county and central government support, • Funding to research, validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE2108, • high cost of seeds, inadequate funds for promotion of WE2108, • lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, • low adoption of recommended agronomic practices, limited information on WE2108 by agricultural extension service providers (Public and private), • limited maize value added products
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, • Seed merchants, ngos, marketers and processors, facilitate continuous maintenance and production of early generation seed of WE2108 by KALRO breeders, • License seed merchants to produce certified seed, • Information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production,

	• Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value added products for increased maize production, • Provide information on WE2108 to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• WE2108 conforms to the market requirements, chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • Accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, • Field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 30,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE2108 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most

	female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2108 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE2108 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE2108 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE2101 maize variety • Target ToT farms for WE2108 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE2108 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	References - WEMA Annual reports 2014-2018. - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)		1-ready for upscaling
G. Contacts		
Contacts	Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katamani@kalro.org	
Lead organizations/scientists	KALRO Katamani, Centre Director, Murenga Mwimali, J Karanja and Tende R.	
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company	

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.3.5 WE5206

TIMP Name	WE5206
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These varieties also suffer grain yield losses of upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A drought tolerant medium maturing (105 to 130 days) three-way cross hybrid with average yield potential of 9 t ha ⁻¹ . It is resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2017.
Justification	Being a drought tolerant white cob maize hybrid that is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus make WE5206 best bet variety for growing in mid altitude moist areas of Kenya where the frequent droughts and the aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones –SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)

Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, • Development of agronomic practices for maize, • identification of agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • County and central government support, funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Linkage with seed companies to produce certified seed, maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• WE5206 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies,

	- Organized production and market aids in wide adoption, - Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, - Accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP.
Social, environmental, policy and market conditions necessary for development and up scaling	- Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, - Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, - Harmonious gender consideration in research, consumption and marketing, - It is cultivated mainly by women in medium altitude moist region hence the need to build their capacity - create an enabling policy, and policy review from time to time. - To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and tv advertisements to enable awareness on the benefits of the timp, - Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 70,000 and thus net benefit KES 45,000
Gender issues and concerns in development, dissemination, adoption and scaling up	- WE5206 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth - Women may be disadvantaged through lack of access to land to engage in maize cultivation - High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access - Slow information flow, and lack of awareness for most female famers with low education levels - Women suffer time constraints due to domestic roles, and miss out on dissemination meetings - Training materials and strategies on WE5206 maize variety may not be favorable to women farmers
Gender related opportunities	- Women and youth friendly production techniques such as mechanization - Employment opportunities for both women and the youth along the maize value chain

	• Reach more women and youth groups with information on WE5206 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE5206 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE5206 maize variety • Target ToT farms for WE5206 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5206 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from	Has been adopted successfully in dryland mid altitude zones of Kenya
previous similar projects	
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katamani@kalro.org
Lead organizations/scientists	KALRO Katamani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.6 WE5230

2.1.1 TIMP Name	WE5230
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These varieties also suffer grain yield losses of upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A drought tolerant medium maturing (105 to 130 days) three-way cross hybrid with average yield potential of 8 t ha ⁻¹ . It is resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2017.
Justification	Being a drought tolerant white cob maize hybrid that is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus make WE5230 best bet variety for growing in mid altitude moist areas of Kenya where the frequent droughts and the aforementioned diseases cause yield losses that range from trace to 100%
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs).
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, • Good Marketing Models and path ways, county and central government support, funding to research, • Validate and promote new maize varieties'

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments (e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, • Awareness and dissemination, NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• WE5230 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe

	KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and tv advertisements to enable awareness on the benefits of the timp, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 70,000 and thus net benefit KES 45,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE5230 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5230 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5230 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members

VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE5230 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE5230 maize variety • Target ToT farms for WE2530 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5230 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.7 EMB225 – KBEST

2.1.1 TIMP Name	EMB225 - KBEST
Category (i.e. technology, innovation or management)	Technology

practice)	
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because these varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	An early maturing (90 to 120 days) three-way cross hybrid with average yield potential of 4.6 t ha ⁻¹ . It is resistant to major leaf diseases such as northern leaf blight, maize streak virus and leaf rust. It also has good husk cover and good plant and ear aspect. Altitude:1000-1800 m. Suitable in Embu, Kirinyaga, Nyeri, Kakamega, Homabay, Kisii, Kiambu, Vihiga, Kwale, Meru. Year of release 2015.
Justification	Major leaf diseases such as northern leaf blight, maize streak virus and leaf rust cause yield losses that range from trace to 100%. Being a resistant maize hybrid to the aforementioned diseases make EMB225 best bet variety for growing in moist mid altitude areas of Kenya where the aforementioned diseases are prevalent.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, • Development of agronomic practices for maize, identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, well organized farmer groups and networks, • Good Marketing Models and path ways, county and central government support, funding to research, • Validate and promote new maize varieties'.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, county governments, • Central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders

	Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Isiolo, Machakos, Kitui and other mid-dry lowlands zones in Kenya
Challenges in dissemination	• Linkage with seed companies to produce certified seed, maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• EMB225 (KBEST) conforms to the market requirements, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days helps in adoption of new technologies, • organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, harmonious gender consideration in research, • Consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and tv advertisements to enable awareness on the benefits of the timp,

	• Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost is KES 25,000
Estimated returns	Per acre returns approximately KES 45,000 and thus net benefit KES 20,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• EMB 225 (K BEST) maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on EMB 225 (K BEST) maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on EMB 225 (K BEST) maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the EMB 225 (K BEST) maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the EMB 225 (K BEST) maize variety • Target ToT farms for EMB 225 (K BEST) maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms

	Increased EMB 225 (K BEST) maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org :
Lead organizations/scientists	KALRO-Embu, Centre Director, Charles Mutinda
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.8 EMB 226 – EMBU POA

2.1.1 TIMP Name	EMB 226 – EMBU POA
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because these varieties are susceptible to leaf diseases such as northern leaf blight and maize streak virus.
What is it? (TIMP description)	A stay green, early maturing (90 to 120 days) three-way cross hybrid with average yield potential of 6.5 ^{t ha⁻¹} . It is resistant to northern leaf blight. It also has good husk cover and good plant and ear aspect. Altitude:1200-1800 m. Suitable in Embu, Kirinyaga, Nyeri, Kakamega, Homabay, Kisii, Kiambu. Year of release 2015.
Justification	Major leaf diseases such as northern leaf blight cause yield losses that range from trace to 100%. Being a resistant maize hybrid to the aforementioned diseases make EMB226 best bet variety for growing in moist mid altitude areas of Kenya where the aforementioned disease are prevalent.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies

Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media –, Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, well organized farmer groups and • Networks, good Marketing Models and path ways, county and central government support, funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central government e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Isiolo, Machakos, Kitui and other mid-dry lowlands zones in Kenya
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, continuous maintenance of breeder seed

	by the Breeder
Lessons learned in up scaling if any	• EMB226 (EMBU POA) conforms to the market requirements, chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost is KES 25,000
Estimated returns	Per acre returns approximately KES 50,000 and thus net benefit KES 25,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• EMB226 (EMBU POA) maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on EMB226 (EMBU

	POA) maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on EMB226 (EMBU POA) maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the EMB226 (EMBU POA) maize variety.
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the EMB226 (EMBU POA) maize variety • Target ToT farms for EMB226 (EMBU POA) maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased EMB226 (EMBU POA) maize production will lead to enhanced food security.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27 - 60100 Embu, Phone: +254 727444608 / 727444638 E-mail: kalro.embu@kalro.org :
Lead organizations/scientists	KALRO-Embu, Centre Director, Charles Mutinda
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

- Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.9 KH500-40E

2.1.1 TIMP Name	KH500-40E
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to low Nitrogen in the soil
What is it? (TIMP description)	A medium maturing (120 to 130 days) three-way cross hybrid with yield potential of 7 t _{ha} ⁻¹ , tolerant to drought and low nitrogen in the soil. Year of release 2008.
Justification	Being a drought tolerant white cob maize hybrid that is also tolerant to low nitrogen in the soil make KH500-40E best bet variety for growing in mid altitude moist areas of Kenya where the frequent droughts and the aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, • Good Marketing Models and path ways, • County and central government support, funding to research, validate and promote new maize varieties'

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Isiolo, Machakos, Kitui and other mid-dry lowlands zones in Kenya
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• KH500-40E conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP

Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, • consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-40E maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-40E maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-40E maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KH500-40E maize variety

VMG opportunities related	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-40E maize variety • Target ToT farms for KH500-40E maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-40E maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27 - 60100 Embu, Phone: +254 727444608 / 727444638 E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO-Embu, Centre Director, Charles Mutinda
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.10 KH500-39E

2.1.1 TIMP Name	KH500-39E
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and

	maize streak virus, and are low in protein quality.
What is it? (TIMP description)	A three-way cross may hybrid with yield potential of 8-10 $t\ ha^{-1}$, tolerant to drought and foliar diseases, medium maturity (120 days). Suitable for Mt Kenya region and adjacent mid-moist areas. Year of release 2017/18
Justification	The hybrid is a white cob, with high yield 8-10 $t\ ha^{-1}$, drought tolerant, tolerant to foliar diseases, medium maturity (120 days). Drought is serious threat in the region to maize production and so high yielding varieties are required to enhance food security in the region. Also, quality protein maize will be a boost to food quality in the area.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good Marketing Models and path ways, county and central government support, • Funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, county governments, • Central governments e.g. Chiefs, agricultural extension (formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for

	financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Isiolo, Machakos, Kitui and other mid-dry lowlands zones in Kenya
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• KH500-39E conforms to the market requirements, chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, • Field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, and the implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 70,000 and thus net benefit KES 45,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-39E maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-39E maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-39E maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KH500-39E maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-39E maize variety • Target ToT farms for KH500-39E maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-39E maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya

Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27 - 60100 Embu, Phone: +254 727444608 / 727444638 E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO-Embu, Centre Director, Charles Mutinda
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.11 KH500-56A

2.1.1 TIMP Name	KH500-56A (KM1101)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because these varieties are susceptible to leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus.
What is it? (TIMP description)	A white cob flint to intermediate like, three-way cross hybrid with yield potential of 6.5 t ha ⁻¹ , matures in 5 to 6 months and resistant to maize streak virus and gray leaf spot. Has good husk cover and ear aspects. Year of release 2017. 
Justification	KH500-56A is resistant to maize streak virus and gray leaf spot and these attributes make it a variety of choice for growing in mid altitude areas of kenya where the aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies

Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, well organized farmer groups and networks, • Good Marketing Models and path ways, • County and central government support, funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central government e.g. Chiefs, agricultural extension (formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Embu, Meru, Kirinyaga, Kiambu
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under these KH500 hybrids series, • Promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Demo seed production by KALRO breeders, joint demonstration (farmers/seed companies) of the new varieties in the target AEZ and disease prone areas for

	MSV, • Production seed research for all KALRO released varieties, promotion of the new varieties using small packs (<250g), • JumpStart certified seed production through KSU, continuous maintenance of breeder seed, • Continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• KH500-56A conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • Create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-56A maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings

	• Training materials and strategies on KH500-56A maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-56A maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KH500-56A maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-56A maize variety • Target ToT farms for KH500-56A maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-56A maize production will lead to enhanced food security

E: Case studies/profiles of success stories

Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling

G. Contacts

Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org :
Lead organizations/scientists	KALRO Embu, Centre Director, Charles Mutinda
Partner organizations	KALRO SeedS, KALRO Seeds, NGOs, County Governments,

	AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company namely; Victoria Seeds Company, Leldet Seeds Company seed Co, Faida seed Co, Olerai seed Co, EA seed Co, Sacred Africa and Crop Africa

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.3.12 KH500-Q

2.1.1 TIMP Name	KH500-Q
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus, and are low in protein quality.
What is it? (TIMP description)	A three way cross may hybrid with yield potential of 8-10 t ha ⁻¹ , tolerant to drought and foliar diseases, medium maturity (120 days). Suitable for Mt Kenya region and adjacent mid-moist areas. Year of release 2017/18
Justification	The hybrid is a white cob, with high yield 8-10 t ha ⁻¹ , drought tolerant, tolerant to foliar diseases, medium maturity (120 days). Drought is serious threat in the region to maize production and so high yielding varieties are required to enhance food security in the region. Also, quality protein maize will be a boost to food quality in the area.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs).
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • good seed system to ensure quality, diversification of maize food products through value addition, • well organized farmer groups and networks, • good Marketing Models and path ways, county and central

	government support, funding to research, • validate and promote new maize varieties’.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, county governments, central government e.g. Chiefs, agricultural extension (formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Isiolo, Machakos, Kitui and other mid-dry lowlands zones in Kenya
Challenges in dissemination	• Linkage with seed companies to produce certified seed, maintenance of breeder seed, • Identify a seed company to produce certified seed, • Promote the variety, continuous maintenance breeder seed and it requires seed multiplication for two seasons.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• KH500-Q conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP

Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in medium altitude moist region hence the need to build their capacity • create an enabling policy, and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-Q maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-Q maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-Q maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the KH500-Q maize variety

VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-Q maize variety • Target ToT farms for KH500-Q maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-Q maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27 - 60100 Embu, Phone: +254 727444608 / 727444638 E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO-Embu, Centre Director, Charles Mutinda
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.4 Medium Altitude -Transitional

2.2.4.1 WE2106

2.1.1 TIMP Name	WE2106
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob dent type, drought tolerant three-way cross hybrid with yield potential of 4.7 to 9.1 t ha ⁻¹ , matures in 4.5-5 months. Resistant to northern leaf blight, gray leaf spot and maize streak

	virus. Has a good husk cover. Year of release 2015. 
Justification	WE2106 is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE2106 best bet variety for growing in mid altitude transitional areas of Kenya where maize leaf diseases and frequent droughts cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, • Organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, validate and promote new maize varieties

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE2106, high cost of seeds, • Inadequate funds for promotion of WE2106, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, low adoption of recommended agronomic practices, • Limited information on WE2101 by agricultural • Extension service providers (Public and private), limited maize value added products
Suggestions for addressing the challenges	• Establish innovation platforms that involve farmers, national and county governments, • Seed merchants, NGOs, marketers and processors, facilitate continuous maintenance and production of early generation seed of WE2106 by KALRO breeders, • License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, promote value addition and consumption of value-added products for increased maize production, • Provide information on WE2106 to agricultural service providers for dissemination to farmers

Lessons learned in up scaling if any	• WE2106 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women farmers in moist transitional areas therefore, the need to build their capacity, • Create an enabling policy environment and possible review over time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV shows to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE2106 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE2106 maize variety may not be favorable to women farmers

Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE2106 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE2106 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE2106 maize variety • Target ToT farms for WE2106 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE2106 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by smallscale farmers in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J. Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding for research, validation and promotion of more superior drought tolerant improved hybrid maize varieties

2.2.4.2 WE3104

TIMP Name	WE3104
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and that suffer grain yield losses of upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob three-way cross hybrid with average yield potential of 5.6 t ha⁻¹, matures in 4 months. Resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2015 
Justification	WE3104 is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE3104 one of the best variety for growing in mid altitude transitional areas of Kenya where these leaf diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agroecological and climate requirements for cultivation, seed availability and accessibility, • good seed system to ensure quality, • diversification of maize food products through value addition, • well organized farmer groups and networks, • good marketing models and path ways,

	• involvement of public and private agricultural service providers for sustainability of the TIMP, • county and central government support, funding to research, validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kakamega, Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE3104, high cost of seeds, inadequate funds for promotion of WE3104, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Low adoption of recommended agronomic practices, • Limited information on WE3104 by agricultural extension service providers (Public and private), • Limited maize value-added products
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, • National and county governments, seed merchants, • Ngos, marketers and processors, • Facilitate continuous maintenance and production of early generation seed of WE3104 by KALRO breeders, • License seed merchants to produce certified seed, • Information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, Provide information on WE3104 to agricultural service providers for dissemination to farmers

Lessons learned in up scaling if any	• WE3104 conforms to the market requirements, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transitional region therefore the need to build their capacity, • Create an enabling policy environment and review over time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is 25,000
Estimated returns	Per acre returns approximately KES 50,000 and thus net benefit KES 25,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE3104 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE3104 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization

	• Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE3104 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE3104 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE3104 maize variety • Target ToT farms for WE3104 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE3104 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully adopted by farmers as a drought tolerant hybrid maize variety dryland mid altitude zone of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Murenga M. et al. 2015. Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	
1-ready for upscaling	
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.3 WE3106

TIMP Name	WE3106
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These improved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus. 
What is it? (TIMP description)	A white cob three-way cross hybrid with average yield potential of 3.28 t ha ⁻¹ , matures in 4 months. Resistant to major leaf diseases such as northern leaf blight, maize streak virus and gray leaf spot. It also has good husk cover and good plant and ear aspect. Year of release 2015.
Justification	WE3106 is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE3106 best bet variety for growing in mid altitude transitional areas of Kenya where the leaf diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches used in Dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research. Trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.

Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, • Validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central government e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kakamega, Kitui, Machakos, West Pokot, Makueni, Kajiado, Isiolo, Lower Meru and Embu, Siaya, and Kisumu
Challenges in dissemination	• Unavailability of certified seed of WE3106, • High cost of seeds, inadequate funds for promotion of WE3106, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, • Low adoption of recommended agronomic practices, • limited information on WE3106 by agricultural extension service providers (public and private), • Limited maize value added products.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, • national and county governments, • Seed merchants, NGOs, • marketers and processors, facilitate continuous maintenance and production of early generation seed of WE3106 by KALRO breeders,

	• License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value added products for increased maize production, • Provide information on WE3106 to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• WE3106 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in the mid altitude transitional region hence the need to build their capacity, • create an enabling policy and review over time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000.
Estimated returns	Per acre returns approximately KES 40,000 and thus net benefit KES 17,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE3106 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most

	female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE3106 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE3106 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE3106 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE3106 maize variety • Target ToT farms for WE3106 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE3106 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by farmers leading to increased incomes in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Murenga et al., 2017. WEMA Hybrids booklet.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
1-ready for upscaling	
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600

	Email: kalro.katamani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.4 WE5107

TIMP Name	WE5107
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus
What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with yield potential of 3.7 to 7.2 t ha⁻¹, early maturity (105 to 130 days), resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Year of release 2017. Has added advantage of a good husk cover, plant and ear aspects.
Justification	It is a drought tolerant, and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus makes WE5107 a best bet maize hybrid to grow in mid altitude transitional regions of Kenya where drought and maize diseases cause yield losses in range of trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies

Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
TIMP Name	WE5107
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, • awareness and dissemination, NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kakamega, Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Unavailability of certified seed of WE5107, high cost of seeds, inadequate funds for promotion of WE5107, • lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • unorganized marketing channels, low adoption of recommended agronomic practices, limited information on WE5107 by agricultural extension service providers (Public and private), limited maize value added products

Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, • NGOs, marketers and processors, facilitate continuous maintenance and production of early generation seed of WE5107 by KALRO breeders, • license seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, • mechanize small-scale maize production, • promote marketing models that encourage collective production and marketing, • promote value addition and consumption of value added products for increased maize production, • Provide information on WE5107 to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• WE5107 conforms to the current market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • The creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, and partnerships are important in technology dissemination and adoption. • This can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, harmonious gender consideration in • Research, consumption and marketing, • It is cultivated mainly by women in coast region hence the need to build their capacity and create an enabling policy environment and review policies over time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, • Field days, radio and tv advertisements to enable awareness on the benefits of the timp.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000

Gender issues and concerns in development, dissemination, adoption and scaling up	• WE5107 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5107 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5107 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE5107 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE5107 maize variety • Target ToT farms for WE5107 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5107 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted by many smallscale farmers successfully in dryland mid altitude zones of Kenya

Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.5 WE5113

TIMP Name	WE5113
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with yield potential of 3.7 to 7.3 t ha⁻¹, early maturity (105 to 130 days), resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Year of  release 2017. Has added advantage of a good husk cover, plant

	and ear aspects.
Justification	WE5113 is a drought tolerant maize hybrid that is resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. These attributes make WE5113 a variety of choice for growing mid altitude transitional regions of Kenya where these leaf diseases and recurrent droughts cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, • Good seed system to ensure quality, • Diversification of maize food
	• Products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the timp, • County and central government support, funding to research, validate and promote new maize varieties
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None

Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay, and Kakamega
Challenges in dissemination	• Unavailability of certified seed of WE5113, • High cost of seeds, inadequate funds for promotion of WE5113, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on WE5113 by agricultural extension service providers (Public and private), • Limited maize value-added products
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, • Seed merchants, NGOs, marketers and processors, facilitate continuous maintenance and production of early generation seed of WE5113 by KALRO breeders, • License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, promote marketing models that encourage collective production and marketing, • promote value addition and consumption of value-added products for increased maize production, • Provide information on WE5113 to agricultural service providers for dissemination to farmers
Lessons learned in up scaling if any	• WE5113 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by

	women in coast region hence the need to build their capacity a • Create an enabling policy environment and policy review from time to time. • to improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE5113 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5113 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5113 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs • VMGs have limited finances to buy the WE5113 maize variety
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs

	• Target VMG for ToT training and promotion of the WE5113 maize variety • Target ToT farms for WE5113 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5113 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted by smallscale farmers successfully in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.6 WE5138

TIMP Name	WE5138
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob drought tolerant white cob three-way cross hybrid with yield potential of 4 to 6.5 t ha ⁻¹ , early maturity (105 to 130 days), resistant to major maize leaf diseases such as northern leaf

	blight, gray leaf spot and maize streak virus. Year of release 2017.
Justification	WE5138 is drought tolerant and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot, maize streak virus. The attributes make WE5138 a variety of choice for growing mid altitude transitional regions of Kenya where the aforementioned diseases and frequent drought cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, • Good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • county and central government support, funding to research, validate and promote new maize varieties.
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None

Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Unavailability of certified seed of WE5138, high cost of seeds, • Inadequate funds for promotion of WE5138, • lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Low adoption of recommended agronomic practices, limited information on WE5138 by agricultural extension service providers (Public and private), • Limited maize value added products.
Suggestions for addressing the challenges	• Establish innovation platforms that involves farmers, national and county governments, seed merchants, • NGOs, marketers and processors, facilitate continuous maintenance and production of early generation seed of WE5138 by KALRO breeders, • License seed merchants to produce certified seed, information dissemination on good agronomic practices for maize production, • Mechanize small-scale maize production, • Promote marketing models that encourage collective production and marketing, • Promote value addition and consumption of value-added products for increased maize production, • provide information on we5138 to agricultural service provides for dissemination to farmers.
Lessons learned in up scaling if any	• WE5138 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research,

	consumption and marketing, it is cultivated mainly by women in mid altitude transitional region hence the need to build their capacity • Create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 45,000 and thus net benefit KES 20,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE5138 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5138 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5138 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the WE5138 maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs

	• Target VMG for ToT training and promotion of the WE5138 maize variety • Target ToT farms for WE5138 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5138 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by smallscale farmers in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katamani@kalro.org
Lead organizations/scientists	KALRO Katamani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.7 WE5205

2.1.1 TIMP Name	WE5205
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus

What is it? (TIMP description)	 A white cob drought tolerant three-way cross hybrid with yield potential of 7.4-9.6 t ha⁻¹, early maturity (105-130 days), resistant to main leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Released in 2017
Justification	It is resistant to leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE5205 best bet variety for growing in mid altitude transitional areas of Kenya where the aforementioned diseases and frequent drought cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), agricultural Innovation Platforms (AIPs), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, field days, agricultural shows, MoALFC/Extension officers, farmer research networks, farmer to farmer, mass media – agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), web material's, Mobile phones –SMS.
Critical/essential factors for successful promotion	• Applied research to release improved maize varieties, identification of Agro ecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good marketing models and path ways, • Involvement of public and private agricultural service providers for sustainability of the TIMP, • County and central government support, funding to research, validate and promote new maize varieties

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • market players to create a demand and pull production, farmers/farmer groups to adopt and produce, county governments, central government e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Unavailability of certified seed of WE5205, • high cost of seeds, inadequate funds for promotion of WE5205, • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Unorganized marketing channels, • Low adoption of recommended agronomic practices, • Limited information on we5205 by agricultural extension service providers (public and private), • Limited maize value added products.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• WE5205 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • Accessibility and affordability of certified seed and other inputs during and after • Promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development And up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe

	KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transition region hence the need to build their capacity • create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE5205 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5205 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5205 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the WE5205 maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMG
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs.

	• Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE5205 maize variety • Target ToT farms for WE5205 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5205 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by smallscale farmers in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.8 WE5210

2.1.1 TIMP Name	WE5210
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.

What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with yield potential of 7.6 to 10.0 t ha⁻¹, early maturity (105 to 130 days), resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Has good husk cover, plant and ear aspect. Year of release 2017. 
Justification	WE5210 is tolerant to drought and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE5210 best bet variety for growing in mid altitude transitional areas of Kenya where the aforementioned diseases and frequent drought cause yield losses that range from trace to 100
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, • Development of agronomic practices for maize, • identification of agro ecological and climate requirements for cultivation, seed availability and accessibility, good seed system to ensure quality, • diversification of maize food products through value addition, well organized farmer groups and networks, • Good Marketing Models and path ways, county and central government support, funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs,

	Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • maintenance of breeder seed identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• WE5210 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • Accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transition region hence the need to build their capacity • Create an enabling policy environment and policy review from time to time.

	To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations and up scaling	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	- WE5210 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth - Women may be disadvantaged through lack of access to land to engage in maize cultivation - High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access - Slow information flow, and lack of awareness for most female famers with low education levels - Women suffer time constraints due to domestic roles, and miss out on dissemination meetings - Training materials and strategies on WE5210 maize variety may not be favorable to women farmers
Gender related opportunities	- Women and youth friendly production techniques such as mechanization - Employment opportunities for both women and the youth along the maize value chain - Reach more women and youth groups with information on WE5210 maize variety - Target women and youth groups during FFBS for effective training of farmers on maize production - Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	- Laborious maize production practices due to limited mechanization not favourable for VMG - VMGs have limited finances to buy the WE5210 maize variety - Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	- Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. - Make friendly training materials with illustrations to enhance communication with VMGs - Target VMG for ToT training and promotion of the WE5210 maize variety - Target ToT farms for WE5210 maize breeding demonstrations

	• Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5210 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by smallscale farmers in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Murenga M. et al., 2015. Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katamani@kalro.org
Lead organizations/scientists	KALRO Katamani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.9 WE5213

2.1.1 TIMP Name	WE5213
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.

What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with yield potential of 7.5 to 9.6 t ha⁻¹, early maturity (105 to 120 days), resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Has good husk cover, plant and ear aspect. Year of release 2017. 
Justification	WE5213 is tolerant to drought and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE5213 best bet variety for growing in mid altitude transitional areas of Kenya where the aforementioned diseases and frequent drought cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, well organized farmer groups and networks, • good marketing models and path ways, • County and central government support, funding to research, validate and promote new maize varieties'

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, • Awareness and dissemination, NGOs (Africa Harvest) to take up maize, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• WE5213 conforms to the market requirements, chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at

	harvest and in storage, to time. To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, and the implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	- WE5213 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth - Women may be disadvantaged through lack of access to land to engage in maize cultivation - High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access - Slow information flow, and lack of awareness for most female famers with low education levels - Women suffer time constraints due to domestic roles, and miss out on dissemination meetings - Training materials and strategies on WE5213 maize variety may not be favorable to women farmers
Gender related opportunities	- Women and youth friendly production techniques such as mechanization - Employment opportunities for both women and the youth along the maize value chain - Reach more women and youth groups with information on WE5213 maize variety - Target women and youth groups during FFBS for effective training of farmers on maize production - Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	- Laborious maize production practices due to limited mechanization not favourable for VMG - VMGs have limited finances to buy the WE5213 maize variety - Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	- Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. - Make friendly training materials with illustrations to enhance communication with VMGs - Target VMG for ToT training and promotion of the WE5213 maize variety - Target ToT farms for WE5213 maize breeding demonstrations

	- Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms - Increased WE5213 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by smallscale farmers in dryland mid altitude zones of Kenya
Application guidelines for users	References - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Murenga M. et al., 2015. Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.10 WE5218

2.1.1 TIMP Name	WE5218
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting fro erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with yield potential of 7.3 to 9.1 t ha ⁻¹ , early maturity (105 to 125 days), resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize

	streak virus. Has good husk cover, plant and ear aspect. Year of release 2017. 
Justification	WE5218 is tolerant to drought and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE5218 best bet variety for growing in mid altitude transitional areas of where these leaf diseases and frequent drought cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs).
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, • Good Marketing Models and path ways, county and central government support, funding to research, validate and promote new maize varieties'

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay
Challenges in dissemination	• Linkage with seed companies to produce certified seed, maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• WE5218 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms,

	availability, • Accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transition region hence the need to build their capacity • Create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in developmen, dissemination, adoption and scaling uptake	• WE5218 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5218 maize variety may not be favorable to women farmers

Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5218 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the WE5218 maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE5218 maize variety • Target ToT farms for WE5218 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5218 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by farmers in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya Murenga M. et al., 2015. Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katamani@kalro.org

Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.11 WE5227

2.1.1 TIMP Name	WE5227
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with yield potential of 7.5 to 9.5 t ha ⁻¹ , early maturity (105 to 130 days), resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Has good husk cover, plant and ear aspect. Year of release 2017.
Justification	WE5227 is tolerant to drought and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. These attributes make WE5227 best bet variety for growing in dryland mid altitude zones of Kenya where these leaf diseases and frequent drought cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, • development of agronomic practices for maize , identification of Agro ecological and climate requirements for cultivation, • seed availability and accessibility, good seed system to

	ensure quality, • diversification of maize food products through value addition, • well organized farmer groups and networks, • good Marketing Models and path ways, county and central government support, • funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Machakos, Kiambu, Homa Bay, Kakamega
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, • Continuous Maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• WE5227 conforms to the market requirements, • Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms,

	• Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in dryland mid altitude zones hence the need to build their capacity • create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 60,000 and thus net benefit KES 35,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• WE5227 maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on WE5227 maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on WE5227 maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members

VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the WE5227 maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the WE5227 maize variety • Target ToT farms for WE5227 maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased WE5227 maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully by farmers in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya Murenga M. et al., 2015. Water Efficient Maize for Africa (WEMA) project Hybrids Booklet, 2017.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS . Phone: 0710-906600 Email: kalro.katumani@kalro.org
Lead organizations/scientists	KALRO Katumani, Centre Director, Murenga Mwimali, J Karanja and Tende R.
Partner organizations	KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties.

2.2.4.12 KH500-13E

2.1.1 TIMP Name	KH500-13E
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus and ear rots
What is it? (TIMP description)	A white cob, drought tolerant, three-way cross hybrid with average yield potential of 4.5 to 5.3 t ha ⁻¹ . It is of medium maturity (120 days), resistant to ear rots and major leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Year of release 2017.
Justification	Being a drought tolerant maize hybrid that is resistant to ear rots and major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus make KH500-13E best bet variety for growing in mid altitude transitional areas of Kenya where frequent droughts and the aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • identification of Agro ecological and climate requirements for cultivation, • seed availability and accessibility, good seed system to ensure quality, • diversification of maize food products through value addition, well organized farmer groups and networks, • good Marketing Models and path ways, county and central government support, funding to research, validate and promote new maize varieties'

Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Isiolo, Machakos, Kitui and other mid-dry lowlands zones in Kenya
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• KH500-13E conforms to the market requirements, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of

	Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in dryland mid altitude zones hence the need to build their capacity • Create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 55,000 and thus net benefit KES 30,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-13E maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-13E maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-13E maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the KH500-13E maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs

VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-13E maize variety • Target ToT farms for KH500-13E maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-13E maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27 - 60100 Embu, Phone: +254 727444608 / 727444638 E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO-Embu, Centre Director, Charles Mutinda
Partner organizations	NGOs, County governments, CIMMYT, Local Seed Companies

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.13 KH500-51A

2.1.1 TIMP Name	KH500-51A (MU07-018)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and that suffer grain yield losses upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.

What is it? (TIMP description)	A white cob flint like, three-way cross hybrid with yield potential of 6.0 to 6.5 t ha⁻¹, matures in 150-170 days, resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. -Year of release 2015 
Justification	Being resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus make KH500-51A best bet variety for growing in mid altitude transitional areas of Kenya where these leaf diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, • Good Marketing Models and path ways, county and central government support, funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs,

	Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Continuous maintenance of breeder seed by the Breeder
Lessons learned in up scaling if any	• KH500-51A conforms to the market requirements, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • organized production and market aids in wide adoption, • partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transitional zones therefore the need to build their capacity

	• Create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 55,000 and thus net benefit KES 30,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-151A maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-51A maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-51A maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the KH500-51A maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-13E maize variety • Target ToT farms for KH500-51A maize breeding

	demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-51A maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO Embu, Centre Director, Charles Mutinda
Partner organizations	KALRO SeedS, KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company namely; Victoria Seeds Company, Leldet Seeds Company seed Co, Faida seed Co, Olerai seed Co, EA seed Co, Sacred Africa and Crop Africa

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.14 KH500-52A

2.1.1 TIMP Name	KH500-52A (MU08-005)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting from erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob flint like, three-way cross hybrid with yield potential of 4.39 t ha ⁻¹ , matures in 4 to 5 months, drought tolerant and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Year of release 2015

Justification	Being tolerant to drought and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus make KH500-52A best bet variety for growing in mid altitude transitional areas of Kenya where frequent droughts and aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones –SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, identification of Agroecological and climate requirements for cultivation, • Seed availability and accessibility, good seed system to ensure quality, diversification of maize food products through value addition, • Well organized farmer groups and networks, good Marketing Models and path ways, • County and central government support, funding to research, • Validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions.
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega

Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• KH500-52A conforms to the market requirements, chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transitional zones therefore the need to build their capacity • create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 45,000 and thus net benefit KES 20,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-52A maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to

	land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-52A maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-52A maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the KH500-52A maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-52A maize variety • Target ToT farms for KH500-52A maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-52A maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling

G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO Embu, Centre Director, Charles Mutinda
Partner organizations	KALRO SeedS, KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company namely; Victoria Seeds Company, Leldet Seeds Company seed Co, Faida seed Co, Olerai seed Co, EA seed Co, Sacred Africa and Crop Africa

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.4.15 KH500-53A

2.1.1 TIMP Name	KH500-53A (MU10-010)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and suffer grain yield losses of upto 100% because of recurrent droughts at the reproductive stage and at the end of the season resulting fro erratic and unreliable rains. These unimproved varieties are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob flint like, three-way cross hybrid with yield potential of 4.9 to 5.0 t ha ⁻¹ , matures in 150 to 170 days, drought tolerant and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot and maize streak virus. Year of release 2015
Justification	Being tolerant to drought and resistant to major maize leaf diseases such as northern leaf blight, gray leaf spot andmaize streak virus make KH500-53A best bet variety for growing in mid altitude transitional areas of Kenya where frequent droughts and aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)

Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, • development of agronomic practices for maize, identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • good seed system to ensure quality, diversification of maize food products through value addition, well organized farmer groups and networks, • good Marketing Models and path ways, county and central government support, • funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • Identify a seed company to produce certified seed for all the maize varieties under the WEMA hybrids series, • Promote the varieties, continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons, • Licensing issues via AATF needs to be addressed.
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• KH500-53A conforms to the market requirements, • chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of new technologies,

	• organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • availability, accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, it is cultivated mainly by women in mid altitude transitional zones therefore the need to build their capacity • create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, • Field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 45,000 and thus net benefit KES 20,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-53A maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-53A maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-53A maize variety

	• Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the KH500-53A maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-53A maize variety • Target ToT farms for KH500-53A maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-53A maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org :
Lead organizations/scientists	KALRO Embu, Centre Director, Chares Mutinda
Partner organizations	KALRO SeedS, KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company namely; Victoria Seeds Company, Leldet Seeds Company, seed Co, Faida seed Co, Olerai seed Co, EA seed Co, Sacred Africa and Crop Africa

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties

2.2.4.16 KH500-54A

2.1.1 TIMP Name	KH500-54A (CKH10778)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and suffer grain yield losses of upto 100% because they are susceptible to leaf diseases such as gray leaf spot, northern leaf blight and maize streak virus.
What is it? (TIMP description)	A white cob flint to intermediate like, three-way cross hybrid with yield potential of 8.5 t ha⁻¹, matures in 5 to 6 Months and resistant to maize streak virus and gray leaf spot. Has good husk cover and ear aspects. Year of release 2017. 
Justification	KH500-54A is resistant to maize streak virus and gray leaf spot and these attributes make it a variety of choice for growing in mid altitude transitional areas of kenya where the aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones – SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agroecological and climate requirements for cultivation, • Seed availability and accessibility,

	• Good seed system to ensure quality, • Diversification of maize food products through value addition, • Well organized farmer groups and networks, good Marketing Models and path ways, • County and central government support, funding to research, • Validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, • Farmers/farmer groups to adopt and produce, county governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • Identify a seed company to produce certified seed for all the maize varieties under these KH500 hybrids series, promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, demo seed production by KALRO breeders, • Joint demonstration (farmers/seed companies) of the new varieties in the target AEZ and disease prone areas for MSV, • Production seed research for all KALRO released varieties, • Promotion of the new varieties using small packs (<250g), jumpstart certified seed production through KSU, continuous maintenance of breeder seed, • Continuous maintenance of breeder seed by the breeder

Lessons learned in up scaling if any	• KH500-54A conforms to the market requirements, chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of new technologies, • Organized production and market aids in wide adoption, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, availability, • Accessibility and affordability of certified seed and other inputs during and after promotion is key to adoption of the TIMP
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to have a policy on quality declared seed to allow production of the seed by farmers under minimal inspection by KEPHIS, • Food safety/Health concerns: recommend use of Aflasafe KE01 a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women in mid altitude transitional zones therefore the need to build their capacity and create an enabling policy environment and policy review from time to time. • To improve on marketing and demand creation, there is a need to carry out field demonstrations, field days, radio and TV advertisements to enable awareness on the benefits of the TIMP, • Implementation of the flour blending policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 55,000 and thus net benefit KES 30,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-54A maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-54A maize variety may not be favorable to women farmers

Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-54A maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the KH500-54A maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion of the KH500-54A maize variety • Target ToT farms for KH500-54A maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-54A maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
Application guidelines for users	Reference - Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO Embu, Centre Director, Charles Mutinda
Partner organizations	KALRO SeedS, KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria

	Seeds Company, Leldet Seeds Company namely; Victoria Seeds Company, Leldet Seeds Company, seed Co, Faida seed Co, Olerai seed Co, EA seed Co, Sacred Africa and Crop Africa

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.4.17 KH500-55A

2.1.1 TIMP Name	KH500-55A (MU10-233)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low yields due to cultivation of unimproved maize varieties, and grain yield losses of upto 100% because of recurrent droughts reproductive stage and at the end of the season resulting from unreliable rains. These unimproved varieties are susceptible to diseases such as gray leaf spot, northern leaf blight and maize virus.
What is it? (TIMP description)	A white cob flint to intermediate like, three-way cross hybrid with yield potential of 6.5 t ha ⁻¹ , matures in 120- to 160 days, tolerant to drought, and resistant to maize streak virus and gray leaf spot. Has good husk cover and ear aspects. Year of release 2016.
Justification	KH500-55A is tolerant to drought and resistant to maize streak virus and gray leaf spot and these attributes make it a variety of choice for growing in mid altitude transitional areas of Kenya where frequent drought and the aforementioned diseases cause yield losses that range from trace to 100%.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Traders, Millers, Seed dealers, Researchers, Extension service, consumers, and Seed companies
Approaches to be used in dissemination	On farm and on station research trials and demonstrations, training workshops, Seminars, Meetings, Field days, Agricultural shows, MoALFC/Extension officers' Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional materials (posters/brochures/leaflets, manuals), Web material's, Mobile phones –SMS, Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Applied Research to release improved maize varieties, development of agronomic practices for maize, • Identification of Agro ecological and climate requirements for cultivation, seed availability and accessibility, • Good seed system to ensure quality, diversification of maize food products through value addition, well organized farmer groups and networks,

	• Good Marketing Models and path ways, county and central government support, • Funding to research, validate and promote new maize varieties'
Partners/stakeholders for scaling up and their roles	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations e.g. CIMMYT, to provide variety, seed and production information, • Market players to create a demand and pull production, farmers/farmer groups to adopt and produce, • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination, • NGOs to take up maize e.g. Africa Harvest, Seed Traders Association (STAK), Cereal Growers Association, Farm Africa for farmer organizing and mobilization, • Seed companies for quality seed multiplication, • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega
Counties where TIMP will be up scaled	Embu, Meru, Kirinyaga, Kiambu, Siaya, Busia, Kakamega
Challenges in dissemination	• Linkage with seed companies to produce certified seed, • Maintenance of breeder seed • Identify a seed company to produce certified seed for all the maize varieties under these kh500 hybrids series, • Promote the varieties, • Continuous maintenance breeder seed of the varieties and it requires seed multiplication for two seasons
Suggestions for addressing the challenges	• Seed production by KALRO Seed Unit assisted by contract farmers, • Demo seed production by KALRO breeders, • Joint demonstration (farmers/seed companies) of the new varieties in the target AEZ and disease prone areas for MSV, • Production seed research for all KALRO released varieties, • Promotion of the new varieties using small packs (<250g), • JumpStart certified seed production through KSU, continuous maintenance of breeder seed, continuous maintenance of breeder seed by the breeder
Lessons learned in up scaling if any	• The technology conforms to the market requirements, • Creation of awareness through demonstrations and farmer workshops helps in adoption of the varieties, • Availability of market is key

Social, environmental, policy and market conditions necessary for development and up scaling	• Creation of awareness on nutritional and livestock importance of the variety, • Harmonious gender consideration in research, consumption and marketing, • It is cultivated mainly by women hence the need to capacity build them, enabling policy and policy review from time to time, • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	The average total production cost per acre is KES 25,000
Estimated returns	Per acre returns approximately KES 50,000 and thus net benefit KES 25,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• KH500-55A maize variety is labour intensive mainly in planting, weeding, shelling which are mostly carried out by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High costs of improved seed and other farm inputs for most smallscale farmers who lack finances to support access • Slow information flow, and lack of awareness for most female famers with low education levels • Women suffer time constraints due to domestic roles, and miss out on dissemination meetings • Training materials and strategies on KH500-55A maize variety may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization • Employment opportunities for both women and the youth along the maize value chain • Reach more women and youth groups with information on KH500-55A maize variety • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMG • VMGs have limited finances to buy the KH500-55A maize variety • Challenging dissemination methods and incomprehensible documents that are also inaccessible by VMGs
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs. • Make friendly training materials with illustrations to enhance communication with VMGs

	• Target VMG for ToT training and promotion of the KH500-55A maize variety • Target ToT farms for KH500-55A maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required farm inputs on favourable credit terms • Increased KH500-55A maize production will lead to enhanced food security
E: Case studies/profiles of success stories	
Success stories from	Tolerant maize varieties have been adopted successfully in dryland mid altitude zones of Kenya
previous similar projects	
Application guidelines for users	Reference: Esilaba, A.O.et al. (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	1-ready for upscaling
G. Contacts	
Contacts	Centre Director, KALRO-Embu, P.O. Box 27-60100 Embu, Phone: +254 727444608 / 727444638, E-mail: kalro.embu@kalro.org
Lead organizations/scientists	KALRO Embu, Centre Director, Charles Mutinda
Partner organizations	KALRO SeedS, KALRO Seeds, NGOs, County Governments, AATF, CIMMYT, Local Seed Companies namely; Victoria Seeds Company, Leldet Seeds Company namely; Victoria Seeds Company, Leldet Seeds Company, seed Co, Faida seed Co, Olerai seed Co, EA seed Co, Sacred Africa and Crop Africa

Research Gaps

1. Funding to research, validation and promotion of more superior drought tolerant improved maize varieties

2.2.5 2Highlands

2.2.5.1 KH600-11D

Technology name	KH600-11D
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss.

What is it? (TIMP description) KH600-11D	This is a varietal cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000 mm. It has white semi-flint grains and matures in 140–160 days giving a yield of 32-42 bags/acre. The special attributes include Strong stalks, good standability, resistance to Gray Leaf Spot and good husk cover 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-11D was released in Kenya for the highland agro-ecological zones in 1999. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Maize value chain actors –producers to market • Strong partnership linkages • Awareness campaigns

Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
• C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• -Scarcity of seed for setting up demo plots in all highland counties • -Dwindling numbers of government extension workers • -Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • -Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful upscaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days helps in adoption of the varieties, availability of market, • partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• -Farmers' willingness to adopt new variety • -Favourable weather conditions in the desired agro-ecology • -Availability of market • -Favourable policies to support seed/production, marketing and value addition

	• -Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 73,600/= (32 bags x 2300) and thus net benefit KES 45,600/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations - Affirmative action opportunities exist for VMGs to acquire

	the required credit expensive inputs - Increased production will lead to enhanced food security - Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories if any	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	Research Gaps - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D. B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G.A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide extension services, KEPHIS- Seed Inspection, Seed Companies – Seed Production, CIMMYT- Technical back stopping

Research Gaps

1. Funding to research, validation and promotion of improved maize varieties especially composites

2.2.5.2 KH600-23A

Technology name	KH600-23A
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss.

What is it? (TIMP description) KH600-23A	This is a top cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000 mm. It has white semi-flint grains and matures in 145–175 days giving a yield of 43-68 bags/acre. The special attributes include Strong stalks, good standability, resistance to rust, resistance to Gray Leaf Spot and good husk cover. 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-23A was released in Kenya for the highland agro-ecological zones in 2008. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs

Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 98,900/= (43 bags x 2300) and thus net benefit KES 70,900/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of

	VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • -Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • -Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	Research Gaps - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D. B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G.A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide extension services, KEPHIS- Seed Inspection, Seed Companies – Seed Production, CIMMYT- Technical back stopping

Research Gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties especially composites

2.2.5.3 High Altitude Composite (HAC)

Technology name	HAC
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Length of maturity of maize in the cold highlands is up to 13 months instead of 6 to 8 months under normal conditions

	making the land to be unavailable for planting other crops, this coupled with frost and Gray Leaf Spot which leads to yield losses of up to 50% is of a great effect on the yield of maize
What is it? (TIMP description) HAC	This is an open pollinated variety (composite) and grows at an altitude of 2200- 3000 m above sea level with a rainfall of 1000 -2000 mm. It has white semi-flint grains and matures in 140–160 days giving a yield of 20-34 bags/acre. The special attributes include early maturity, frost tolerance, resistance to Gray Leaf Spot. 
Justification	Late maturity, frost and foliar diseases is a major problem in the cold highlands of Kenya. Commercial highland varieties take upto 13 months to mature in the very cold highlands hence the need for early maturing frost tolerant varieties like HAC which was released in 2006 takes and 7-8 months. It is highly adapted to the cold highlands and preferred by farmers due to earliness and frost tolerance and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs

Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Nyandarua, Uasin Gishu, Elgeyo Marakwet
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Nyandarua, Uasin Gishu, Elgeyo Marakwet
Challenges in dissemination	• -Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days helps in adoption of the varieties, • Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 57,500/= (25 bags x 2300) and thus net benefit KES 29,500/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • Well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to

	enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • -Increased production will lead to enhanced food security Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Technology name	HAC
Success stories in the past if any	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D. B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide extension services, KEPHIS- Seed Inspection, Seed Companies – Seed Production, CIMMYT- Technical back stopping

Research Gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties especially composites

KH600-14E

Technology name	KH600-14E
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Due to climate change development of varieties which are drought tolerant is of paramount importance as this will ensure that the farmer gets some yield even under

	unfavorable climatic conditions.
Technology name	KH600-14E
What is it? (TIMP description) KH600-14E	This is a top cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 150–165 days giving a yield of 38-48 bags/acre. The special attributes include drought tolerance, resistance to rust, resistance to Gray Leaf Spot and Turcicum leaf blight. 
Justification	Drought is a problem in some regions in the highland agro-ecological zones of Kenya. A variety which can survive under low input and low rainfall conditions is therefore essential. KH600-14E which is a top cross hybrid with similar characteristics, but slightly high yielding than the famous H614D was developed in 2004. It is highly adapted to the region and preferred by farmers due to its adaptation to dry conditions and low yielding environments and is also good for roasting. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets)

	• Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors –producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, reation of awareness through demonstrations and farmer field days help in adoption of the varieties, • availability of market, partnership is important in technology dissemination and adoption and this can be

	facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 78,200= (34 bags x 2300) and thus net benefit KES 50,200/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints

VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • .Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	- References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
Technology name	KH600-14E
	- Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural service providers, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

KH600-15A

Technology name	KH600-15A
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss.
What is it? (TIMP description) KH600-15A	This is a top cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 145–180 days giving a yield of 33-47 bags/acre. The special attributes include Strong stalks, resistance to rust, resistance to blight, resistance to Gray Leaf Spot and good husk cover.  KH 600 – 15A MATURITY 145 – 148 DAYS YIELD 33 – 47 BAGS/ACRE
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-15A was released in Kenya for the highland agro-ecological zones in 2001. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions

	• Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors –producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations

	• The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 75,900/= (33 bags x 2300) and thus net benefit KES 47,900/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system

VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D.O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural service providers, KEPHIS - Seed Inspection, Seed
	Companies – Seed production

Research Gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.4 KH600-16A

Technology name	KH600-16A
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss.
What is it? (TIMP description) KH600-16A	This is a top cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 140–180 days giving a yield of 35-48 bags/acre. The special attributes include, resistance to MSV, resistance to blight, resistance to rust, resistance to Gray Leaf Spot  KH 600 – 16A MATURITY 140 – 180 DAYS YIELD 35 – 48 BAGS/ACRE 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-16A was released in Kenya for the highland agro-ecological zones in 2001. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists

Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for

	demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• -Farmers' willingness to adopt new variety • -Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 80,500/= (35 bags x 2300) and thus net benefit KES 52,500/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not

	always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • - Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • - Increased production will lead to enhanced food security • - Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G., D. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. workshop for maize breeders, agronomists, post harvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural service providers, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.5 KH600-17A

Technology name	KH600-17A
Category (i.e. technology, innovation or management practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-17A	This is a varietal cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000 mm. It has white semi-flint grains and matures in 140–160 days giving a yield of 37-51 bags/acre. The special attributes include good standability, resistance to blight, resistance to Gray Leaf Spot and less rots. 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-17A was released in Kenya for the highland agro-ecological zones in 2002. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps)

	• Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• -Scarcity of seed for setting up demo plots in all highland counties • -Dwindling numbers of government extension workers • -Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • -Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers

Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition- • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 85,100/= (37 bags x 2300) and thus net benefit KES 57,100/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the

	expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • - Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • - Increased production will lead to enhanced food security • - Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G., D. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling, 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D.O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural service providers, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.6 KH600-18A

Technology name	KH600-18A
Category (i.e. technology, innovation or management practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
Technology name	KH600-18A
What is it? (TIMP description) KH600-18A	This is a varietal hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 155–170 days giving a yield of 36-50 bags/acre. The special attributes include good standability, resistance to blight, resistance to Gray Leaf Spot and less rots. 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-18A was released in Kenya for the highland agro-ecological zones in 2004. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits

	• Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• -Scarcity of seed for setting up demo plots in all highland counties • -Dwindling numbers of government extension workers • -Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • -Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers

Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • -Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 82,800/= (36 bags x 2300) and thus net benefit KES 54,800/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always

	easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • - Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • - Increased production will lead to enhanced food security • - Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Uasin Gishu counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale, Phone: 020 3509161, Email: kalrokitale@kalro.org ,
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural service providers, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research Gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.7 KH600-19A

Technology name	KH600-19A
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-19A	This is a double cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 160 –175 days giving a yield of 38-53 bags/acre. The special attributes include Strong stalks, resistance to blight, resistance to Gray Leaf Spot and less rots.
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-19A was released in Kenya for the highland agro-ecological zones in 2005. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs

Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up and their roles	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation

	• The government to employ more extension officers platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 87,400/= (38 bags x 2300) and thus net benefit KES 59,400/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • Well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for vmgs • Dissemination methods and documents that are not always easy to understand or access by vmgs • Vmgs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints

VMG related opportunities	• Provide vmgs with affordable and easy to use mechanized equipment for maize cultivation • And utilization of maize and hence improved health of vmgs • Make friendly training materials with illustrations to enhance communication with vmgs • Target VMG for tot training and promotion • Target tot farms for maize breeding demonstrations • Affirmative action opportunities exist for vmgs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions

E: Case studies/profiles of success stories

Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling

G: Contacts

Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension service providers, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research Gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.8 KH600-20A

Technology name	KH600-20A
Category (i.e. technology, innovation or management practice)	

A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base, weak stalks and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-20A	This is a top cross hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 160 - 180 days giving a yield of 38 -55 bags/acre. The special attributes include Strong stalks, resistance to rust, resistance to blight, resistance to Gray Leaf Spot and good husk cover. 
Justification	Low yields, lodging and gray leaf spot hamper maize production in the highlands. Breeding for increased yield per unit area and incorporating stalk strength and GLS resistance is a good solution to this problem. A high yielding variety KH600-20A was released in Kenya for the highland agro-ecological zones in 2005. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets)

	Partners –NGOs
Critical/essential factors for successful promotion	- Seed availability, accessibility and affordability - Strong linkage among Green Gram value chain actors – producers to market - Strong partnership linkages - Awareness campaigns
Partners/stakeholders for scaling up	- KALRO - to provide breeder seed and technical back stopping - CIMMYT- to provide variety, seed and production information and technical back stopping - Agrovets and seed stockists – to stock the varieties - CBOs, NGO's- Technology dissemination - County governments, central governments - for policy, awareness and dissemination - Seed companies - for quality seed multiplication - Farmers/farmer groups - to adopt and produce the varieties - Financial institutions – Provide credit - Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	- Scarcity of seed for setting up demo plots in all highland counties - Dwindling numbers of government extension workers - Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders - Unorganized marketing channels
Suggestions for addressing the challenges	- Establish a working seed system - Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. - Dissemination of information on production practices and promotion of the variety in the suitable areas. - continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations - The government to employ more extension officers

Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 87,400/= (38 bags x 2300) and thus net benefit KES 59,400/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties

	• Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.9 KH600-21A

Technology name	KH600-21A
Category (i.e. technology, innovation or management practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-21A	This is a top cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 140–180 days giving a yield of 38-62 bags/acre. The special attributes include Strong stalks, resistance to rust, resistance to blight, resistance to Gray Leaf Spot and good husk cover. 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-21A was released in Kenya for the highland agro-ecological zones in 2006. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather

	- information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of the varieties,

	• Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 87,400/= (38 bags x 2300) and thus net benefit KES 59,400/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints

VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • .Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D., B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G., D. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed
	Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.10 KH600-22A

Technology name	KH600-22A
Category (i.e. technology, innovation or management practice)	

A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base, poor husk cover and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-22A	This is a top cross hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 140–180 days giving a yield of 40-66 bags/acre. The special attributes include Strong stalks, resistance to Gray Leaf Spot and good husk cover. 
Justification	Low yields, ear rots and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance and good husk cover is a good solution to this problem. A high yielding variety KH600-22A was released in Kenya for the highland agro-ecological zones in 2006. It is highly adapted to the region and preferred by farmers due to high yields, less ear rots and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles

	• Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and

	farmer field days help in adoption of the varieties, availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• -Farmers' willingness to adopt new variety • -Favourable weather conditions in the desired agro-ecology • -Availability of market • -Favourable policies to support seed/production, marketing and value addition • -Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 92,000/= (40 bags x 2300) and thus net benefit KES 64,000/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints

VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation ◦ and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D., B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G., D. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding to research, validation and promotion of improved maize varieties

2.2.5.11 KH600-24A

Technology name	KH600-24A
Category (i.e. technology, innovation or management practice)	Technology

A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-24A	This is a top cross hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi–flint grains and matures in 140–160 days giving a yield of 47-69 bags/acre. The special attributes include well established roots and strong stalks, resistance to gray leaf spot, rust, blight., and good husk cover
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-24A was released in Kenya for the highland agro-ecological zones in 2001. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns

Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market

	• Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 108,100/= (47 bags x 2300) and thus net benefit KES 80,100/=..
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations

	• Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D., B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding for research to develop climate smart improved maize varieties
3. Funding for validation and promotion of released improved maize varieties

2.2.5.12 KH600-25A

Technology name	KH600-25A
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss

What is it? (TIMP description) KH600-25A	This is a top cross hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 140–165 days giving a yield of 49-70 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, good husk cover 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-25A was released in Kenya for the highland agro-ecological zones in 2015. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs

Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted, if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of • Market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 112,700/= (49 bags x 2300) and thus net benefit KES 84,700/=.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs

	• Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D., B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G., D. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research Gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding for research to develop climate smart improved maize varieties
3. Funding for validation and promotion of released improved maize varieties

2.2.5.13 KH600-26A

Technology name	KH600-26A
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss

What is it? (TIMP description) KH600-26A	This is a top cross hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 142–170 days giving a yield of 51 - 70 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, good husk cover , strong stalks. 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-26A was released in Kenya for the highland agro-ecological zones in 2015. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs

Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, partnership is important in technology dissemination and adoption and this can be

	facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 117,300/= (51 bags x 2300) and thus net benefit KES 89,300/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation

	• and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G., D. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding for research to develop climate smart improved maize varieties
3. Funding for validation and promotion of released improved maize varieties

2.2.5.14 KH600-27A

Technology name	KH600-27A
Category (i.e. technology, innovation or management practice)	
A: Description of the technology, innovation or management practice	

Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) KH600-27A	This is a top cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 145–175 days giving a yield of 53-71 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, good husk cover white semi- flint kernels, strong stalks . 
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety KH600-27A was released in Kenya for the highland agro-ecological zones in 2015. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles

	• Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• -Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of market,

	partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 121,900/= (53 bags x 2300) and thus net benefit KES 93,900/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development and dissemination and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use

	mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References • Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya • Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Postharvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 • Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, agronomists, postharvest and crop health scientists. DTI, Naivasha. 25-29 March, 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection, Seed Companies – Seed production

Research gaps

1. Unavailability of adequate early generation seed. KALRO Seed Unit to produce early generation seed
2. Funding for research to develop climate smart improved maize varieties
3. Funding for validation and promotion of released improved maize varieties

2.2.5.15 H614D

Technology name	H614D
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem addressed	Due to climate change varieties are giving low yields as a result of drought and this coupled with susceptibility to Gray Leaf Spot leads to yield losses of more than 20%
What is it? (TIMP description) KH600-H614D	This is a top cross hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 145–175 days giving a yield of 30-35 bags/acre. The special attributes include Strong stalks, drought tolerance, resistance to blight, resistance to rust, resistance to Gray Leaf Spot and good husk cover. 
Justification	Low yields due to drought and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area, drought tolerance and incorporating GLS resistance is a good solution to this problem. A high yielding variety H614D was released in Kenya for the highland agro-ecological zones in 1986. It is highly adapted to the region and preferred by farmers due to high yields, tolerance to drought and its resistance to gray leaf spot and good performance in low yielding environments. However, seed availability has been a major challenge. Breeder seed stocks are available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets)

	• Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms

Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 69,000/= (30 bags x 2300) and thus net benefit KES 41,000/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to

	enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D., B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Center Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	Kenya Seed Company, NGOs – Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: The variety is licensed to Kenya Seed Company and they are producing basic and commercial seed.

2.2.5.16 H626

Technology name	H626
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base, poor husk cover and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H626	This is adouble cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi–flint grains and matures in 160–180 days giving a yield of 38-42 bags/acre. The special attributes include Strong stalks, resistance to rust, resistance to blight and good husk cover.

Justification	Low yields and ear rots are a problem to maize production in the highlands. Breeding for increased yield per unit area and minimizing ear rots is a good solution to this problem. A high yielding variety H626 was released in Kenya for the highland agro-ecological zones in 1989. It is highly adapted to the region and preferred by farmers due to high yields, strong stalks and drooping ears. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	

Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 87,400/= (38 bags x 2300) and thus net benefit KES 59,400/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles

	• Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest

	and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Centre Director KALRO-Kitale, P.O. Box 450-30200, Kitale. Phone: 020 3509161, Email: kalrokitale@kalro.org
Lead organization/scientists	KALRO, Centre Director, D. O. Ligeyo, B. Awalla, E. Saina
Partner organizations	NGOs – Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: The variety is licensed to Kenya Seed Company and they are producing basic and commercial seed.

2.2.5.17 H625

Technology name	H625
Category (i.e. technology, innovation or management practice)	
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base, poor husk cover and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H625	This is a double cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi–flint grains and matures in 155–180 days giving a yield of 37-40 bags/acre. The special attributes include Strong stalks, resistance to rust, resistance to blight and good husk cover. 
Justification	Low yields, ear rots and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and developing varieties with good husk cover is a good solution to this problem. A high yielding variety H625 was released in Kenya for the highland agro-ecological zones in 1981. It is highly adapted to the region and preferred by farmers due to

	high yields and good husk cover. However, seed availability has been a major challenge. Breeder seed stocks available at KALRO-Kitale, but there is need to increase pre-basic and basic seed.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers

	• Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers • Maintenance of breeder seed and production of pre-basic and basic seed, • Production of seed for demonstrations
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 85,100/= (37 bags x 2300) and thus net benefit KES 57,100/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers

Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling

G: Contacts	
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke
Lead organization/scientists	Kenya Seed Co, Alphonse Laboso, Joseph Kamau
Partner organizations	NGOs – Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: The variety is licensed to Kenya Seed Company and they are producing basic and commercial seed.

2.2.5.18 H6213

Technology name	H6213
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H6213	This is a double cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 160–180 days giving a yield of 52-56 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, strong stalks, good husk cover.
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety H6213 was released in Kenya for the highland agro-ecological zones in 2002. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles

	• Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • -Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, partnership is important in

	technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • -Favourable weather conditions in the desired agro-ecology • -Availability of market • -Favourable policies to support seed/production, marketing and value addition • -Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 119,600/= (52 bags x 2300) and thus net benefit KES 91,600/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation

	• and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for vmgs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	Ready for upscaling
G: Contacts	
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke
Lead organization/scientists	Kenya Seed Co, Alphonse Laboso, Joseph Kamau
Partner organizations	NGOs - Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: Kenya Seed Company is producing basic and commercial seed.

2.2.5.19 H6218

Technology name	H6218
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H6218	This is a double cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 145–175 days giving a yield of 56-71 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, good husk cover white semi- flint

	kernels, strong stalks.
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety H6218 was released in Kenya for the highland agro-ecological zones in 2004. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination

C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• -Scarcity of seed for setting up demo plots in all highland counties • -Dwindling numbers of government extension workers • -Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • -Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • Continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of market, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 128,800/= (56 bags x 2300) and thus net benefit KES 100,800/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to

	land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • -Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties

Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. DTI, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke
Lead organization/scientists	Kenya Seed Co., Alphonse Laboso, Joseph Kamau
Partner organizations	NGOs - Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: Kenya Seed Company is producing basic and commercial seed.

2.2.5.20 H6210

Technology name	H6210
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H6210	This is a double cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 160–185 days giving a yield of 50-53 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, good husk cover white semi- flint kernels, strong stalks
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety H6210 was released in Kenya for the highland agro-ecological zones in 2004. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities

	• Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels

Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through • innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 115,000/= (50 bags x 2300) and thus net benefit KES 87,000/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize

	- varieties - Target women and youth groups during FFBS for effective training of farmers on maize production - Adoption of the TIMP has the potential of offering food and nutrition security to household members - well organized gender friendly markets and marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	- Laborious maize production practices due to limited mechanization not favourable for VMGs - Dissemination methods and documents that are not always easy to understand or access by VMGs - VMGs have limited finances to buy inputs especially the expensive varieties - Dissemination methods and documents that are not always easy to understand or access - Low access to markets and financial constraints
VMG related opportunities	- Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation - and utilization of maize and hence improved health of VMGs - Make friendly training materials with illustrations to enhance communication with VMGs - Target VMG for ToT training and promotion - Target ToT farms for maize breeding demonstrations - Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs - Increased production will lead to enhanced food security - Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
Ready for upscaling	
G: Contacts	
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke
Lead organization/scientists	Kenya Seed Co, Alphonse Laboso, Joseph Kamau
Partner organizations	NGOs - Extension, County governments – Extension, KEPHIS –

	Seed inspection, Seed companies- Seed production

Note: Kenya Seed Company is producing basic and commercial seed.

2.2.5.21 H629

Technology name	H629
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H629	This is a double cross hybrid and grows at an altitude of 1800-2500 m above sea level with a rainfall of 1000 –2000mm. It has white semi-flint grains and matures in 160–175 days giving a yield of 48-52 bags/acre. The special attributes include resistance to gray leaf spot, rust, blight, good husk cover, strong stalks
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety H629 was released in Kenya for the highland agro-ecological zones in 2000. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors – producers to market • Strong partnership linkages • Awareness campaigns

Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • creation of awareness through demonstrations and farmer field days help in adoption of the varieties, availability of market, • partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.

D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 110,400/= (48 bags x 2300) and thus net benefit KES 82,4000/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions

E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke
Lead organization/scientists	Kenya Seed Co, Alphonse Laboso, Joseph Kamau
Partner organizations	NGOs - Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: Kenya Seed Company is producing basic and commercial seed.

2.2.5.22 H628

Technology name	H628
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Technology name	H628
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H628	This is a double hybrid and grows at an altitude of 1800- 2500 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 155–175 days giving a yield of 46-50 bags/acre. The special attributes include resistance to rust, blight, strong stalks, resistance to Gray Leaf Spot and good husk cover.
Justification	Low yields and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating GLS resistance is a good solution to this problem. A high yielding variety H628 was released in Kenya for the highland agro-ecological zones in 1999. It is highly adapted to the region and preferred by farmers due to high yields and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors –producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate

	interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 105,800/= (46 bags x 2300) and thus net benefit KES 77,800/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers

Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties • Dissemination methods and documents that are not always easy to understand or access • Low access to markets and financial constraints
VMG related opportunities	• Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation • and utilization of maize and hence improved health of VMGs • Make friendly training materials with illustrations to enhance communication with VMGs • Target VMG for ToT training and promotion • Target ToT farms for maize breeding demonstrations • Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs • Increased production will lead to enhanced food security • Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	- References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018

F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)		Ready for upscaling
G: Contacts		
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke	
Lead organization/scientists	Kenya Seed Co, Alphonse Laboso, Joseph Kamau	
Partner organizations	NGOs - Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production	

Note: Kenya Seed Company is producing basic and commercial seed.

2.2.5.23 H624

Technology name	H624
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize yields caused by use of varieties with narrow genetic base, late maturing varieties and varieties susceptible to Gray Leaf Spot leads to 20% yield loss
What is it? (TIMP description) H624	This is a double cross hybrid and grows at an altitude of 1600-2300 m above sea level with a rainfall of 1000 – 2000mm. It has white semi-flint grains and matures in 135–150 days giving a yield of 30-32 bags/acre. The special attributes include Strong stalks, resistance to blight, resistance to rust, resistance to Gray Leaf Spot.
Justification	Low yields, late maturity and gray leaf spot are a problem to maize production in the highlands. Breeding for increased yield per unit area and incorporating earliness and GLS resistance is a good solution to this problem. A high yielding variety H624 was released in Kenya for the highland agro-ecological zones in 2004. It is highly adapted to the region and preferred by farmers due to high yields, earliness and its resistance to gray leaf spot.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Seed companies/Agro-dealers • Traders/Exporters, • Research organizations and universities • Agro-processors • Extension Agents (Public and Private) • Stockists
Approaches to be used in dissemination	• Agricultural Innovation platforms • On-farm demonstration • Field days • Agricultural shows and exhibitions • Farmer to farmer visits • Digital platforms (e.g KALRO, Digifarm, Weather information Apps) • Mass Media Radio/TV programmes (e.g. Mkulima

	programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles • Extension publications (posters/ brochures/leaflets) • Partners –NGOs
Critical/essential factors for successful promotion	• Seed availability, accessibility and affordability • Strong linkage among Green Gram value chain actors –producers to market • Strong partnership linkages • Awareness campaigns
Partners/stakeholders for scaling up	• KALRO - to provide breeder seed and technical back stopping • CIMMYT- to provide variety, seed and production information and technical back stopping • Agrovets and seed stockists – to stock the varieties • CBOs, NGO's- Technology dissemination • County governments, central governments - for policy, awareness and dissemination • Seed companies - for quality seed multiplication • Farmers/farmer groups - to adopt and produce the varieties • Financial institutions – Provide credit • Donors – To provide funds for research and dissemination
C: Current situation and future scaling up	
Counties where already promoted. if any	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Counties where TIMPs will be upscaled	Transnzoia, West Pokot, Bungoma, Kakamega, Uasin Gishu, Elgeyo Marakwet, Nandi
Challenges in dissemination	• Scarcity of seed for setting up demo plots in all highland counties • Dwindling numbers of government extension workers • Lack of maize innovation platforms to facilitate interaction of farmers with other maize value chain stakeholders • Unorganized marketing channels
Suggestions for addressing the challenges	• Establish a working seed system • Establish innovation platforms that involves farmers, national and county governments, NGOs, marketers and processors. • Dissemination of information on production practices and promotion of the variety in the suitable areas. • continuous maintenance of breeder seed and production of pre-basic and basic seed, production of seed for demonstrations • The government to employ more extension officers

Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field days help in adoption of the varieties, • Availability of market, partnership is important in technology dissemination and adoption and this can be facilitated through • innovation platforms
Social, environmental, policy and market conditions necessary	• Farmers' willingness to adopt new variety • Favourable weather conditions in the desired agro-ecology • Availability of market • Favourable policies to support seed/production, marketing and value addition • Implementation of the flour blending policy.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Per acre production cost KES 28,000
Estimated returns	Per acre returns KES 69,000/= (30 bags x 2300) and thus net benefit KES 41,000/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize varieties are labour intensive mainly in planting, weeding, shelling which are mostly done by women and youth • Women may be disadvantaged through lack of access to land to engage in maize cultivation • High cost of seed and other inputs where small-scale farmers lack funds to acquire • Slow information and awareness flow to female farmers due to low academic levels • Women may not have time to attend dissemination meetings due to their domestic roles • Training materials and strategies on maize varieties may not be favorable to women farmers
Gender related opportunities	• Women and youth friendly production techniques such as mechanization Women and youth will get employment at various nodes of the value chain • Reach more women groups with information on maize varieties • Target women and youth groups during FFBS for effective training of farmers on maize production • Adoption of the TIMP has the potential of offering food and nutrition security to household members • well organized gender friendly markets and marketing system
VMG issues and concerns in development, dissemination, adoption and scaling up	• Laborious maize production practices due to limited mechanization not favourable for VMGs • Dissemination methods and documents that are not always easy to understand or access by VMGs • VMGs have limited finances to buy inputs especially the expensive varieties

	- Dissemination methods and documents that are not always easy to understand or access - Low access to markets and financial constraints
VMG related opportunities	- Provide VMGs with affordable and easy to use mechanized equipment for maize cultivation and utilization of maize and hence improved health of VMGs - Make friendly training materials with illustrations to enhance communication with VMGs - Target VMG for ToT training and promotion - Target ToT farms for maize breeding demonstrations - Affirmative action opportunities exist for VMGs to acquire the required credit expensive inputs - Increased production will lead to enhanced food security - Well organized friendly trading conditions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Has been adopted successfully in Transnzoia, West Pokot and Bungoma counties
Application guidelines for users	References - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Ligeyo D.O, B. Awalla, E. Saina. Achievements of highland maize improvement sub-program. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018 - Ombakho G. A, D.O. Ligeyo, B. Awalla, E. Saina. Maize Research in Kenya: Achievements and future prospects. Workshop for maize breeders, Agronomists, Post harvest and Crop health scientists. Dairy Training Institute, Naivasha. 25-29 March 2018
F: Status of TIMP readiness (1-ready for upscaling; 2- requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	Kenya Seed Company, P.O. Box 553-30200, Kitale. Phone: 020 3509161, Email: alphonse.laboso@kenyaseed.co.ke
Lead organization/scientists	Kenya Seed Co, Alphonse Laboso, Joseph Kamau
Partner organizations	NGOs - Extension, County governments – Extension, KEPHIS – Seed inspection, Seed companies- Seed production

Note: Kenya Seed Company is producing basic and commercial seed.

2.3 MAIZE SEED SYSTEM

2.3.1 Improved Farmer-Saved-Seed-System

TIMP Name	Improved farmer-saved-seed-system
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	

Problem to be addressed	Although formal seed system for maize is well established, about 70% small-scale farmers especially in the coastal and mid altitude zones grow traditional maize varieties which they prefer because of good attributes such as pest and disease resistance, palatability and adaptability. These traditional varieties also make significant contributions during research processes. The source of seed is usually from the traditional farm saved seed which in most cases has admixtures resulting to genetic deterioration and low yields. In addition, under traditional farmer-saved-seed-system, selection of seed is done after harvesting and is based on external characteristics such as size and colour and does not consider such parameters as germination, purity and moisture content. This results to decrease of yields in every subsequent growing season and loss of quality and originality of the variety.
What is it? (TIMP description)	Improved farmer-saved-seed system is a process of selecting quality seed from the farm before harvesting of the entire crop. Improved farmer-saved-seed-system involves observation, selection and tagging of health, true to type plants in the middle of the farm where pollen from other farms cannot reach. The selected plants are then harvested early and dried well. The cobs are shelled, dried at 13% moisture content and stored in a dry, clean well-ventilated place or in hermetic containers to be planted the next season. Before planting germination tests are done to determine the seed rate. Improved farmer-saved-seed selection should only be practiced on one variety for a maximum of three seasons then the farmer should get certified seed.
Justification	Farm saved maize seed produced under improved farmer-saved-seed system is usually of high quality and purity. The cultivation of traditional and improved open pollinated maize varieties using farm saved seed produced under improved farmer-saved-seed system will contribute to increased yields, maintain genetic purity and conserve biodiversity of farmer preferred traditional maize varieties with good attributes such as pest and disease resistance, palatability and adaptability. Collections from these landraces is likely to make significant contributions during the research processes.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	• Farmer field and business Schools (FFBS), • Agricultural Innovation Platforms (AIP), on farm and on station research trails and demonstrations, • Farmer field days, Agricultural shows and exhibitions, • Public and private agricultural extension services, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS, Digital platforms (e.g KALRO, Digifarm, Weather

	information Apps), • Mass Media Radio/TV programmes (e.g. Mkulima programme, Smart Farmer and Seeds of Gold), Magazines and Newspapers articles.
Critical/essential factors for successful promotion	• Development, validation, promotion and documentation of improved farmer-saved-seed-system. • Active involvement of public and private agricultural service providers. • Well organized farmer groups and networks. County government support in sensitizing farmers. • Applied research to develop, validate and promote improved climate smart open pollinated maize varieties where quality seed can be produced under improved farmer-saves-seed-system thus making quality seed of improved open pollinated maize varieties accessible.
Partners/stakeholders for scaling up and their roles	• KALRO to develop, validate and promote improved climate smart open pollinated maize varieties where quality seed can be provided through improved farmer-saved-seed-system. • KALRO in collaboration County MoALFC extension officers to validate and document improved farmer-saved-seed-system. KALRO Seed Unit to provide certified seed for selected OPVs. • Farmers/farmer groups to adopt improved farmer-saved-seed-system to produce seed and probably sell to other farmers. • Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMP will be upscaled	Tana River and Uasin Gishu
Challenges in dissemination	• Improved farmer-saved-seed-system is not well documented and therefore needs to be documented. • Unorganised farmer groups to ease trainings. • Agricultural extension officers lack of knowledge and skills to disseminate improved farmer-saved-seed-system. • Unwillingness of farmers to embrace improved farmer-saved-seed-system. • Farmers with small maize farms each growing different maize varieties making it difficult to maintain purity. • Low awareness of importance of quality maize seed in most parts of Kenya

Suggestions for addressing the challenges	• Validate and document improved farmer-saved-seed-system. Develop manuals for training. • Organise farmer groups/CIGs/VMGs at community level for ease of training and follow up. • Identify and train public and private agricultural extension officers, and lead farmers to be ToTs on improved farmer-saved-seed-system for ease of dissemination. • Financial institutions (banks, donors, credit facilitators) for financial solution.
Lessons learned in upscaling if any	• Creation of awareness through demonstrations, • farmer workshops and media helps in adoption of technologies and innovations. • Availability of market is key
Social, environmental, policy and market conditions necessary for development and upscaling	• Establish innovation platform that involves farmers, national and county governments and NGOs to promote used of quality maize seed. Creation of awareness on importance of practicing improved farmer-saved-seed-system instead of using traditional farmer-saved-seed-system. • Registration of CIGs/VMGs will ease in dissemination and follow up. • Harmonious gender and social consideration in research, consumption and marketing. • Enabling policy and policy review from time to time.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Negligible
Estimated returns	Increased yields by 15 to 20%
Gender issues and concerns in development, dissemination, adoption and scaling up	• Land ownership is mainly by men who may have no interest in production of quality seed • Women have limited access to agricultural and extension services hence they might not have adequate knowledge on farmer-saved-seed-system • Women and youth lack funds to buy seed storage materials • Slow information and awareness flow to female farmers due to their low academic levels • Improved training materials and strategies for farmer-saved-seed-system are not favorable to women farmers
Gender related opportunities	• Women and youth to be trained on quality seed under improved farmer-saved-seed-system which they can sell to their fellow farmers and relatives • Empower women and youth to acquire land • Train women and youth to be lead farmers and part of the ToT team for training on improved farmer-saved-seed-system • Empower the women and youth who want to produce maize seed by connecting them to financial sources • The TIMP has the potential of increasing production, hence improved household food security

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to productive resources such as land, credit, and quality seeds • Majority of VMGs are food insecure and therefore may not be interested in farm saved seed because they depend on seed subsidies • Slow information and awareness flow to VMGs farmers due to low academic levels • Training materials and strategies for maize seed may not be favorable for VMGs • Due to their social status VMGs are often excluded from decision making in development and dissemination activities.
VMG related opportunities	• Empower VMGs to acquire land and train them on how to produce quality farm saved maize under improved farmer- saved-seed for their use and to sell to other farmers and relatives • Train VMGs to be lead farmers and part of the ToT team for training on production of quality maize seed under improved farmer-saved-seed-system • Target VMGs farms for demonstration of improved farmer-saved-seed-system • Empower the VMGs who want to produce quality farm saved maize seed by connecting them to financial source • The TIMP has the potential of increasing production, hence improved household food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	No documentation
Application guidelines for users	References - Chivatsi W.S et al. 2004. Community-based maize seed production in coastal lowland kenya. In Friesen D.K. and A. F. E. Palmer (eds.). Integrated Approaches to Higher Maize Productivity in the New Millenium. Proceedings of the 7th Eastern and Southern Africa Regional Maize Conference, Nairobi, Kenya, 11 - 15 February 2002. Mexico, D. F.: CIMMYT, pp. 446-451
	- Mapendekezo ya kukuza mahindi - Muli M.B. et.al. (2017). Evaluation of Released Maize Hybrids to Hasten Their Commercialization in Coastal Lowland Kenya. <i>Journal of Environmental Sustainability Advancement Research. Vol 3 No.3 pp 12-16</i>
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires research and validation
G. Contacts	
Contacts	Deputy Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Phone: 0202024751, Email: kalro.mtwapa@kalro.org. Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600, Email: kalro.katumani@kalro.org

Lead organization/scientists	KALRO Mtwapa, KALRO Katumani
Partner organizations	County government and local NGOS.

Research gaps

1. Research, testing and validation of improved farmer-saved-seed needs to be done
2. Identification of local and improved varieties to be subjected to own seed selection

2.3.2 Quality Declared Seed system

TIMP Name	Quality Declared Seed system
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	The use of recycled maize seed results to low yields. On the other hand use of maize hybrid seeds is the best option for achieving high yields, However, maize hybrid seeds are relatively expensive to the resource-limited farmer and in short supply. They are also unavailable at the right time hindering the adoption of improved maize varieties especially in the coastal region and the medium altitude - dry areas. The quality declared seed system is complementary systems that can be used increase the supply of quality maize seed thus sustainably increasing maize yields. .
What is it? (TIMP description)	Quality Declared Seed (QDS) system is community based semi-commercial but informal seed supply system. Selected farmers or farmer groups are given basic seed from research stations or formal seed companies and they multiply the seed under the guidance of agricultural staff and KEPHIS seed inspector. The seed does not undergo the full scale of government rigorous certification processes. Only simple standards on crop health and hygiene are adhered to by the seed producers, provided the source of the basic seed is known and therefore traceable. Only 10% of the seed crop by the farmer group is inspected once, at the critical stage such as flowering.
Justification	In the coastal lowlands of Kenya and medium altitude – dry regions, small-scale farmers complain that commercial maize seed is highly priced and many times out of their reach. Adoption of quality declared seed system for production of maize seed for selected climate smart maize varieties will ensure high yields which are sustainable since quality maize seed will be available at affordable prices by the small-scale farmers.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed companies, Seed dealers, Researchers, Extension service.

Approaches used in dissemination	Farmer field and business Schools (FFBS). Agricultural Innovation Platforms (AIP) targeting, small-scale farmers, breeders and seed companies. Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets
	and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Amendment of the seed and plant variety act to allow quality declared seed system for maize. • Development of ToT manuals for quality declared seed system in Kenya. • Seed availability, accessibility and affordability. • Good marketing models and path ways. Train public and private agricultural service providers on quality declared seed production. • Farmer producer groups for production of quality declared seed. • Funding to support production of basic seed to be used under quality declared seed system. • Funding for research, validation and promotion of new climate smart maize varieties to be produced under quality declared seed system.
Partners/stakeholders for scaling up and their roles	• KEPHIS to spearhead amendment of Seed and Plant Act Cap 326 to include guidelines for quality declared seed system. • KALRO Seed Unit and interested seed companies for provision of basic seed of climate smart maize varieties that can be produced under quality declared seed. • Well organised community-based maize seed producer groups. • Market players to create a demand and pull production. • Farmers/farmer groups to adopt and produce. • Public and private agricultural extension officers for supervision of production of quality declared seed, awareness and dissemination. • NGOs to organize and mobilize farmer groups and assist them to take up production of quality declared maize seed as a business. Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	Tana River and Uasin Gishu

Challenges in dissemination	• Quality declared seed system not yet authorized in Kenya. Unorganised farmer producer groups for seed production. • The agricultural extension officers lack of knowledge and skills to conduct seed inspection. • Climate smart maize varieties that can be produced under the quality declared seed system not identified. • Low awareness of importance of quality maize seed in most parts of Kenya
Suggestions for addressing the challenges	• Amendment of Seed and Plant Varieties Act Cap 326 to include guidelines for quality declared seed system. • KALRO Seed Unit and interested seed companies to identify climate smart maize varieties that can be produced under quality declared seed and provide their basic seed. • Organise farmer groups/CIGs/VMGs at community level into produce groups for production of quality declared maize seed and to encourage them to take up production of quality declared maize seed as a business. • Market players to create a demand and pull production. Identify and train public and private agricultural extension officers for supervision of production of quality declared seed, awareness and dissemination. • Financial institutions (banks, donors, credit facilitators) for financial solution.
Lessons learned in upscaling if any	• Quality declared seed allows many farmers to access quality seed of improved maize varieties efficiently and at a cheaper cost than the formal seed sector. • Well organized farmer producer groups can effectively take up the task of producing quality declared maize seed. • Creation of awareness through demonstrations, farmer workshops and media helps in adoption of technologies and innovations. • Availability of market is key
Social, environmental, policy and market conditions necessary for development and upscaling	• Amendment of Seed and Plant Varieties Act Cap 326 to include guidelines for quality declared seed system. • Creation of awareness on importance of quality seed compared to farmer saved seeds. • Registration of CIGs/VMGs producer groups for production of quality declared maize seeds. • Harmonious gender and social consideration in research, consumption and marketing.

	• Enabling policy and policy review from time to time
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	
Estimated returns	
Gender issues and concerns in development, dissemination, adoption and scaling up	• Land ownership mainly by men who may have no interest in production of quality declared seed • Women and youth lack funds to engage in seed production • Slow information and awareness flow to female farmers due to low academic levels • Training materials and strategies for the quality declared maize seed systems are not favorable to women farmer.
Gender related opportunities	• maize seed production • Empower women and youth to acquire land and connect them to seed companies to become sustainable seed businesses • Train women and youth to be lead farmers and part of the ToT team for training quality declared maize seed production • Train women and youth agricultural extension officers as supervisors to supervise production of the quality declared seed • Empower the women and youth who want to produce maize seed by connecting them to financial institutions
VMG issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity and high input use involved in contract maize seed production • Most VMGs do not own land and therefore difficult to be involved in quality declared maize seed production • VMGs have inadequate funds to engage in quality declared seed production Slow information and awareness flow to VMGs farmers due to low academic levels • The maize seed training materials and strategies may not be favorable to VMGs
VMG related opportunities	• VMGs can be organized into producer groups to produce quality declare maize seed • Empower VMGs to acquire land and connect them to seed companies for sustainable seed businesses • Train VMGs to be lead farmers and part of the ToT team to train in quality declared maize seed production • Train agricultural extension officers from VMG communities as supervisors for production of the quality declared seed • Link VMGs interested in maize seed production with

	financial institutions
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	References - Kimenyi L. and McEwan M. (eds). 2014. Scaling up, Dissemination and Adoption of Agricultural Technologies using Innovation Platforms—Lessons from Eastern and Central Africa. ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa), Entebbe - Chivatsi W.S <i>et al.</i> 2004. Community-based maize seed production in coastal lowland Kenya. In Friesen D.K. and A. F. E. Palmer (eds.). Integrated Approaches to Higher maize Productivity in the New Millennium. Proceedings of the 7th Eastern and Southern Africa Regional Maize Conference, Nairobi, Kenya, 11 - 15 February 2002. Mexico, D. F.: CIMMYT, pp. 446-451 - Esilaba, A. O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires research and validation
G. Contacts	
Contacts	Deputy Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Phone: 0202024751, Email: kalro.mtwapa@kalro.org, Institute Director, KALRO-Katamani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600, Email: kalro.katamani@kalro.org
Lead organization/scientists	KALRO Mtwapa, KALRO Katamani
Partner organizations	NGOs and County governments to provide agricultural extension services, KEPHIS - Seed Inspection,

Research gaps

1. Enabling policy for quality declared seed
2. Identification of climate smart maize varieties that can be subjected to seed production under quality declared seed.

2.3.3 Maize formal seed system

TIMP Name	Maize formal seed system
Category (i.e. technology, innovation or management practice)	Innovation

A: Description of the technology, innovation or management practice	
Problem to be addressed	Unavailability of some released high yielding climate smart varieties for commercial production due to lack of early generation seed and weak public private maize seed value chain resulting to lack of accessibility of improved maize varieties and poor accessibility to quality seeds for the smallholder farmers.
What is it? (TIMP description)	Formal seed system is the process of producing seed starting from release of varieties, production of early generation seed, and certified seed up to the stage where the farmers can access it through seed merchants for planting. The main stakeholders in formal seed systems include breeders, seed companies and retailers among others.
Justification	The KALRO has released many improved climate smart maize varieties which are not yet commercialized. Strengthening the public-private seed value chain in Kenya is the best option to ensure that majority of the seed companies and merchants are licensed to produce certified seed of these improved varieties. Supporting KALRO Seeds to produce the early generation seed ensures that there is availability and timely production of the certified seed which will result to increased productivity and production of maize in Kenya.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Seed dealers, Researchers, Extension service.
Approaches to be used in dissemination	Agricultural Innovation Platforms (AIP) targeting breeders and seed companies, on farm and on station demonstrations of new maize varieties, Agricultural shows and exhibitions, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Innovation platform for interaction of maize seed value chain stakeholders. • A strong public – private maize seed value chain. • License seed merchants for production of certified seeds. • Seed availability, accessibility and affordability. • Good seed system to ensure quality. Good marketing models and path ways. Public and private agricultural service providers. • Funding for production of early generation seed and certified seed for promotion.
Partners/stakeholders for scaling up and their roles	• KALRO Seed Unit for production of early generation seed. • KALRO legal office to licence more seed companies and merchants. • Seed companies and merchants for certified seed production. Market players to create a demand and pull production. • Farmers/farmer groups to adopt and produce. Involvement of public and private agricultural service providers in promotion and dissemination. • NGOs to take up maize e.g. Africa Harvest, Farm Africa

	for farmer organizing and mobilization. Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMP will be upscaled	Tana River and Uasin Gishu
Challenges in dissemination	- Lack of innovation platforms to facilitate interaction among maize seed value chain stakeholders. - Unwillingness of seed companies to take up KALRO varieties. Delayed MoU between KALRO and seed companies. - Farmers' unwillingness of to buy certified seed. - Low awareness of importance of improved maize in some parts of Kenya
Suggestions for addressing the challenges	- Establish innovation platforms for maize seed value chain stakeholders. - Establish demonstration to showcase new improved varieties for seed companies to select from. - Strengthen public – private maize seed value chain. License seed companies and merchants to produce certified seed of released varieties by KALRO. - Strengthen KALRO Seed Unit to produce early generation seed. - Ensure certified seed affordability, availability and accessibility for commercial production. - Well organized farmer maize seed producer groups and networks. - County and central government support. - Develop good policies for the maize seed production and marketing. - Funding for research, validation and promotion of new maize varieties and seed production
Lessons learned in upscaling if any	- Creation of awareness through demonstrations helps seed companies identify and pick best climate smart maize varieties for production of certified seed. - Availability of market is key
Social, environmental, policy and market conditions necessary for development and upscaling	- A strong innovation platform for maize seed value chain stakeholders is key. MOU between KALRO and willing seed companies/merchants for production of certified seed. - Harmonious gender and social consideration in maize seed production and marketing. - Farmer producer organizations for maize seed production
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of Seed
Estimated returns	Not determined

Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in contractual maize seed production not favourable for women who are already overburdened • Land ownership mainly by men who may have no interest in contract maize seed production • Women and youth may not have the required finances for contract maize seed production • Slow information and awareness flow to female farmers due to low academic levels • The maize seed training materials and strategies are not favorable to women farmers
Gender related opportunities	• Women and youth can be organized into producer groups for formal seed production • Empower women and youth to acquire land and connect them to seed companies to become sustainable seed businesses • Train women and youth to be lead farmers part of the ToT team for training maize seed contract farmers • Empower the women and youth who want to produce maize seed by connecting them to financial institutions
VMG issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity and high input use involved in contract maize seed production • Most VMGs do not own land and therefore difficult to be involved in contract maize seed production • VMGs lack funds for contract maize seed production • Slow information and awareness flow to VMGs farmers due to low academic levels • The maize seed training materials and strategies may not be favorable to VMGs farmers
VMG related opportunities	• VMGs can be organized into producer groups for maize seed production • Empower VMGs to acquire land and connect them to seed companies to become sustainable seed businesses • Train VMGs to be lead farmers and part of the ToT team for training contract farmers for maize seed production • Empower the VMGs who want to produce maize seed by connecting them to financial source
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Hybrid maize seed production in Kenya
Application guidelines for users	References - MacRobert, J.F., P.S. Setimela, J. Gethi, and M. Worku. (2014) Hybrid Seed Production Manual. Mexico, D.F.: CIMMYT. - Muli, M.B., J.G. Gethi and G.M. Kamau. 2000. The response of maize (<i>Zea mays</i> L.) varieties to fertilizer, processing and storage methods in coastal Kenya. Proceedings of the 7th KARI Scientific Conference, Nairobi. 13-17 November 2000. Pp179-187.
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling;

G. Contacts	
Contacts	Deputy Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Phone: 0202024751, Email: kalro.mtwapa@kalro.org . Institute Director, KALRO-Katumani, P.O. Box 340-90100 MACHAKOS. Phone: 0710-906600, Email: kalro.katamani@kalro.org
Lead organization/scientists	KALRO Mtwapa, KALRO Katumani
Partner organizations	Seed Companies, Agro dealers, KEPHIS - Seed Inspection, NGOs and County governments to provide agricultural extension services.

Research Gaps

1. Unavailability of early generation seed of KALRO released climate smart maize varieties.
2. Inadequate promotion of the released varieties

2.4 Good Agricultural Practices and Food Safety Management Systems

2.4.1 Food Safety Management System

TMP Name	Food Safety Management System: Hazard Analysis Critical Control Points (HACCP) Plan for Maize Chain in Kenya
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	The presence of chemical, biological and physical hazards within the Maize value chain in Kenya have a direct effect on consumer's health. There is increasing demand for high quality of the crop and other products where it is incorporated, from consumers and public health departments in counties. The biological contaminations previously reported on this value chain include presence of Escherichia coli (E. coli), Salmonella spp., Aspergillus flavus and Aspergillus parasiticus. The chemical hazards are mainly due to heavy metal presence such as lead/mercury/cadmium; while exceedance of MRLs been reported. These hazards are suspected to cause neurological disorders, cancer and birth defects.
What is it? (TIMP description)	Food safety management system (FSMS) through Hazard Analysis and Critical Control Point (HACCP) in Maize value chain is a system of food safety monitoring and control based on the systematic identification and assessment of various hazards. It is a preventive, rather than a reactive, tool that places the protection of the Maize supply from biological, chemical and physical hazards into the hands of food management systems. The system is designed to minimize the risk of food safety

	hazards by identifying the hazards, establishing controls and monitoring these controls.
Justification	There is increasing demand for high quality of the crop and other products where it is incorporated, from consumers and public health departments in counties. The chemical hazards are mainly due to heavy metal presence such as lead/mercury/cadmium; while exceedance of MRLs been reported. These hazards are suspected to cause neurological disorders, cancer and birth defects. There is need to put in place risk analysis and hazard monitoring and management system to ensure that food contaminants are kept at bay along the Maize value chain. Presence of these contaminants not only poses serious risks to human health and trade. Such tools are used globally and even adapted by Codex Alimentarius as a global acceptable FSMS. This will set limitation values for monitoring so that action can be taken if the set point values of hazards are out of the defined range as required. Parameters will be quantified for production, harvesting, processing, distribution and value addition
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Maize value chain actors from farmers, traders, processors, food vendors and consumers.
Approaches to be used in dissemination	Training of stakeholders on GAP, Good Manufacturing Practice (GMP) and Good Hygiene Practice (GHP) Maize innovation platforms FFBS sessions Through common interest groups discussions, field days, exhibitions, radio, TV and social media (Whats App, Facebook, Twitter).
Critical/essential factors for successful promotion	• Formation of “experts” team composed of HACCP specialists, food scientists, microbiologists, representative of the Maize (and other similar crops) value chain players, public health officers, and a quality control and safety specialists from the competent authorities to guide the process • Local and National governments support
Partners/stakeholders for scaling up and their respective roles.	• KALRO, National Agricultural Research Institutes (NARIs) and international research organizations • Market players • Farmers/farmer groups • County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination • NGOs for farmer organizing and mobilization e.g. SACDEP • National competent authorities • Analytical testing services • Processors and local traders
C: Current situation and future scaling up	
Counties where already promoted if any	Not promoted in any county of Kenya

Counties where TIMPs will be up scaled	All counties growing and consuming Maize in Kenya.
Challenges in development and dissemination	• Inadequate funds to reach value chain actors • New concept not very well known among the primary stakeholders and market outlets
Suggestions for addressing the challenges	• Funding of dissemination platforms • Training of all stakeholders on food safety
Lessons learned in up scaling, if any	• None since scaling up has not been done
Social, environmental, policy and market conditions necessary for development and up-scaling	• Maize being observed by stakeholders as a food and commercial crop that requires protection from contamination • Use of less toxic crop protection methods in handling crop health issues • Establishment of practical and acceptable food handling protocols at both county and National levels
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth might not be aware of the existing hazards, their preventive measures and control • Women and youth might to be aware of the impact identified hazards could have to their health • In harvesting and processing Maize to meet the acceptable national standards, women and youth play critical roles. • Therefore, there is need to build the capacity of women and youth in the identifications of food safety hazards/risks and the control measures along Maize value chain • Women and youth lack finances
Gender related opportunities	• Opportunities exist for women and youth in the marketing and use of Maize and it's by products as an entrepreneurship.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to production resources such as land, knowledge, information, extension training, and credit and quality seed. • VMGs have limited participation in decision making at community and County level • Require strategies that target the VMG during scaling up of the Maize value chain.
VMG related opportunities	• Identification of critical limits to be defined • Control measures to be identified • Criteria for compliance already clearly defined for adoption
E: Case studies/profiles of success stories	
Success stories	N/A
Application guidelines for users	HACCP general guidelines - https://www.fao.org/fao-who-codexalimentarius/codex-texts/codes-of-practice/en/ General principles of food hygiene - https://www.fao.org/fao-who-codexalimentarius/codex-texts/codes-of-practice/en/

	codexalimentarius/sh-proxy/en/?lnk=1&url=https%25253A%25252F%25252Fworkspace.fao.org
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling;
G: Contacts	
Contacts	The Institute Director, FCRI Njoro; Email director.fcrinjoro@kalro.org The Institute Director, KALRO-HRI Thika; E-mail: director.hri@kalro.org Director, KALRO Seeds, E-mail: info.ptc@kalro.org The Centre director, KALRO-Muguga Email: kalro.FCRC@kalro.org The Centre director, KALRO-Kabete; E-mail: cd.narl@kalro.org The Institute director, KALRO-FCRI Kitale; E-mail: director.fcric@kalro.org
Lead organization and scientists	Mr. John N. Ndung'u, FCRI - KALRO Njoro Antony Nyaga, KALRO Seeds Thika Dr. Francis Wayua, KALRO Kakamega Dr. Lusike Wasilwa, Crops Director, KALRO Headquarters Mrs. Violet Kirigua, KALRO Headquarters Beatrice Wanjiku, KALRO Njoro
Partner organizations	MoA, AFA, FPEAK, PCPB, AAK, KEPHIS, KEBS, County governments, NGO's and Universities.

2.4.2 Good Agricultural Practices (GAPs) for maize

TIMPs name	Good Agricultural Practices (GAPs)
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Detection of food contaminants in both fresh produce and cereals, including Maize, has been rampant. The detection has been in both whole grain and processed products. This results in declining food safety and quality, therefore frustrating sustainable farming of these crops for both food and income generation. Most market continue to impose more stringent measures (to ensure safety of consumers) for those wishing to access the said markets. These contaminants also impact negatively on the environment, worker safety and health, and consequently making it difficult to implement traceability as most producers do not give accurate information on inputs and processes used during production, to avoid commercial losses and even prosecution

What is it? (TIMP description)	It is a systematic process of implementing a standardized production system globally designed to reassure consumers about how food is produced on the farm, pre-farm gate or on-farm standards (It is not about a specific crop production but the process through which production takes). The four 'pillars' of GAP (economic viability, environmental sustainability, social acceptability and food safety and quality) are included in most private and public sector standards, but the scope which they actually cover varies widely. Commercialization of Maize on the domestic and the future export level highly depends on compliance to these market standards
Justification	There is need to arrest the rampant detection of food contaminants in Maize. Good Agricultural Practice (GAP) is based on the principals of risk prevention, risk analysis, sustainable agriculture [by means of Integrated Pest Management (IPM) and Integrated Crop Management (ICM)] to continuously improve farming systems. GAP is of utmost importance in protecting consumer health by ensuring safety throughout the food chain. It needs to be enforced and transparent not only from the table but also upstream to include suppliers (e.g. quality of fertilizers and plant protection products) and all the value chain players including providers of logistics and farm equipment.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• All value chain players including producers, extension staff, • Processors, transporters and market outlet operators including wholesale and retail chains, • Domestic markets and farm gate handlers.
Approaches to be used in dissemination	• FFBS, On-farm experimentation and dissemination, field days, shows, farmer to farmer communication, leaflets, and larger plot demonstrations.
Critical/essential factors for successful promotion	• Policy support from government particularly the enforcement of KS1758 (a domestic scope standard that has been passed after undergoing the public participation stage).
Partners/stakeholders for scaling up and their roles	• Producer organizations (FPEAK, FPC, KFC, AGAK etc), NCPB, Seed Companies, Transporters, NGO's, MOALID, Private extension providers, CoG, and other value chain players.
C: Current situation and future scaling up	
Counties where already promoted, if any	It has not been adapted my most cereal growers other than prevention of aflatoxin. For other fresh produce crops, already promoted in Meru, Embu, Nyeri, Nyandarua, Muranaga, Embu, Kirinyaga, Kisii, Uasingishu, Nakuru, Kericho, Bomet and other horticultural hot spots
Counties where TIMP will be up scaled	All counties in Kenya particularly where Maize is grown
Challenges in dissemination	• Lack/inadequate knowledge on the benefits GAPs • Lack of legislative mechanisms to support the GAP, in particular the domestic scope • The perception that GAP is oppressive rather than supportive

Recommendations for addressing the challenges	Continuous training of farmers, extension staff and other value chain players
Lessons learned in up scaling, if any	The low number of stakeholders aware of GAP
Social, environmental, policy and market conditions necessary	Supportive policy of national and county governments to promote adaption of GAP's.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Difficult to put monetary gains figures as most involves social and welfare issues in addition to markets lost due to non-compliance
Estimated returns	Benefits are mostly social welfare issues in addition to additional markets accessed
Gender issues and concerns in development, dissemination adoption and scaling up,	- Women and youth have less access to factors of production like land and credit In most households, it is the men who make decision on what to do and how it is done - Women may not have time and mobility to attend trainings and other extension activities far from home or held at times when they are performing other domestic roles - Women have limited access to markets as they sometimes cannot travel to far markets due to their domestic roles - Women might not be aware of GAPs due to their low level of education and the social economic status - There is need for all the stakeholders to be sensitized in GAPs to achieve good profits from their Maize products
Gender related opportunities	- Agro-enterprise development by youth, females and males based on GAPs - Increased income due to improved income as a result of using GAPs by the youth, females and males
VMG issues and concerns in development, dissemination, adoption and scaling up	- VMGs have less access to GAPs as they are not given chances to participate in agricultural trainings and workshops - VMGs have less access to farmer organization - VMGs have less access to farm implements VMGs have limited access credit to purchase the required GAPs - VMGs have limited access to training on GAPs and extension services - Due to their social status VMGs are often excluded from decision making in development and dissemination of GAPs - There is low adoption by VMGs due lack of awareness
VMG related opportunities	- Agro-enterprise development by VMGs based on GAPs - Increased income due to improved yield because of using GAPs, market access for the VMGs - Increased employment for VMGs and improved food security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	This has not been done for Maize. However, Small, holders in groups in the counties of Kirinyaga, Nyeri, Meru, Nakuru and other counties have been able to produce and export produce that is

	certified after adopting and complying with GAP's.
Application guidelines for users	Global GAP Version 6 (Code Ref: IFA V5.2_Feb19; English Version Versionn /Edition Update Register Page: 45 of 45) - https://www.globalgap.org/.content/.galleries/documents KALRO-USAID Training And Extension Manual On Good Agricultural Practices (Gap) - Nov. 2017
F: Status of TIMP readiness (1. Ready for upselling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Director, KALRO Seed –Thika; info.ptc@kalro.org Centre Director KALRO Njoro, Centre Directors; KALRO Kandara, KALRO NSRC; Director General KALRO
Lead organization and scientists	KALRO: Nyaga A., Ndungu J., Gatambia E., Kambo C., Kuria, S Musyoki R. Wasilwa, L., Kirigua, V., Muriuki SJN.
Partner organizations and their roles	MoALF&I, AFA, FPEAK, FPC, PCPB, AAK, KEPHIS, County governments, NGO's, Universities

2.4.3 Aflasafe KE01™

TIMP Name	Aflasafe KE01™
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Aflatoxin contamination of maize before harvesting
What is it? (TIMP description)	Aflasafe KE01 is a pre-harvest bio-control agent that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage. It is applied preharvest but has postharvest benefits. Aflasafe is mainly roasted sterile sorghum (99.7% of the product), coated with four atoxigenic (i.e. non-poisonous producing) types of <i>A. flavus</i> native in Kenya. To avoid confusion with sorghum for food, Aflasafe is dyed blue using food colour. Aflasafe is broadcast by hand 2-3 weeks before flowering at the rate of 10 kg/ha (4 kg/acre). The friendly Aflasafe fungi grow out and eliminate the aflatoxin producing types of <i>A. flavus</i> . Hence, maize at harvest will have reduced levels of aflatoxins.

	 
Justification	Aflatoxin contamination in maize is a serious food safety concern and with dire public health consequences, including death if contaminated maize is consumed. Aflasafe is a natural pre-harvest biocontrol product that reduces aflatoxin contamination in maize by 80-99% at harvest and in storage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	Farmer field and Business School (FFBS), Agricultural innovation platforms (AIP), Extension publications, On-farm demonstrations, Farmer field days, Farmer training, Agricultural shows and exhibitions as well as farmer to farmer training, On farm and on station research trails and demonstrations, Training workshops and seminars, Public and private agricultural service providers, Farmer to farmer extension, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• A platform for interaction of maize value chain stakeholders, • Prior to broadcasting Aflasafe, the farm should be weeded, fertilizer applied, and all other agricultural practices carried out. Also follow good harvest and postharvest practices, • Participatory implementation, stakeholder capacity building and networks, • Availability of Aflasafe closer to farmers by enhancing distribution networks, e.g. using agro-dealers.

Partners/stakeholders for scaling up and their roles	• Farmers – for activity implementation and promotion, Extension service (public and private) – technology transfer and dissemination, • Researchers (KALRO) – for manufacturing Aflasafe KE01 at the KALRO-Katamani factory; establishment of demonstration plots, capacity building of county stakeholders, extension workers and farmers, • International Institute of Tropical Agriculture (IITA) – backstopping KALRO during upscaling the aflasafe to other maize growing areas. • Also testing efficacy of aflasafe in other crops which are prone to contamination with aflatoxin. • Private sector – Koppert Biological Systems, for distributing aflasafe to farmers. • Agro-dealers – working with Koppert Biological Systems to ensure Aflasafe is available at farmers’ reach, especially in rural areas. • CIGs play the role of adoption of the technologies through their various groups. • VMGs are recipients of the technologies and will benefit from the grants as they adopt the technologies.
C: Current situation and future scaling up	
Counties where already promoted if any	Major maize growing areas in Eastern Kenya (Machakos, Kitui, Embu, Galana Kulalu Scheme)
Counties where TIMP will be upscaled	Uasin Gishu and Tana River
Challenges in dissemination	• Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Lack of knowledge on the public health consequences of aflatoxin contamination in maize. • Lack of knowledge on use of Aflasafe to control aflatoxins in maize. Availability of Aflasafe KE01 close to farmers
Suggestions for addressing the challenges	• Establish maize innovation platforms. • Adopting public-private-partnerships, so that the private sector (e.g. NGOs and agrovets) can provide aflasafe closer to farmers; KALRO is partnering with Koppert Biological Systems for distribution of Aflasafe to farmers. Koppert Biological Systems, on the other hand, is partnering with agro-dealers to ensure • Aflasafe is available close to farmers. Availing data on the economics and the gains to be made through adoption of aflasafe (e.g. reduction of aflatoxin contamination and the associated health costs for treatment and management)
Lessons learned in upscaling if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform. • Involvement of stakeholders and private sector such as CIG, CBOs and agrovets enhances adoption Continuous capacity building is key to attitude change.

	• Consistent trainings, demonstrations and sensitisations would motivate farmers to adopt the technology. • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	• Adopting public-private-partnerships, so that the private sector (e.g. NGOs and agrovets) can provide the aflasafe closer to farmers; Capacity building of farmers on use of aflasafe
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 201 per kg
Estimated returns	Aflasafe KE01 TM reduces aflatoxin contamination of maize by 80-99% at harvest and storage. This also means reduced health costs for treating aflatoxin poisoning in the population. The savings in the health sector can be used in other sectors of the economy.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Financial empowerment where majority of small-scale farmers lack funds to acquire inputs including Aflasafe. • Slow information and awareness flow to female farmers due to academic levels. • Training materials and strategies are not favorable to women farmers. • The TIMP is easily adoptable after training and many farmers can use the TIMP since it reduces aflatoxin at harvesting and during storage
Gender related opportunities	• Use of Aflasafe increases farm income through reduction of harvest losses, by reducing aflatoxin contamination. • Women can capitalize on this aspect of maize production to reduce harvest losses. • Opportunity for youth and women to venture into business of distributing Aflasafe to farmers (as stockists and agro-dealers). Train women and youth to be part of lead farmers and ToT team for promotion of Aflasafe. • Conduct demonstrations in their maize farms, empower the women and youths by connecting them to financial source
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs will need continuous and consistent capacity building to learn the skill. Lack of resources to buy Aflasafe
VMG related opportunities	• Adoption of the Aflasafe means reduced losses, hence more maize available for consumption and sale. • This will enable VMGs to have enough maize to consume, hence get macro- and micro-nutrients (especially minerals). There will be more income for the farmers (VMGs). • Train VMGs to be part of lead farmers and ToT team for promotion of Aflasafe. • Conduct demonstrations in their maize farms. Empower the VMGs by connecting them to financial source
E: Case studies/profiles of success stories	

Success stories from previous similar projects	Success stories from maize producing regions of Eastern Kenya (Galana Kulalu scheme, Machakos, Embu and Tharaka Nithi Counties). Aflasafe reduced aflatoxin contamination of maize by 80-99% at harvest and storage.
Application guidelines for users	References - Aflasafe KE01 leaflets and manuals - IITA. 2018. Atehnkeng, J., Mutegi, C., Ortega-Beltran, A., Augusto, J., Akande, A. Senghor, L.A. Falade, T. Akello, J., Cotty, P.J. Bandyopadhyay, R. (2018). <i>Management of Aflatoxins in maize and Groundnuts in Kenya: A Farmers' Training Manual</i> . IITA.
F: Status of TIMP readiness (Ready for upscaling; Requires validation; Requires further research)	
G: Contacts	
Contacts	The Centre Director, KALRO-Kakamega; P.O. Box 169-50100, Kakamega Email: francis.wayua@gmail.com , Tel. 0710629683
Lead organization/scientists	KALRO, F. Wayua, J. Ndambuki, Musila R.N., Ligeyo D.O., Murenga M., Nekesa C., Esilaba A.O., Muli B.M., Bett C., Nasirembe ., Mwangi H.W., Momanyi V.N., Otipa M., Ndubi J., Kirigua, V. O. Karanja and Wasilwa, L.A.
Partner organizations	IITA, Koppert Biological Systems, Agro-dealers, MoALFC, NGOs, CBOs

Research Gaps

1. Validation to test the use of non-food materials as carriers for Aflasafe (to replace sterile sorghum, which sometimes is eaten by poultry and birds)
2. Research on use of Aflasafe in other cereal crops such as rice

2.5 Agronomic Management Practices

2.5.1 Land preparation

TIMP Name	Land preparation
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	• Low yields due to improper land preparation practices
What is it (TIMP description)	Maize seeds requires a fine seedbed and conventionally, one tractor ploughing followed by one harrowing is adequate. When using animal draft plough, two ploughs are adequate. Proper seedbed preparation is prerequisite in controlling weeds, pests and diseases and enhancement of O ₂ and CO ₂ circulation so as to optimize maize plant growth.

	 Land preparation by use of oxen
Justification	Improper land preparation leads to low yields. Proper land preparation allows weeds to dry and decompose before planting, ensures increased water infiltration, controls pest and diseases and prevent competition from weeds that results in significant yield losses thus early ploughing/harrowing prior to planting is also crop protection measure.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Research organizations and universities • Extension Agents (Public and Private) • Seed producers and traders
Approaches to be used in dissemination	• On-farm demonstrations, • Farmer field schools • Farmer to farmer • Agricultural Innovation platforms • Digital platforms • Media • Trainings • Shows/Exhibitions/Field days
Critical/essential factors for successful promotion	• Validates small-scale mechanized land preparation methods. • Well organized farmer groups and networks for ease of promotion. • Active involvement of public and private agricultural service providers during dissemination and ToT trainings. • Capacity building on the importance of GAPs
Partners/stakeholders for scaling up and their respective roles	• County Ministry of Agriculture, Livestock, Fisheries and Irrigation: Link to farmers and offer extension services • Extension services providers mobilise farmers and facilitate engagement with farmers • Farmer platforms (farmer groups, AIPs, FFBS, etc): mobilise farmers and facilitate engagement with farmers • Farmers will test/validate the practice • KALRO-offer technical backstopping • NGOs, CBOs for dissemination of management practice
C: Current situation and future scaling up	

Counties where already promoted, if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMPs will be upscaled	Tana River, Machakos, Makueni and Uasin Gishu
Challenges in dissemination	• Lack of organized farmer groups • Inadequate farm household labour • Unavailability of proper farm implements for small-scale farmers • Limited knowledge on importance of correct land preparation practices
Suggestion for addressing the challenges	• Establish farmer groups, • Enhancing capacity of the farmers through awareness and sensitization campaigns and training in workshops • Partnerships with County extension services staff to enhance dissemination of information and provide the required farm implements during dissemination
Lessons learned in upscaling	• Limited knowledge by farmers on land preparation • Need to create awareness through demonstrations and farmer field days to help farmers gain skills and knowledge and increases adoption of new management practices • Availability of information and land preparation implements that can be used by small-scale farmers is key to adoption of the TIMP. • Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary for development and scaling	• Socially, farming is a way of life though field operations differ from one community to another due to historical existence. • For most communities in Kenya, maize is food. • Existence of different bio-physical environments in target counties which will require innovations in small-scale implements for land preparation e.g the walking tractor. • Increased productivity will ensure food security and surplus for the market
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of one ploughing and harrowing is KES. 4,500
Estimated returns	Return of grain KES72,000/- to the total profit of KES 67,500/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Maize farmers, majority of whom are women have been having low yield due to improper land preparation • Land preparation is a laborious activity for women and also increase labour for women who are usually burdened by their domestic roles • Women maize farmers are hesitant in carrying out proper land preparation because of the perceived high cost which they are not able to meet

Gender related opportunities	• Land preparation techniques in maize such as small-scale mechanization will encourage women and youth to engage in land preparation activities • Mechanization of land preparation operation will result to youth employment • There is need to reach more women groups with information on site selection and land preparation for maize production • Make gender friendly training materials with illustrations to enhance communication • Train women and youth to be lead farmers and part of the ToT team for dissemination of information on site selection and land preparation • Need to target women by conducting demonstrations on their maize farms • Adoption of improved Maize production will lead to increased household food and security
VMG issues and concerns in development, dissemination, adoption and scaling up;	• Land preparation is a labour intensive and laborious for VMGs to under take • The labour cost of adopting this technology might be out of reach for the VMGs thus affecting adoption and scaling up. • The technology demands proper training and access to information to enable proper implementation, which might be lacking among the VMGs • Lack of access to information will limit the VMG accessing and adopting the technology • There might be low attendance by VMGs during awareness and sensitization campaigns due to physical disabilities, cultural norms or insecurity challenges
VMG related opportunities	• VMGs friendly land preparation techniques such as small-scale mechanization of maize land preparation operations • Reach more VMGs with information on site selection and land preparation for maize production • Make VMGs friendly training materials with illustrations to enhance communication • Train VMGs to be lead farmers and part of the ToT team for dissemination of information on site selection and land preparation • Target VMGs by conducting demonstrations on their maize farms • Adoption of improved maize production will lead to increased food and nutrition security for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar project	In Kaloleni sub-county of Kilifi County, 30 farmers were trained on proper maize crop husbandry and each was facilitated with inputs (for land preparation, seed, basal fertilizer) enough to establish one acre of maize crop. The

	yields increased from three bags per acres to between 12 and 18 bags per acre. This showed that the low yields at farm level were due to inadequate knowledge and the necessary resources
Application guidelines for users	References - What variety do I grow in coastal Kenya - Leaflet - Mapendekezo ya kukuza mahindi – Leaflet
	- Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
Status of TIMP readiness .1) Ready for upscaling; 2. Require validation; 3) Require further research R	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B., A. O. Esilaba, R. N Musila
Partner organizations	NGOs and County governments to provide agricultural extension services,

Research Gaps

1. Inadequate promotion of demonstration of proper land preparation

2.5.2 Maize variety selection

TIMP Name	Maize variety selection
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low yields due to mismatch of maize varieties in agro ecological zones of Kenya
What is it? (TIMP description)	Variety selection is choosing the appropriate/recommended maize variety for a given agro ecological zone because it matches the climatic conditions, soil type, tolerance/resistance to pest and diseases prevalent in that region and its maturity period fits well in the growing season for the region. Two types of maize varieties exist; open pollinated variety (OPV) and hybrid. Open pollinated varieties are in which farmers do not need new seed each season. If farmers follow proper selection procedures, they can use farm saved seeds selected from their harvests up to three seasons after which, they can buy fresh seeds from seed stockists. Yields of OPV are lower than hybrids. Hybrids are high yielding and are liable to segregation.

Justification	Planting the recommended maize varieties for a given location is very important because every variety has extensively been tested and recommended based on climatic conditions, soil type, yield potential, tolerance/resistance to pest and diseases or maturity period among others. Planting of recommended improved maize varieties for each region result to high yields and reduces crop failure. Farmers are advised to use certified seeds that are available from authorized agents.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, Researchers, Extension service providers, Seed producers, NGOs, CBOs
Approaches to be used in dissemination	• Farmer field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Farmer field days • On farm and on station research trials and demonstrations • Farmer training • workshops and seminars • Public and private agricultural service providers • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• A platform for interaction of maize value chain stakeholders especially researchers' seed companies, agricultural service providers and farmers • Availability and accessibility of seed of recommended varieties for each agro ecological zone at the right time and at an affordable price • Well organized farmer groups and networks for ease of dissemination • Good marketing models and path ways • Active involvement of public and private agricultural service providers during dissemination and ToT trainings.
Partners/stakeholders for scaling up and their roles	• Farmers will test/validate the practice • KALRO-Provide management practice and technical backstopping • County Ministry of Agriculture, Livestock, Fisheries & Irrigation, Private service providers, -Extension services • NGOs, CBOs for dissemination of practice
C: Current situation and future scaling up	
County where TIMP has been promoted (if any)	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui, Makueni and Tharaka Nithi
County where TIMP will be upscaled	Tana River, Machakos, Makueni and Uasin Gishu
Challenges in dissemination	• Limited awareness and poor access to information on matching recommended maize varieties to the right agroecological zones to support decision-making

	• Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders • Inorganized farmer groups to ease dissemination of information • Limited information on recommended maize varieties to specific agro ecological zones by agricultural extension service providers (Public and private) • Limited access to certified maize seeds since most farmers is resource-poor.
Suggestions for addressing the challenges	• Constitute a maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings • Enhance capacity of farmers through awareness and sensitization campaigns and workshops • Capacity build public and private agricultural extension service provides with information on recommended Maize varieties and their agro ecological zones • Form Maize CIGs ease dissemination of information • KALRO Seed Unit and seed companies to ensure timely delivery of recommended maize varieties in the right agro- ecological zones.
Lessons learned	• Successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies • Capacity building public and private agricultural extension service with information on recommended maize varieties and their agro- ecological zones is key to successful adoption of the TIMP • Availability of information on - which maize variety to grow where - is key in making the right choice of variety • Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary	• Socially, farming is a way of life though field operations differ from one community to another due to historical existence. • Different agro ecological zones in Kenya necessitates use of improved maize varieties in these zones failure to which it results to low yields and frequent crop failures. • For most communities in Kenya, maize is the staple food.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	One acre requires 8 kg @ KES 300.00 amounting to 2400/-
Estimated returns	Seeds contributes KES 28,600/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling	• Men own land and dominate most decisions at the household and community levels yet have no interest in maize production. This may demoralize the women and limit their uptake of improved maize varieties • Women and youth have limited access to productive resources

up	such as land, credit, and other inputs and therefore may not be in a position to make the right choice on recommended varieties since it attracts a cost • Women and youth have limited access to training on extension • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	• Empower women and youth to acquire land • Train women and youth to be lead farmers and part of the FFBS • Involve the young people in ToT teams for training on the importance of matching recommended maize varieties with the right agro ecological zone • Train women and youth agricultural extension officers to be part of FFBS ToT team
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to productive resources such as land and credit. • VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Empower VMGs to acquire land. • Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance of matching recommended maize varieties with the right agro ecological zones. • Train VMGs agricultural extension officers to be part of FFBS ToT team. • Empower the VMGs who want to buy seed of improved maize varieties and other inputs by connecting them to financial source. Make friendly training materials with illustrations to • enhance communication.
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	References - Maize: What variety do I grow in coastal Kenya. Leaflet - Esilaba, A.O.<i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B., A. O. Esilaba, R. N. Musila
Partner organizations	County government and local NGOS

2.5.3 Planting Spacing

1.3.3 Planting Spacing																						
TIMP Name	Plant Spacing																					
Category (i.e. technology, innovation or management practice)	Management Practice																					
A: Description of the technology, innovation or management practice																						
Problem addressed	Low grain yields due to less or more plant population than optimum																					
What is it? (TIMP description)	Plant spacing is the distance within and between rows at which seeds are planted. One plant is maintained plant per station. Over seeding reduces yield and lowers quality of grains because of competition for light and nutrients. Optimum maize plant population is attained by planting maize in rows at recommended spacing. The recommended spacing and planting density for different areas is as shown in table below <table><tr><th>Region (ha)</th><th>Plant population</th><th>Spacing Density (plants per ha)</th></tr><tr><td>Highland</td><td>33,333</td><td>75x25cm 1 plant/hill (pure stand)</td></tr><tr><td></td><td>33,333</td><td>75 x 50 cm 2 plants/hill (intercrop)</td></tr><tr><td>Medium</td><td>44,444</td><td>75 x 30 cm 1 plant/hill (pure stand)</td></tr><tr><td></td><td>44,444</td><td>75 x 60 cm 2 plants/hill (intercrop)</td></tr><tr><td>Dry land and coastal</td><td>37,850</td><td>90 x 30 cm 1 plant/hill (pure stand)</td></tr><tr><td></td><td>37,850</td><td>90x 60 cm 2 plants/hill (intercrop)</td></tr></table>	Region (ha)	Plant population	Spacing Density (plants per ha)	Highland	33,333	75x25cm 1 plant/hill (pure stand)		33,333	75 x 50 cm 2 plants/hill (intercrop)	Medium	44,444	75 x 30 cm 1 plant/hill (pure stand)		44,444	75 x 60 cm 2 plants/hill (intercrop)	Dry land and coastal	37,850	90 x 30 cm 1 plant/hill (pure stand)		37,850	90x 60 cm 2 plants/hill (intercrop)
Region (ha)	Plant population	Spacing Density (plants per ha)																				
Highland	33,333	75x25cm 1 plant/hill (pure stand)																				
	33,333	75 x 50 cm 2 plants/hill (intercrop)																				
Medium	44,444	75 x 30 cm 1 plant/hill (pure stand)																				
	44,444	75 x 60 cm 2 plants/hill (intercrop)																				
Dry land and coastal	37,850	90 x 30 cm 1 plant/hill (pure stand)																				
	37,850	90x 60 cm 2 plants/hill (intercrop)																				
Justification	Low grain yields due to less or more plant population than optimum Planting maize in rows and at recommended spacing ensures optimum plant population per unit area hence reducing intra- and inter- plant competition for nutrients, water and sunlight. Row planting ensures uniform plant distribution and permits routine farm operations to be carried out with ease due to good spacing between plants which translates into increased yield and quality.																					
B: Assessment of dissemination and scaling up/out approaches																						
Users of TIMP	Farmers, extension service providers, researchers, CBOs, NGOs																					
Approaches to be used in dissemination	• On-farm demonstrations, • Farmer field schools • Agricultural Innovation platforms • Digital platforms • Media • Trainings																					

Critical/essential factors for successful promotion	• Capacity building on the importance of GAPs • Active involvement of public and private agricultural service providers during dissemination and ToT trainings.
Partners/stakeholders for scaling up	• County government: Link to farmers • Extension services Providers mobilise farmers and facilitate engagement with farmers • Farmer platforms (farmer groups, AIPs, FFBS, etc): mobilise farmers and facilitate engagement with farmers
C: Current situation and future scaling up	
County where TIMP has been promoted (if any)	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
County where TIMP will be upscaled	Tana River, Machakos and Uasin Gishu
Challenges in dissemination	• Limited knowledge on importance of correct crop spacing • Manual planting of maize in rows is slow and takes quite a lot of time; it is also labour intensive and expensive for majority of small holder farmers • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders • Unorganized farmer groups to ease dissemination of information • Limited information on the recommended spacing and planting density for different areas by farmers and agricultural extension service providers (Public and private)
Suggestions for addressing the challenges	• Promotion of simple and cheap planters for use by small-scale farmers and innovate the same for different maize growing areas • Government to subsidize price of farm equipment's • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings • Enhance capacity of farmers through awareness and sensitization campaigns and workshops • Capacity build public and private agricultural extension service with information on recommended spacing and planting density for different areas. • Form maize CIGs to ease dissemination of information.
Lessons learned	• Successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies • Capacity building public and private agricultural extension service with information on recommended spacing and planting density for different areas is key to

	successful adoption of the TIMP • Farmers need initial financial resources to start them up and training for sustainability
Social, environmental, policy and market conditions necessary	Existence of different maize agro ecological zones in Kenya necessitates availing information on recommended spacing and planting density of maize for each agro ecological zone. Socially, farming is a way of life though field operations differ from one community to another due to historical existence. For most communities in Kenya, maize is the staple food. Availability of simple and cheap planters in the market.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour cost for planting: 6 people x 400/- = 2400.00
Estimated returns	Row planting contributes KES 28,600/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women perform most of the activities within the maize production, hence planting in rows will lead to increased workload for women in addition to their domestic role • Women and youth have limited access to productive resources such as land, credit, and other inputs • Women and youth have limited access to education, training and extension services, hence might not be aware of row planting of maize • Lack of awareness of the benefits of planting maize in rows may lead to low adoption of the technology by women • Women and youth have limited access to production resources such as land, capital to purchase equipment used for making rows in maize production
Gender related opportunities	• Empower women and youth to acquire land • Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of using recommended spacing and planting density for increased maize yields • Train women and youth agricultural extension officers to be part of FFBS ToT team • Empower women and youth who want to buy planters and other inputs by connecting them to financial source • Make gender friendly training materials with illustrations to enhance communication.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to production resources such as land and credit. • VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by VMGs due lack of awareness

VMG related opportunities	Empower VMGs to acquire land for maize production. Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance of using recommended spacing and planting density for increased maize yields. Train VMGs agricultural extension officers to be part of FFBS ToT team. Empower the VMGs who want to buy planters and other inputs by connecting them to financial source. Make friendly training materials with illustrations to enhance communication. Train VMGs to be artisans of recommended small-scale planters.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual KALRO, Nairobi, Kenya
F: Status of TIMP Readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B, A. O. Esilaba and R. N. Musila
Partner organizations	County government and local NGOS to provide agricultural extension services.

Research Gap

1. Mechanizing row planting of maize

2.5.4 Intercropping

TIMP Name	Intercropping
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low yields due to continuous monocropping of maize resulting to depletion of soil fertility

What is it? (TIMP description)	Intercropping is growing two or more crops in proximity and in various combinations. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. The practice allows different crops in terms of rooting, shapes, weed suppression, pest repulsion etc. co-exist on the same  piece of land. Maize intercropped with legume
Justification	Maize and pulse crop intercropping ensures optimum exploitation of the environmental resources, better land use efficiency, reduces weed problems through non-chemical methods and increased maize yields with limited resources.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Producers (farmers), • Research organizations and universities • Extension Agents (Public and Private)
Approaches to be used in dissemination	• Farmer field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Farmer field days • Agricultural shows and exhibitions • On farm and on station research trails and demonstrations • Farmer training, workshops and seminars • Public and private agricultural service providers • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Form a platform for interaction of maize value chain stakeholders especially researchers' agricultural service providers and farmers • Implementation of Farmer field and Business School (FFBS) strategy • Well organized farmer groups and networks for ease of dissemination • Active involvement of public and private agricultural service providers during dissemination and ToT trainings.
Partners/stakeholders for scaling up	Agricultural Extension: Farmer sensitization for on farm demonstrations. Farmer leaders for group organization. NGOs dealing with maize – for dissemination of the practices.

C: Current situation and future scaling up	
Counties where already promoted, if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMPs can be upscaled	Tana River, Machakos and Uasin Gishu
Challenges in development and dissemination	• Limited access to improved seed materials (intercrop varieties) • Inadequate access of technical materials on the establishment, operations and management of intercrop management practice by farmers • The increased effects of climate change hindering adoption • Farmer have high poverty levels coupled with illiteracy especially in deep rural areas of Kenya • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders • Unorganized farmer groups to ease dissemination of information.
Suggestions for addressing the challenges	• Enhance access of certified seed especially for legumes to be used in the intercrop system. • Train and sensitize farmers on the basic principles of intercropping, their benefits and types suitable to their contexts. • Develop a comprehensive manual on the practice to guide farmers during adoption. • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings. • Enhance capacity of farmers through awareness and sensitization campaigns and workshops. • Capacity build public and private agricultural extension service providers with information on various intercropping system for their locations. • Form maize CIGs to ease dissemination of information.
• Lessons learned in upscaling	• Farmers can use a trap crop to attract pests keeping them away from the main crop. Therefore, farmers can easily adopt this method to significantly cut down on pesticides input costs. • The number of ecological benefits provided by this practice can also accelerate upscaling. Intercropping promotes interactions between crops and pollinators, thus supporting biodiversity. • Chances of successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform. • Creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies.

	Capacity building public and private agricultural extension service providers with information on intercropping system is key to successful adoption of the TIMP.
Social, environmental, policy and market conditions necessary	Socially accepted by both male and female gender. The practice is environmentally friendly as it enhances biodiversity, controls erosion and minimizes use of pesticides
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Labour cost for planting: 6 people x 400/- = 2400.00
Estimated returns	planting contributes KES 28600/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	- Decision making on land use is done by men, limiting women and youth participation in uptake of the management practice - Priorities on intercropping within the gender - Gender disparities in access to information may impact on adoption decisions
Gender related opportunities	- Intercropping offers good opportunities to both men and women to grow diverse crops for economic gains and at the same time offers enhanced biodiversity benefits - Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of using maize – legume intercrop system for optimum exploitation of the environmental resources, better land use efficiency, weed control and increased maize yields with limited resources - Train women and youth agricultural extension officers to be part of FFBS ToT team - Make gender friendly training materials with illustrations to enhance communication
VMG issues and concerns in development, dissemination, adoption and scaling up	- VMGs have limited access to inputs and quality seeds due to their low status in society - Limited technical knowhow
VMG related opportunities	- Enhanced crop diversification will generate food and income for VMGs - The practice is low cost and enhances adoption for VMGs
E: Case studies/profiles of success stories	
Success stories	In Wote, Makueni County, farmers cultivate maize, cowpeas and pigeon peas as their staple crops. Food insecurity resulting from frequent droughts is a major challenge and crop failure is common, partly because of inadequate rainfall and poor soils that are deficient in phosphorous and nitrogen. A farmer reported “ I started growing an intercrop of maize and cowpeas in 2010 and this has transformed my family’s life. I have been able to get income, build a house, have food to eat and pay school fees for my two children”

Application guidelines for users	Reference: - Esilaba, A. O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Muli M.B (2019) Evaluation of New Cassava Varieties for Compatibility with maize and Cowpea under Intercropping. Journal of Agricultural Science and Technology B 9 (2019) 417-422 doi: 10.17265/2161-6264/2019.06.005
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	Further research needed
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M. B., A. O. Esilaba and R. N. Musila
Partner organizations	County government and local NGOS

Research gaps

1. Need to determine compatibility of various crops/varieties under intercropping system
2. Need to determine the most suitable spatial arrangement of various crops under intercropping Fertilizer apportioning in companion crops under intercropping system should be studied

2.5.5 Weeding

TIMP Name	Weeding
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low yield of maize due to competition with weeds for nutrients
What is it? (TIMP description)	The most common practice in weed management is hand weeding and use of herbicides. Hand weeding should be done at least three weeks after emergence of the plants followed by a second weeding three weeks later. Herbicide application for weed control is mostly done before or immediately after planting for post-emergence herbicides
Justification	Weeds reduce maize yields by competing for moisture, nutrients, space and light. Weeds are also an alternative host to pests and diseases. The most critical stage of weed competition in the life of a maize plant is during the first four to six weeks after emergence of the crop. This implies that the maize crop should be weed free within this period.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension service providers
Approaches to be used in dissemination	• Farmer field and Business School (FFBS) • Agricultural innovation platforms (AIP)

	• Farmer field days • Agricultural shows and exhibitions • On farm and on station research trials and demonstrations • Farmer training • Public and private agricultural service providers • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Applied and adaptive research to test, validate and promote methods and frequencies of weeding. • A platform for interaction of maize value chain stakeholders especially researchers' agricultural extension service providers and farmers • Implementation of Farmer field and Business School (FFBS) strategy for dissemination of the TIMP • Well organized farmer groups and networks for ease of dissemination • Active involvement of public and private agricultural service providers during dissemination and ToT trainings Introduce, test and promote user friendly mechanical weeders for small-scale farmers
Partners/stakeholders for scaling up	• Agricultural Extension for farmer sensitization • Organized farmer Groups' • NGOs dealing with maize for dissemination of the practices
C: Current situation and future scaling up	
Counties where already promoted, if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMPs can be upscaled	Tana River, Machakos and Uasin Gishu
Challenges in development and dissemination	• Manual weeding takes quite a lot of time; it is also labour intensive and expensive for majority of small holder farmers and therefore some farmers prefer to use herbicides • Lack of information on herbicide use • Lack of user-friendly mechanized weeders for small maize farms • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders • Unorganized farmer groups to ease dissemination of information
Suggestions for addressing the challenges	• Introduce, test and adopt user friendly mechanized weeders • Promote use of herbicides • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for

	information sharing through field days, workshops and trainings • Enhance capacity of farmers through awareness and sensitization campaigns and workshops • Capacity build public agricultural extension service providers with information on weed management in maize production • Form maize common interest groups (CIGs) to ease dissemination of information.
Lessons learned in upscaling	• Adoption of user-friendly mechanized weeder reduces the cost of weeding thus increasing maize yields. • Availability and proper use of herbicides assists farmers in timely management of weeds thus increasing maize yields. • Chances of successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform, creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies. • Capacity building public and private agricultural extension service providers with information on weed management in maize production is key to successful adoption of the TIMP. • Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary	Have an environmental and safety plan when using herbicides, social concerns related to use of agrochemicals, address the environmental and, a functional agro- dealer network to supply the products when required by the farmers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of weeding one acre: 8 people x 400/- x 2 weeding = 6400/-
Estimated returns	Weeding contributes 9400/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Labour intensity in weeding which are mostly done by women and youth • Financial disempowerment where by women and youth have limited access to production resources such as land, credit, and other inputs and therefore may not be in a position to purchase mechanical weeder and herbicides. • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	• Youth can be engaged in weed control activity by use of herbicide • User friendly mechanization will create employment for youth • Train women and youth to be lead farmers and part of

	the FFBS ToT team for training on the importance of weed management for increased maize yields • Train women and youth agricultural extension officers to be part of FFBS ToT team • Empower women and youth who want to buy mechanical weeders, herbicides and other inputs by connecting them to financial source • Make gender friendly training materials with illustrations to enhance communication
VMG issues and concerns in development, dissemination, adoption and scaling up	• Weeding in maize is labor intensive for VMGs to undertake • VMG groups could have limitations in accessing weed technologies due to limited access to agricultural information and extension • VMGs have limited funds and resources to purchase herbicides due to limited access to credit facilities. • VMGs might be able to unable to read and understand the protocols and dissemination material written on IWM due to illiteracy • Low attendance by VMGs during awareness and sensitization campaigns on agricultural activities • Due to their social status VMGs are often excluded from decision making.
VMG related opportunities	• Train VMGs to be artisans of recommended small-scale mechanical weeders • Empower VMGs who want to buy mechanical weeders, herbicides and other inputs by connecting them to financial source • Train VMGs to be lead farmers and part of the FFBS ToT team for training on importance of weed management for increased maize yield • Make friendly training materials with illustrations to enhance communication. • Adoption of weeding technologies in maize will lead to increased production of maize and enhanced food security and nutrition among VMGs • Adoption of weeding technologies will lead to increased supply of maize hence increased incomes for VMGs
E: Case studies/profiles of success stories	
Success stories	In Kaloleni sub-county of Kilifi County, 30 farmers were trained on proper maize crop husbandry and each was facilitated with inputs (for land preparation, seed, basal fertilizer) enough to establish one acre of maize crop. The yields increased from three bags per acres to between 12 and 18 bags per acre. This showed that the low yields at farm level were due to inadequate knowledge and the necessary resources
Application guidelines for users	What variety do I grow in coastal Kenya – a leaflet Mapendekezo ya kukuza mahindi – a leaflet

F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B., A. O. Esilaba and R. N. Musila
Partner organizations	County government and local NGOS

Research Gaps

1. Capacity building farmers on herbicide use and safe use of herbicides in maize production
2. Lack of mechanized weeders for small-scale maize farms

2.5.6 Basal fertilizer application

2.4.6 TIMP Name	Basal fertilizer application
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low maize productivity as result of poor soil fertility
What is it? (TIMP description)	A method of applying small quantity of fertilizer in a hole meant for either seed or seedling during planting of maize. Soil fertility management practice options that comprise the use of inorganic fertilizers, locally available organic inputs and improved seed, which combined enhance maize yields. Basic fertilizer: The recommended basic fertilizers are NPK and DAP or organic fertilizers. The application of either depends on the acidic condition of the soil. In acidic soils NPK is recommended while in none acidic soils DAP can be applied. Apply during planting at the rate of 50kg/acre for DAP or 100kg/acre for NPK 23:23:0. Apply the fertilizer in the planting holes then mix with soil to protect the seed from scotching. Plant and cover the seed.
Justification	Soils in most maize growing areas have either been degraded or have low inherent fertility leading to low crop yields. Many farmers in the maize growing regions apply below the recommended fertilizer rates per unit area due to limited resources. This implies that farmers do not exploit the full potential of the maize variety they choose. Application of the recommended inorganic fertilizers enriched with locally available organic fertilizers significantly enhances maize yields by unlocking yield potential of recommended maize varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Maize farmers, researchers, environmentalists, County governments extension workers, input stockists.

Approaches to be used in dissemination	• Farmer field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Farmer field days, Agricultural shows and exhibitions • On farm and on station research trails and demonstrations • Farmer training, workshops and seminars • Public and private agricultural service providers • Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Applied and adaptive research to test, validate fertilizer types and application rates in different agro ecological zones • A platform for interaction of maize value chain stakeholders especially researchers', agricultural service providers, input stockists and farmers • Implementation of Farmer field and Business School (FFBS) strategy • Well organized farmer groups and networks for ease of dissemination • Active involvement of public and private agricultural service providers during dissemination and ToT trainings • Availability of inputs (recommended variety seed)
Partners/stakeholders for scaling up and their roles	Scientists: Fertilizer application recommendations. Extension agents (both private and public): Farmer mobilization, participatory training. County governments: Fertilizer awareness, policy and credit
C: Current situation and future scaling up	
Counties where already promoted if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMP will be upscaled	Tana River and Uasin Gishu counties
Challenges in dissemination	• Resource poor farmers may not have the ability to invest on inorganic fertilizers and improved seed because of high cost. • The myth that inorganic fertilizers make the soil hard to manage. • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Unorganized farmer groups to ease dissemination of information. • Limited information by farmers and agricultural extension service providers (Public and private) on the importance of inorganic and organic fertilizers in maize production

Suggestions for addressing the challenges	• Provision of credit to purchase inorganic fertilizer and subsidizing input prices by the County governments. • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings. • Enhance capacity of farmers through awareness and sensitization campaigns and workshops on merits of fertilizer use to maize yields and encourage them to use of organic fertilizers. • Capacity build public and private agricultural extension service providers with information on recommended inorganic fertilizer rates for different areas. • Form maize CIGs to ease dissemination of information
Lessons learned in upscaling if any	• Chances of successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform. • Creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies. • Capacity building public and private agricultural extension service with information on fertilizer use in maize production for increased yields is key to successful adoption of the TIMP. • Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary for development and upscaling	• Need for structured markets to enhance financial returns for farmers in maize production. • County NEMA officials to certify that the fertilizers have no adverse effect to the environment. • Farmers to be trained on safe handling of the fertilizers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of fertilizer: 4500/- Cost of labour: 2400/- Total: 6900/-
Estimated returns	Fertilizer application contributes 12400/- to the total profit of KES 55000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Decision making on land use is done by men, limiting women and youth participation in uptake of the management practice • The high cost of fertilizers limit impact on women and youth • Land ownership by men limits women and youth access to land • Men own land and dominate most decisions at the household and community levels yet have no interest in maize production which demoralizes women • Women perform most of the maize production activities such as planting, weeding and harvesting hence increases their work burden and therefore do not see the need of using fertilizer which is labour intensive

	• Women and youth have limited access to production resources such as land, credit, and other inputs and therefore may not be in a position to purchase fertilizers • Women and youth have limited access to training on extension issues • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	• Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of fertilizer use for increased maize yields • Train women and youth agricultural extension officers to be part of FFBS ToT team • Empower women and youth who want to buy fertilizers and other inputs by connecting them to financial source • Make gender friendly training materials with illustrations to enhance communication.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to production resources such as land and credit • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and • dissemination activities • There is low adoption by VMGs due lack of awareness
VMG related opportunities	• Empower VMGs to acquire land for maize production • Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance of using fertilizers for increased maize yields • Train VMGs agricultural extension officers to be part of FFBS ToT team • Empower the VMGs who want to buy fertilizer and other inputs by connecting them to financial sources • Make friendly training materials with illustrations to enhance communication.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Fertilizer use increases maize yield by more than 50% yields in most maize growing areas
Application guideline for users	References - Esilaba, A.O.<i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Muli, M.B., J.G. Gethi and G.M. Kamau. 2000. The response of maize (<i>Zea mays</i> L.) varieties to fertilizer, processing and storage methods in coastal Kenya. Proceedings of the 7th KARI Scientific Conference, Nairobi. 13-17 November 2000. Pp179-187
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	
	Ready for upscaling

G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B, A.O. Esilaba, R.N Musila
Partner organizations	County government and local NGOS

Research Gaps

1. Labour for inorganic fertilizer has become costly hence the need to explore on organic fertilizer their effectiveness and the economics in maize production

2.5.7 Top-dressing fertilizer application

2.4.6 TIMP Name	Top-dressing fertilizer application
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low soil fertility resulting in low maize productivity
What is it? (TIMP description)	Calcium Ammonium Nitrate (CAN) fertilizer is used for top dressing when the crop is 2-3 weeks after planting, when the crop is about 45cm high). In most cases, the optimum is around the 8-10 leaf stage for top dressing fertilizer for maize. Apply at the rate of 50 kg per acre if in a low rainfall area, while in areas with high rainfall, apply the fertilizer in two splits. The fertilizer is applied around the crop avoiding direct contact to protect the crop from scotching. CAN contains 28% nitrogen typically and is rapidly and efficiently taken up by plants. Weeding and thinning should be done before top dressing
Justification	Soils in most maize growing areas have either been degraded or have low inherent fertility leading to low crop yields. Many farmers in the maize growing regions apply below the recommended fertilizer rates per unit area due to limited resources. This implies that farmers do not exploit the full potential of the maize variety they choose. Application of the recommended inorganic fertilizers enriched with locally available organic fertilizers significantly enhances maize yields by unlocking yield potential of recommended maize varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Maize farmers • Researchers • environmentalists • County governments extension workers, • Input stockists.
Approaches to be used in dissemination	• Farmer field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Farmer field days, Agricultural shows and exhibitions • On farm and on station research trails and demonstrations • Farmer training, workshops and seminars • Public and private agricultural service providers

	• Farmer to farmer extension • Mass media – Agricultural programs • Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Applied and adaptive research to test, validate fertilizer types and application rates in different agro ecological zones • A platform for interaction of maize value chain stakeholders especially researchers', agricultural service providers • input stockists and farmers • Implementation of Farmer field and Business School (FFBS) strategy • Well organized farmer groups and networks for ease of dissemination • Active involvement of public and private agricultural service providers during dissemination and ToT trainings • Availability of inputs (recommended variety seed).
Partners/stakeholders for scaling up and their roles	• Scientists: Fertilizer application recommendations. • Extension agents (both private and public): Farmer mobilization, participatory training. • County governments: Fertilizer awareness, policy and credit
C: Current situation and future scaling up	
Counties where already promoted if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMP will be upscaled	Tana River and Uasin Gishu counties
Challenges in dissemination	Resource poor farmers may not have the ability to invest on inorganic fertilizers and improved seed because of high cost. The myth that inorganic fertilizers make the soil hard to manage. Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders. Unorganized farmer groups to ease dissemination of information. Limited information by farmers and agricultural extension service providers (Public and private) on the importance of inorganic and organic fertilizers in maize production
Suggestions for addressing the challenges	• Provision of credit to purchase inorganic fertilizer and subsidizing input prices by the County governments. • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings. • Enhance capacity of farmers through awareness and sensitization campaigns and workshops on merits of fertilizer use to maize yields and encourage them to use of organic fertilizers. • Capacity build public and private agricultural extension

	service providers with information on recommended inorganic fertilizer rates for different areas. • Form maize CIGs to ease dissemination of information
Lessons learned in upscaling if any	• Chances of successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform. • Creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies. • Capacity building public and private agricultural extension service with information on fertilizer use in maize production for increased yields is key to successful • Adoption of the TIMP. Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary for development and upscaling	Need for structured markets to enhance financial returns for farmers in maize production. County NEMA officials to certify that the fertilizers have no adverse effect to the environment. Farmers to be trained on safe handling of the fertilizers.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of fertilizer: 4000/- Cost of labour: 2400/- Total: 6400/-
Estimated returns	Fertilizer application contributes 12400/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men own land and dominate most decisions at the household and community levels yet have no interest in maize production which demoralizes women • Decision making on land use is done by men, limiting women and youth participation in uptake of the management practice • Women perform most of the maize production activities such as planting, weeding and harvesting hence increases their work burden and therefore do not see the need of using fertilizer which is labour intensive • Women and youth have limited access to production resources such as land, credit, and other inputs and therefore may not be in a position to purchase fertilizers • Women and youth have limited access to training on extension issues • Women have less access to agricultural information, technology and knowledge than men • The high cost of fertilizers limit impact on women and youth

Gender related opportunities	• Empower women and youth to acquire land. • Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of fertilizer use for increased maize yields. • Train women and youth agricultural extension officers to be part of FFBS ToT team. • Empower women and youth who want to buy fertilizers and other inputs by connecting them to financial source. • Make gender friendly training materials with illustrations to enhance communication.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Capacity build women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of fertilizer use for increased maize yields • Train women and youth agricultural extension officers to be part of FFBS ToT team • Empower women and youth who want to buy fertilizers and other inputs by connecting them to financial source • Make gender friendly training materials with illustrations to enhance communication.
VMG related opportunities	• Vulnerable and marginalized groups (VMGs) to be empowered to acquire land for maize production. • Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance of using CAN fertilizers for increased maize yields. • Train VMGs agricultural extension officers to be part of FFBS ToT team. • Empower the VMGs who want to buy fertilizer and other inputs by connecting them to financial source. • Make friendly training materials with illustrations to enhance communication.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Fertilizer use increases maize yield by more than 50% yields in most maize growing areas
Application guideline for users	References - Esilaba, A.O.<i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya - Muli, M.B., J.G. Gethi and G.M. Kamau. 2000. The response of maize (<i>Zea mays</i> L.) varieties to fertilizer, processing and storage methods in coastal Kenya. Proceedings of the 7th KARI Scientific Conference, Nairobi. 13-17 November 2000. Pp179-187
F: Status of TIMP readiness (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B, A.O. Esilaba, R.N Musila

Partner organizations	County government and local NGOS

Research Gaps

1. Labour for inorganic fertilizer has become costly hence the need to explore on organic fertilizer their effectiveness and the economics in maize production

2.5.8 Timely harvesting

TIMP Name	Timely harvesting
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low yield and poor quality of maize grain harvested due to poor timely harvesting of maize from the field.
What is it? (TIMP description)	Maize should be harvested at physiological maturity. Maize for the green market is ready for harvest: When the grain hardens or when the silky flowering at the top of the maize cob turns black. Maize for dry grain should be harvested when: Most leaves have dried up, cob husks are no longer green, stalks turn yellow or brown, cobs begin to droop on the stalk, kernels show a black layer between the seed and point of attachment to the cob, grains are hard and not milky and cobs are no longer good for roasting. Dry maize ready for harvesting
Justification	Maize should be harvested at physiological maturity to avoid losses caused by delayed harvesting, left overs during stooking, poor supervision during de-husking and spillage during transportation to the homestead stores.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers (farmers), extension agencies

Approaches to be used in dissemination	Farmer field and Business School (FFBS), Agricultural innovation platforms (AIP), Farmer field days, Agricultural shows and exhibitions, On farm and on station research trails and demonstrations, Farmer training, workshops and seminars, Public and private agricultural service providers, Farmer to farmer extension, Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Introduce and adopt mechanical harvester and shellers for small-scale farmers, • Applied and adaptive research to test, validate harvesting options. • A platform for interaction of maize value chain stakeholders especially researchers', engineers, agricultural service providers and farmers. • Implementation of Farmer field and Business School (FFBS) strategy. • Well organized farmer groups and networks for ease of dissemination. • Active involvement of public and private agricultural service providers during dissemination and ToT trainings.
Partners/stakeholders for scaling up	County government – To provide extension services, farmer mobilization and policy formulation. KALRO Engineers to fabricate mechanical harvesters and shellers. NGOs– to provide support on capacity building and micro-financing services. Farmer leaders for group organization
C: Current situation and future scaling up	
Counties where already promoted, if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMPs can be upscaled	Tana River and Uasin Gishu
Challenges in development and dissemination	• Manual harvesting of maize is slow and takes quite a lot of time; it is also labour intensive and expensive for majority of small holder farmers. • Lack of user-friendly mechanized harvesters for small maize farms. • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders. • Unorganized farmer groups to ease dissemination of information. • Limited information by farmers and agricultural extension service providers (Public and private) on how to correctly assess maize physiological maturity for timely harvesting.

Suggestions for addressing the challenges	• Introduce, test and adopt user friendly mechanized harvesters and shellers for small-scale farmers. • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings. • Enhance capacity of farmers through awareness and sensitization campaigns and workshops. • Capacity build public and private agricultural extension service providers with information on maize physiological maturity for timely harvesting to avoid post-harvest losses. • Form maize CIGs to ease dissemination of information.
Lessons learned in upscaling	Timely harvesting of maize reduces postharvest losses. Adoption of user-friendly mechanical harvesters saves time and labour and reduces postharvest losses. Chances of successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform. Creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies. Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary	Policies targeting the empowerment of women and youth as entrepreneurs in society. Subsidy in inputs and supply
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of harvesting one acre: 10 people x 400/- = 4000/-
Estimated returns	Harvesting contributes KES 5900/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women have limited access to credit and may not in mechanical manage to buy harvesters and shellers which are costly • Women and youth have limited access to production resources such as land, quality seed and credit • Men own land and dominate most decisions at the household and community levels yet have no interest in maize production • Women perform most of the maize production activities such as planting, weeding and harvesting hence increasing their work load • Women and youth have limited access to training and extension extension • Women have less access to agricultural information, technology and knowledge than men

Gender related opportunities	• Mechanizing maize harvesting will reduce labour incurred during harvesting and reduce post-harvest losses due to timely harvesting of maize • Mechanical harvester and shellers for small-scale farmers this will create employment for youth • Youth may participate in transportation of harvested maize produce to the homestead • Train women and youth to be lead farmers and part of the FFBS ToT team for training on importance of observing maize physiological maturity for timely harvesting to avoid post-harvest losses • Train women and youth agricultural extension officers to be part of FFBS ToT team. • Empower women and youth who want to mechanical harvesters and shellers and other inputs by connecting them to financial source. • Make gender friendly training materials with illustrations to enhance communication.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to maize production resources such as land and credit. • VMGs have limited access to training and extension services. • Due to their social status VMGs are often excluded from decision making in development and dissemination activities. • There is low adoption by VMGs due to lack of awareness
VMG related opportunities	• Empower VMGs to acquire land for maize production • Train VMGs to be lead farmers and part of the FFBS ToT team for training on importance of observing maize physiological maturity for timely harvesting to avoid post-harvest losses • Train VMGs agricultural extension officers to be part of FFBS ToT team • Empower the VMGs who want to access mechanical harvesters and shellers plus other inputs by connecting them to financial source • Make simple training materials with illustrations to enhance communication.
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	Reference - Esilaba, A.O. <i>et al.</i> (2021). KCEP-CRAL Maize Extension Manual. KALRO, Nairobi, Kenya. https://www.kalro.org/maize_post_harvesting

F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-ICRI Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B, A.O. Esilaba, R.N Musila
Partner organizations	County government and local NGOS

Research Gap

1. Mechanization of maize harvesting for small-scale farmers

2.5.9 Crop rotation

TIMP Name	Crop rotation for increased yield
Category (i.e., technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low yield of maize due to nutrient mining as a result of mono-cropping
What is it? (TIMP description)	Crop rotation is the practice of growing different crops in succession on the same land chiefly to preserve the productive capacity of the soil. It's a practice of growing different types of crops (or none at all) in the same area over a sequence of seasons. A basic principle of crop rotation is to avoid growing the same crop for consecutive years and principles of crop production is interchanging of tap root crops with fibrous root crops, leguminous with non-leguminous, avoidance of crop of same family follows one another to avoid pest and diseases build up. Different types of plants derive nutrients from different levels in the soil profile
Justification	Changing crops routinely allows the land to remain fertile, since not all of the same nutrients are being used each season. For example, planting a legume such as cowpeas, helps to replenish necessary nitrogen in the soil. Crop rotation can help to manage soil fertility, reduce soil erosion, improve soil health and increase nutrients availability to plants.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers (farmers), extension agencies
Approaches to be used in dissemination	• Farmer field and Business School (FFBS) • Agricultural innovation platforms (AIP) • Farmer field days • Agricultural shows and exhibitions • On farm and on station research trials and demonstrations • Farmer training, workshops and seminars

	• Public and private agricultural service providers • Farmer to farmer extension • Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals), Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	• Easy access of crop varieties that are compatible with associated crops planned for crop rotation • Applied and adaptive research to test and validate • Technical packages describing appropriate schedules of crop rotation • Package on fertilizer rates and regimes under the practice • A platform for interaction of maize value chain stakeholders especially researchers', agricultural service providers, seed companies, input stockists and farmers • Implementation of Farmer field and Business School (FFBS) strategy • Well organized farmer groups and networks for ease of dissemination • Active involvement of public and private agricultural service providers during dissemination and ToT trainings
Partners/stakeholders for scaling up	Farmers, farmer groups for capacity building and adoption. County government – to provide extension services, farmer mobilization and policy formulation. NGOs– to provide support on capacity building and micro-financing services
C: Current situation and future scaling up	
Counties where already promoted, if any	Kwale, Kilifi, Lamu and Taita Taveta, Embu, Machakos, Kitui Makueni and Tharaka Nithi
Counties where TIMPs can be upscaled	Tana River and Uasin Gishu
Challenges in development and dissemination	• The increased effects of climate change hindering adoption. • Limited access and narrow distribution of seed materials – appropriate varieties for crop rotation. • Inadequate access of technical materials on the establishment and management of crop rotation practices by farmers. • Limited farmland sizes which limit the practice of crop rotation. • Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders. • unorganized farmer groups to ease dissemination of information. • Limited information by farmers and agricultural extension service providers (Public and private) on the importance of crop rotation in maize production.

Suggestions for addressing the challenges	• Enhance access of appropriate seed materials across the counties - work closely with certified seed merchants, research institutions • Train and sensitize farmers on the basic principles of crop rotation, the benefits and types suitable to their contexts. • Develop a comprehensive manual on the practice to guide the farmers during the adoption. Rotate with high value pulse crops to maximize on income from a small area. • Constitute maize innovation platform to facilitate interaction of farmers with relevant stakeholders for information sharing through field days, workshops and trainings. • Capacity build public and private agricultural extension service providers with principles of crop rotation in maize. • Form maize CIGs to ease dissemination of information
Lessons learned in upscaling	• The practice is very important in pest management and replenishment of soil fertility in the soil. • The number of ecological benefits provided by this practice accelerates upscaling. • Chances of successful scaling up are higher when diverse maize value chain stakeholders collaborate in an innovation platform. • Creation of awareness through demonstrations and farmer field days helps farmers to gain skills and knowledge and increases adoption of new technologies. • Capacity building farmers and, public and private agricultural extension service with information on importance of crop rotation in maize production for increased yields is key to successful adoption of the TIMP. • Farmers need initial financial resources to start them up and training for sustainability.
Social, environmental, policy and market conditions necessary	• Crop rotation can help to manage soil fertility, reduce soil erosion, improve soil health and increase nutrients availability to plants and therefore need to create awareness on the benefits of crop rotation. • Crop rotation places emphasis on the importance of using available land space to grow diverse food crops, increase biodiversity, manage pests thus the practice is economically viable.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	• Cost of one ploughing and harrowing is KES. 4,500
Estimated returns	• Seeds contributes 6650/- to the total profit of KES 31,000/- per acre
Gender issues and concerns in development, dissemination,	• Increased workload will burden women who perform most of the activities within the maize chain

adoption and scaling up	• Women and youth have limited access to productive resources such as land, credit, and other inputs so they might not be able to adopt the TIMP • Women and youth have limited access to education, training and extension services than men hence might not be aware of the importance of crop rotation in maize • Men dominate most decisions at the household and community levels hence they determine whether crop rotation will for maize will be done
Gender related opportunities	• Crop rotation will be determined to a larger extent by having access and control of land especially by women • Train women and youth to be lead farmers and part of the FFBS ToT team for training on the importance of crop rotation in maize production for sustainability of maize yields • Train women and youth agricultural extension officers to be part of FFBS ToT team • Empower women and youth who want to buy maize inputs by connecting them to financial source • Make gender friendly training materials with illustrations to enhance communication
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to production resources such as land, credit, and quality seed • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There is low adoption by VMGs due to lack of awareness
VMG related opportunities	• Crop rotation places emphasis on the importance of using available land space to grow diverse food crops, increase biodiversity, manage pests, thus the practice is economically viable and cost effective to the advantage of VMGs • Train VMGs to be lead farmers and part of the FFBS ToT team for training on the importance of crop rotation in maize production for sustainability of maize yields • Train VMGs agricultural extension officers to be part of FFBS ToT team • Empower VMGs who want to buy maize inputs by connecting them to credit source • Make simple training materials with illustrations to enhance communication
E: Case studies/profiles of success stories	
Success stories	Farmers have reported improved soil conditions, reduced runoff and nutrient loss, soil moisture retention in soil and generally increased crop production after application of this widely used and readily available TIMP.

Application guidelines for users	References - Charles L. Mohler and Sue Ellen Johnson (Eds) 2009. Crop rotation on organic farms: a planning manual - FAO 2015. Training manual for Organic Agriculture
F. Status of TIMP readiness: 1. Ready for upscaling; 2. Require validation; and 3. Require further research	Ready for upscaling
G: Contacts	
Contacts	The Institute Director, KALRO-Mtwapa, P.O. Box 16-80109. Mtwapa, Kalro.mtwapa@kalro.org , Phone: 0202024751
Lead organization/scientists	KALRO, Muli M.B, A.O. Esilaba, R.N Musila
Partner organizations	County government and local NGOS

Research Gaps

1. Limited crop rotation packages for maize crop rotation with other crops
2. Cost benefit analysis for crop rotation farming system

2.6 SOIL FERTILITY MANAGEMENT TIMPS

2.6.1 Integrated Soil Fertility Management (ISFM)

TIMP name	Integrated Soil Fertility Management (ISFM)
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize productivity 4-8 bags per acre ($1-2 \text{ t ha}^{-1}$) against a potential yield of 35-50 bags per acre ($8-12 \text{ t ha}^{-1}$). The low yields are as a result of low and declining soil fertility, low soil organic matter, poor soil structure and poor water-holding capacity of soils.
What is it? (TIMP description)	ISFM is a set of soil fertility management practices that include the use of fertilizers, locally available organic inputs and improved seed combined to adapt practices to local conditions. The ISFM places emphasis on the importance of using often scarce resources like fertilizer and organic inputs efficiently through techniques such as fertilizer banding (field application of fertilizer directly in area of root-zone to increase the potential for uptake) and micro dosing (applying small quantities of fertilizer with the seed at planting time and a few weeks after emergence)
Justification	Soils within the farming systems are heterogeneous due to spatial variability in soil fertility. These inherent differences arise from the parent material from which the soil has evolved, and the position in the landscape that influences how soil develops. A large proportion of soils in the KCSAP target project counties are derived from some of the oldest land surfaces which, due to weathering and cropping, have low nutrients. Where younger, volcanic soils occur these are inherently richer in nutrients, but may have other soil fertility

	problems such as fixation of some critical nutrients such as phosphorus. Past management of the soils also has a major influence on soil fertility which in turn influences productivity. These challenges call for an integrated soil fertility management (ISFM) approach that combines appropriate interventions on soil management that include fertilizer use and crop agronomy. The aim of ISFM is therefore to optimize agronomic use efficiency of the applied nutrients for improved crop productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers, extension workers, researchers
Approaches to be used in dissemination	Farmer field and Business School (FFBS), Agricultural innovation platforms (AIP). Agricultural shows and exhibitions. On farm and on station research trails and demonstrations. Farmer field days, training, workshops and seminars. Public and private agricultural service providers. Farmer to farmer extension. Mass media – Agricultural programs, Promotional materials (posters, brochures, leaflets and manuals). Web material's, Mobile Apps and SMS
Critical/essential factors for successful promotion	These include applied and adaptive research to test, validate ISFM practice; a platform for interaction of maize value chain stakeholders; development of ISFM practices for maize production; funding research to validate and promote ISFM practice in maize production; availability of affordable quality manure and inorganic fertilizers; factors of production-land, money, labour, crop residues that different farming families are able to invest.
Partners/stakeholders for scaling up and their roles	Community farmer groups - play coordination role for ease in problem identification and dissemination. Farmers/farmer groups play a joint-learning role which promotes adoption County governments, National governments- mobilization and information dissemination as well as extension (Formal and informal) for policy, awareness and dissemination, NGOs play a role in farmer organizing and mobilization, and linking farmers to financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Machakos, Busia, Siaya, Kisumu, Kakamega, Tharaka Nithi, Isiolo, Nyeri, Uasin Gishu, Elgeyo Marakwet
Counties where TIMP will be promoted	Bomet, Kericho, West Pokot, TaitaTaveta, Lamu, Nyandarua, Tana River, Baringo, Marsabit, Garissa, Kajiado, Laikipia
Challenges in dissemination	Lack of ISFM innovation platforms to facilitate interaction of farmers with relevant stakeholders, change of mind-set in some regions/cultures that organic manures cannot be applied on maize, misconceptions that chemical fertilizer damage the soils

Suggestions for addressing the challenges	• Awareness trainings on role of organic manures in crop cultivation, • Training and awareness creation on the usefulness of fertilizer applications to clear the misconceptions about fertilizers, • Establish integrated soil fertility innovation platforms, Research to develop high yielding superior varieties, Information dissemination on production practices, Promotion of the variety in the suitable areas, • Promote marketing models that encourage collective production and marketing, • Involve County governments, extension, marketers and processors to promote value addition and consumption in local food systems
Lessons learned if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Creation of awareness through demonstrations and farmer field and business schools help in adoption of the ISFM practice, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms
Social, environmental, policy and market conditions necessary for development and upscaling	• Practice is socially acceptable to farmers and other stakeholders, • Environmentally friendly since it improves soil health, • Increased productivity will provide supply to the markets, • Supporting frameworks/policies are available
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	This is a technically demanding technology and high cost due to the various ISFM components: certified seed, manure, mineral fertilizer, pests and disease control. The average total production cost is KES 50,000-60,000 per acre
Estimated returns	Farmers who have adopted ISFM technologies have more than doubled maize productivity and increased their farm-level incomes. Returns at 4 bags/acre= kes 12,000/= against returns at 35 bags per acre of Kes 55,000/=.
Gender issues and concerns in development and dissemination	• It is labour intensive hence may not be adopted by women who are already overburdened. • Women and youth have limited access to credit to purchase the required inputs such as fertilizers than men. • Women and youth have limited access to land for dry beans cultivation than men • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	• Opportunity exist for women to access the required credit through the women enterprise funds.

VMG related opportunities	• Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production due to use of the TIMP will lead to increased consumption and utilization of dry beans and hence improved health of VMGs
Gender issues and concerns in development and dissemination	• It is labour intensive hence may not be adopted by women who are already overburdened. • Women and youth have limited access to credit to purchase the required inputs such as fertilizers than men. • Women and youth have limited access to land for dry beans cultivation than men • Women have less access to agricultural information, technology and knowledge than men.
E: Case studies/profiles of success stories	
Success stories	ISFM successes have been reported in maize in Kenya highlands. A 46-year old long-term experiment at KALRO Kabete has shown that high maize yields can be sustained when manures and mineral fertilizers are combined in the production process as soil fertility amendments.
Application guidelines for users	Always use well-adapted, disease- and pest-resistant germplasm/seed to make efficient use of available nutrients. Ensure that good agronomic practices are upheld, for sustainability, lone use of inorganic or organic materials should be avoided.
F: Status of TIMP readiness (1=Ready for upscaling; 2=Requires validation; 3=Requires further research)	
	Requires validation
G: Contacts	
Contacts	Centre Director, KALRO Kabete, P.O. Box 14733-00800, NAIROBI Tel: +254-020-2464435 Ext. 300, E-mail: cd.narl@kalro.org
Lead organization/scientists	KALRO; E. Gikonyo, C. Kibunja, A. Muriuki, D. Kamau, A. Esilaba, J. Ndufa, M. Okoti, C. Kundu and S. Kimani
Partner organizations	County governments, KEFRI

Research Gaps

- Validation of the ISFM technology in Counties where technology has not been tested.
- Testing (fertilizer types, rates, frequencies) with different value chains
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2.6.2 Integrated Manure Management (IMM)

Technology name	Integrated Manure Management
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Low maize productivity 4-8 bags per acre (1-2 t ha ⁻¹) against a potential yield of 35-50 bags per acre (8-12 t ha ⁻¹) and reduction of Greenhouse Gas (GHG) emissions. Declining soil fertility has resulted in low crop productivity. To address this challenge,

	farmers have resulted to use of manures, albeit poorly in terms of management and handling leading to increased GHG emissions
What is it? (TIMP description)	Integrated Manure Management (IMM) is the optimal, site-specific handling of livestock manure from collection, through treatment and storage up to application to crops. 
Justification	The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are being depleted at annual rate of 22 kg/ha for nitrogen, 2.5 kg/ha for phosphorous, and 15 kg/ha for potassium. Manure plays an essential role in the nutrient cycle where crops grow on land to feed livestock, which in return feeds the land with their manure. Recycling the (macro and micro) nutrients in manure reduces the need for additional mineral fertilizer purchase. In general, adding manure to soils enhances soil fertility and soil health that leads to increased agricultural productivity, improved soil structure and biodiversity. Given the acute poverty and limited access to mineral fertilizers, manure has the potential providing the limiting nutrients and improving the soil health.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Farmers
Approaches to be used in dissemination	Farmer field and business Schools (FFBS), Agricultural Innovation Platforms (AIP), On farm and on station research trials and demonstrations, Training workshops, Seminars, Meetings, Field days, Agricultural shows, Moa/Extension officers, Farmer research networks, Farmer to farmer, Mass media – Agricultural programs, Promotional (posters, brochures, leaflets and manuals), Web material's, mobile APPs and SMS.
Critical/essential factors for successful promotion	• Applied and adaptive Research to test, validate and integrated manure management, • A platform for interaction of IMM practice with stakeholders, Model demonstration plots using cereal crops, • Training on management and use of manure, Dissemination approach used to reach target farmers
Partners/stakeholders for scaling up and their roles	• County government extension services - Provide link with farmers. • Community farmer groups - play coordination role for ease in problem identification and dissemination, • ILRI - Technical backstopping,

	• NGOs – Micro financing services
C: Current situation and future scaling up	
Counties where already promoted if any	Tharaka Nithi, Kajiado, Uasin Gishu
Counties where TIMP will be promoted	All counties where maize is produced
Challenges in dissemination	• Lack of IMM innovation platforms to facilitate interaction of farmers with relevant stakeholders, • Limited model demonstration farms, • Cultural challenges, for instance lack of interest by pastoral communities, • Lack of continuity in training of extension and farmers in the skill for manure management, • Lack of proper mobilization mechanism for reaching many farmers
Suggestions for addressing the challenges	• Establish IMM innovation platforms, • Establishment of many IMM demonstration plot by counties, • Capacity building of pastoral communities on manure management and its benefit, • Continuous capacity building of demonstration farmers and extension workers, • Use of improved approaches to mobilize farmer to attend demonstration forums.
Lessons learned if any	• Chances of successful scaling are higher when diverse value chain stakeholders collaborate in an innovation platform, • Partnership is important in technology dissemination and adoption and this can be facilitated through innovation platforms, • Proper use of manures improves soil fertility, Use of manures enhances crop productivity, • Skills in manure preparation, storage and application ensures efficiency and effectiveness
Social, environmental, policy and market conditions necessary	• Awareness that applying manure to soils saves on purchase of inorganic fertilizer, increases crop yield and improves crop water use efficiency. • Awareness that manure can harbor pathogens which can cause disease outbreaks to livestock, • Awareness that manure affects the environment and can contaminate water sources through leaching of • nutrients, • Awareness that organic manures when poorly managed and handled can increase GHG emissions.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	Proper handling of manure needs labour for collecting the manure, storing and maintaining it and finally transporting and applying it in the field which takes a lot of effort and time, Manure costs are dependent on type, e.g. goat, sheep, cattle, poultry, etc. The basic costs is estimated at KES 20,000-26,000 per acre. Using locally available manure often saves on purchase of inorganic fertilizer.
Estimated returns	The estimated returns are about Kshs. 52, 000 - 94,000 per acre
Gender issues and concerns in development and dissemination	• It is labour intensive in terms of handling and application hence may not be adopted by women who are already overburdened. • Women and youth may also have limited access to inputs such as manures than men. • Women have less access to credit to purchase the required inputs like manure than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	• Opportunity exists for women to access the required credit through the women enterprise funds.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may also have limited access to finances to buy the required inputs such as manures than men. • VMGs have less access to credit to purchase the required inputs like manure than men. • VMGs have less access to agricultural information, technology and knowledge than men.
VMG related opportunities	• Affirmative action in various areas as for instance in the provision of finances to VMGs. • Increased production due to use of manure will lead to increased consumption and utilization of dry beans hence improved health of VMGs.
E: Case studies/profiles of success stories	
Success stories	Farmers who adopt manure management practice have reported improved soil health and increased crop yield, and sustainable source of income, e.g. keeping one steer in a smallholder farm measuring 0.45ha in central Kenya produces manure equivalent to 112 kg N/ha/year of whole farm area when optimum collection and manure composting strategies are followed (Lekasi <i>et al</i> , 2001).
Application guidelines for users	The guideline focuses on Livestock housing and manure collection, Manure storage to preserve nutrient and avoid loses, Manure treatment for ease of transport and application in the field, Timing of application for maximum utilization by the crop, Anaerobic digestion for biogas production, Regular analysis of manure to ascertain the quality. Manure/Composts take a long time to cure, hence need good planning prior to use. IMM is always site specific and users advised to only use information relevant to local circumstances
F: Status of TIMP readiness (1=Ready for upscaling: 2=Requires validation; 3=Requires further research)	
Requires validation	

G: Contacts	
Contacts	Director, Environment & Natural Resource Systems, KALRO Secretariat, P.O. Box 57811-00200 +254 722 206986/8, Ext 2316
Lead organization/scientists	KALRO, S. Kimani, E. Mutuma, D. Kamau, M. Okoti, J. Wamuongo, A. Esilaba
Partner organizations	County government and Private Public Partnerships

Research Gaps

1. Promote IMM complementary technology in counties that have not practiced it.
2. Conduct nutrient budget study on selected farms utilizing manures (including composts) in each of the 24 counties.

2.6.3 Rapid soil testing services

TIMP name		Rapid soil testing services	
Category (i.e. technology, innovation or management practice)	Innovation		
	  		
A: Description of the technology, innovation or management practice			
Problem addressed	Low maize productivity 4-8 bags per acre (1-2 tha ⁻¹) against a potential yield of 35-50 bags per acre (8-12 tha ⁻¹). Low crop yields are obtained since farmers apply soil fertility amendments which are not based on soil testing to ascertain the inherent fertility status. Conventional methods for soil testing are not cheap to farmers; results take long and not reproducible, Conventional methods have not provided solutions for paired soil and leaf testing to determine health of soil and crop simultaneously, Current methods do not provide a framework for large-scale assessment of geo-referenced sampled points using standardized protocols, Limited access to soil testing services (centralized soil testing laboratories and cost)		
What is it? (TIMP description)	This is a dry method for soil testing using simplicity of light—the interaction of electromagnetic radiation with matter to characterize biochemical composition of a soil and/or plant tissue. Requires that partners involved in this TIMP (ICRAF, iSDA and Soil Cares) work closely with KALRO and county agricultural officers to sensitize farmers to embrace the testing method. This innovation will involve working closely with soil		

	scientists to generate specific fertilizer recommendation driven by soil, crop and manure data obtained.
Justification	Soil testing is the basis for good fertilizer management that maintains the productivity of soil and improves the quality of crops. It promotes more efficient and targeted fertilizer use and prevents environmental pollution from excess fertilizer application, and cost efficiency. However, limited access to soil testing services is depriving the farmers' ability to make informed decisions with regard to soil management and fertilizer use.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Lead farmers, public and private agricultural service providers
Approaches to be used in dissemination	Farmer field and business Schools (FFBS); Agricultural Innovation Platforms (AIP); On farm and on station research trials and demonstrations; Training workshops, Seminars, Meetings, Field days Agricultural shows; Moa/Extension officers Farmer research networks Farmer to farmer Mass media – Agricultural programs Promotional materials (posters, brochures, leaflets and manuals), Web material's, mobile APPs and SMS.
Critical/essential factors for successful promotion.	• Availability of the necessary equipment for rapid on the spot soil testing. • Established rapport between farmers and the technical personnel involved in soil testing. • Adequate qualified staff to cover the large number of samples from the target 24 counties before the planting season begins. • A well-designed information storage system for data obtained at farm level including (GPS readings, physical description of the locations, raw measured scanned data, and fertilizer recommendation according to crop type suitability). • Farmers must understand, trust, and be willing to act upon the information provided.
Partners/stakeholders for scaling up and their roles	• County government extension services; providing the link to farmers. • Soil cares; Provides soil scanners technology and capacity building in collaboration with KALRO and ICRAF, ICRAF and iSDA; Tests and validate the recommendations obtained in collaboration with Soil Cares and • KALRO Fertilizer companies; To provide fertilizer blends according to soil health status • Agro dealers to stock required fertilizers that is readily available to farmers
C: Current situation and future scaling up	
Counties where already promoted	Technology has not been promoted though testing has been ongoing in a few counties including Bungoma, Trans Nzoia, Kiambu, Nyeri

Counties where TIMP will be upscaled	All the 24 KCSAP counties
Challenges in dissemination	• Lack of maize innovation platforms to facilitate interaction of farmers with relevant stakeholders • The TIMP requires continuous updating of methods to improve recommendations. • Lack of awareness on the importance of regular testing of soil quality
Suggestions for addressing the challenges	• Awareness creation, intensive farmer field training (capacity building) • Make the whole process cost efficient. • Use of scanners (spectroscopy) and less wet chemistry analysis. • Automated pipelines for updating existing recommendation methods.
Lessons learned in upscaling if any	• Timely affordable soil information will guide on fertilizer use. • Farmers have reported frustration when they apply the wrong fertilizers and see no results because they did not take the first step to understand what the soil demand in terms of macro, micronutrients and trace elements like Zinc and Boron.
Social, environmental, policy and market conditions necessary for development and upscaling.	• Socially acceptable as it brings income, increases food production, nutrition security and family cohesion. • Environmentally friendly; Recommendations provided ensures that farmers only apply the required amounts of fertilizers. • No excess nutrients to contaminate ground and surface water. Market will absorb the increased productivity Supporting frameworks/policies are available.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Soil testing equipment and consumables, sampling and packaging materials, personnel. The actual costs will be determined upon consultation. Its estimated Kshs. 650,000 for acquiring thus shipping the kit and services per acre.
Estimated returns	At least 30% to 50% higher returns for all value chains utilising the service.
Gender issues and concerns in development and dissemination	• It is labour intensive hence may not be adopted by women who are already overburdened • Women and youth have limited access to credit to purchase the required inputs such as fertilizers than men • Women and youth have limited access to land for kale cultivation than men • Women have less access to agricultural information, technology and knowledge than men
Gender related opportunities	• Opportunity exist for women to access the the required credit through the women enterprise funds.

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for kale cultivation than men. • VMGs have less access to agricultural information, technology and knowledge than men. • It is labour intensive hence may not be adopted by some VMGs who are elderly. • Women and youth have limited access to credit to purchase the required inputs such as fertilizers than men.
VMG related opportunities	• Affirmative action in various areas as for instance in the provision of finances to VMGs • Increased production due to use of the TIMP will lead to increased consumption and utilization of kale and hence improved health of VMGs consumption and utilization of maize hence improved health of VMGs
E: Case studies/profiles of success stories	
Success stories	Has been tested and used successfully by other organizations like ICRAF, Soil Cares & former Kenya Sugar Research Foundation. It has been adopted at Kenya cane testing centre for checking maturity level and quality of sugarcane.
Application guidelines for users	A handheld scanner to test soils and crops in the field. Community soil sampling champions are identified and trained on good soil sampling procedures. Soil and crop are analyzed and the results including fertilizer recommendation generated on site.
F: Status of TIMP readiness (1=Ready for upscaling; 2=Requires validation; 3=Requires further research)	Requires validation
G: Contacts	
Contacts	Director, Environment & Natural Resource Systems, KALRO Secretariat, P.O. Box 57811-00200 +254 722 206986/8, Ext 2316
Lead organization/scientists	KALRO; C. Kibunja, E. Gikonyo, Christy van Beek, A. Sila, D. Kamau, A. Esilaba, M. Okoti, C. Kundu and S. Kimani
Partner organizations	County governments in the 24 counties, Soil Cares, ICRAF and iSDA

Research Gaps

1. Testing paired soil and crop samples to determine nutrients in the soil and what is available to plant.
2. Determine nutrient deficiency and make recommendation for the type of fertilizer to use and at what rate.
3. Developing a fertilizer recommendation system with options for new blends.
4. Working with fertilizer companies to produce fertilizer blends packaged in smaller quantities as per farmer needs.

5. Using scanners at farm level to undertake fertilizer quality analysis, e.g. quantitative and qualitative analysis, major and trace elemental analysis, and chemical and physical analysis.
6. Updating existing soil maps with newly acquired soil data to provide current soil fertility status in the country.

2.6.4 Low-Cost Composting technology

Technology name	Low Cost Composting
Category (i.e. technology, innovation or management practice) A: Description of the technology, innovation or management practice	Management practice
Problem addressed	Low maize productivity 4-8 bags per acre ($1-2 \text{ tha}^{-1}$) against a potential yield of 35-50 bags per acre ($8-12 \text{ tha}^{-1}$) Organic wastes constitute the highest percentage of waste flow in Kenya leading to big landfills especially near the urban centres. However, there is low awareness on appropriate low-cost composting technologies and lack of supporting policies. Moreover, lack of proper composting management and handling leads to increased GHG emissions.
What is it? (TIMP description)	Composting is the biological decomposition of organic waste such as food or plant material by bacteria, fungi, worms and other organisms under controlled aerobic conditions resulting in an accumulation of partially decayed organic matter called humus. Composting is thus an effective process for recycling organic wastes intended for use in agriculture 
Justification	The decline in soil fertility in smallholder system is a major factor inhibiting agricultural development on farms. It is estimated that soils are being depleted at annual rate of 22kg/ha for nitrogen, 2.5kg/ha for phosphorus, and 15kg/ha for potassium. Composts contain the nutrients- nitrogen, phosphorus and potassium and that are found in most chemical fertilizer and even secondary and trace elements (such as zinc, iron and magnesium) that are not, and which are useful to the roots of growing plants. Composts also contain micronutrients. The compost also adds balanced nutrients to soil in an easily assimilated form, and helps improving soil structure by lightening heavy clays and improving water retention properties in porous sands
B: Assessment of dissemination and scaling up/out approaches	

Users of TIMP	Farmers, extension workers, researchers, small & medium enterprises
Approaches to be used in dissemination	Farmer field and business Schools (FFBS) Agricultural Innovation Platforms (AIP) On farm and on station research trials and demonstrations Training workshops, Seminars, Meetings Field days Agricultural shows Moa/Extension officers Farmer research networks Farmer to farmer Mass media – Agricultural programs Promotional materials posters/brochures/leaflets, manuals) Web material's, mobile APPs and SMS
Critical/essential factors for successful promotion	• Applied and adaptive Research to test, validate and disseminate low-cost composting management practices • Platform for interaction of maize value chain stakeholder training on different composting techniques and use • Model demonstration plots using cereal crops
Partners/stakeholders for scaling up and their roles	• County government extension services - Provide link with farmers. • Community farmer groups - play coordination role for ease in problem identification and dissemination, • ILRI - technical backstopping, • NGOs – Micro financing services, Financial institutions (banks, donors, credit facilitators) for financial solutions
C: Current situation and future scaling up	
Counties where already promoted if any	Tharaka Nithi, Kajiado, Nyeri, Bomet, Uasin Gishu, Kakamega, Busia, Machakos
Counties where TIMP will be promoted	All 24 KCSAP counties
Challenges in dissemination	• Lack of low-cost composting innovation platforms to facilitate interaction of farmers with relevant stakeholder. • Lack of model demonstration farms • Lack of continuity in training of extension and farmers in composting skill slack of proper mobilization mechanism for reaching many farmers • Lack of composting innovation platforms • Poor information dissemination on composting practices
Suggestions for addressing the challenges	• Establish maize innovation platforms, Establishment of many demonstration plots by counties, Capacity building of smallholder farmers on composting management and its benefit, Continuous capacity building of demonstration farmers and extension workers, Use of approaches to mobilize farmer to attend demonstration forums

Lessons learned if any	• Proper use of composts to improve soil fertility, • Use of composts to enhance crop productivity, • Skills in composting methodologies and minimizing health risks associated with composts making
Social, environmental, policy and market conditions necessary for development and upscaling	• Awareness that composting requires care when handling wastes that would normally contain heavy loads of pathogens • Awareness that composts may contain non-biodegradable and hazardous waste which may affect human health. Environmental hazards including contamination by leaching of nutrients. • Knowledge that applying composts to soils saves on purchase of inorganic fertilizer, increases crop yield and saves water. Hence socially and environmentally acceptable
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Preparation of composts require labour for building a compost heap, maintaining it and finally transporting and applying it in field which take a lot of effort and time. The cost is estimated at KES 10,000/= per acre.
Estimated returns	Returns estimated at Kshs.65,400 to 112,000 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	• It is labour intensive in terms of preparation and application hence may not be adopted by women who are already overburdened. • Women and youth have limited access to land for kale cultivation than men. • Women have less access to agricultural information, technology and knowledge than men.
Gender related opportunities	• Opportunities for youth's male's employment exist in the task of composting.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to land for kale cultivation than men. • VMGs have less access to agricultural information, technology and knowledge than men.
VMG related opportunities	• Opportunities for youth's males' employment exist in the task of composting.
E: Case studies/profiles of success stories	None
Success stories	• Farmers who use composts in quickly maturing crops have reported 3 to 5 times increased production due to • improved soil health

Application guidelines for users	The guidelines for users focus on need to mix the compost with the soil to ensure adequate nutrition in the rooting zone. Compost storage to preserve nutrient and avoid losses. Timing of application for maximum utilization by the crop. Regular analysis of compost to ascertain the quality including contaminants like heavy metals and pathogens. Type of composts and quality that will determine the application rates. Materials that cannot be used for composts include, charcoal ashes, dog/cat manure, meat/animal fat, leaves or biomass from certain tree species that have toxic levels for microbes, e.g. eucalypts and cassia spp. Reference Karanja NK, Kwach HO, Njenga M (2005). Low-cost composting training manual. Techniques based on the UN Habitat urban harvest CIP community-based waste management initiative.
F: Status of TIMP readiness (1=Ready for upscaling; 2=Requires validation; 3=Requires further research	Requires validation
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat
Lead organization/scientists	KALRO, B. Mugo, D. Kamau, E. Mutuma, M. Okoti, C. Kundu and S. Kimani
Partner organizations	County government, NGOs

Research Gaps

1. Promote composting technology in counties that have not practiced it.
2. Conduct nutrient budget study on selected farms using composts in the 24 Counties.



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