



***DRAFT***

**INVENTORY OF CLIMATE SMART AGRICULTURE SORGHUM  
TECHNOLOGIES, INNOVATIONS & MANAGEMENT PRACTICES**

**Compiled by**

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## **1.0 Definition of terms and summary tables of Sorghum Technologies, Innovations and Management Practices (TIMPS)**

### **1.1 Definition of terms**

**Technology:** This is defined as an output of a research process which is beneficial to the target clientele (mainly farmers, pastoralists, agro-pastoralists and fisher folk 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 defined as recommendation(s) on practice(s) that is/are considered necessary for a technology to achieve its optimum output. These include, for instance, different agronomic and practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation, watering regimes, etc.), protection methods, for crops; and feed rations, management systems, disease control methods, etc. for animal breeds. This is therefore important information which is generated through research to accompany the parent technology before it is finally released to users and the technology would be incomplete without this information.

**Innovation:** This is defined as 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 Sorghum Value Chain

The inventory process identified 33 TIMPs comprising 21 technologies, 6 innovations and 6 management practices, distributed among the 6 sub-themes, as indicated in the table

**Table 1: Summary of sorghum TIMPs**

Commodity/VC	Sub-Theme	Technologies	Innovations	Management Practices
Sorghum	Improved sorghum varieties	20	0	0
Sorghum	Agronomic management practices	1	0	5
Sorghum	Bird Damage Management	0	0	1
Sorghum	Mechanization	0	1	0
Sorghum	Postharvest management	0	2	0
Sorghum	Marketing	0	1	0
Sorghum	Value addition	0	2	0
<b>Overall Total</b>		<b>21</b>	<b>6</b>	<b>6</b>

### Summary of Status of TIMPs in Sorghum Value Chain

The inventory process resulted in a total of 15 TIMPs that are ready for up-scaling, 16 TIMPs that require validation and 2 TIMPs that require further research in the sub-themes, as indicated in Table 2.

**Table 2. Number of TIMPs ready for up-scaling, require validation or further research**

Commodity/VC	Sub-Theme	Ready for up-scaling	Require validation	Further Research
Sorghum	Improved sorghum varieties	9	11	0
Sorghum	Agronomic management practices	3	2	1
Sorghum	Bird Damage Management	0	1	0
Sorghum	Mechanization	0	0	1
Sorghum	Postharvest management	1	1	0
Sorghum	Marketing	0	1	0
Sorghum	Value addition	2	0	0
<b>Overall Total</b>		<b>15</b>	<b>16</b>	<b>2</b>

**Table 3: Inventory of Sorghum TIMPs by Category and Status**

<b>TIMPs Sub-Theme</b>	<b>TIMPs Title</b>	<b>TIMPs Category</b>	<b>Status</b>	
<b>2.1 Improved sorghum varieties</b>	2.1.1 Sorghum variety Gadam	Technology	Ready for up-scaling	
	2.1.2 Sorghum Variety KARI Mtama-1	Technology	Ready for up-scaling	
	2.1.3 Sorghum variety Sila	Technology	Ready for up-scaling	
	2.1.4 Sorghum variety SC Smile	Technology	Requires validation	
	2.1.5 Sorghum variety EUSH 1 Hybrid	Technology	Requires validation and seed access	
	2.1.6 Sorghum variety KM 32 -1	Technology	Requires validation and seed access	
	2.1.7 Sorghum variety Seredo	Technology	Ready for up-scaling	
	2.1.8 Sorghum Variety Serena	Technology	Ready for up-scaling	
	2.1.9 Sorghum variety E97	Technology	Requires validation and seed access	
	2.1.10 Sorghum variety BJ28	Technology	Ready for up-scaling	
	2.1.11 Sorghum variety Ikinyaluka	Technology	Ready for up-scaling	
	2.1.12 Sorghum variety E 1291 variety	Technology	Ready for up-scaling	
	2.1.13 Sorghum variety E6518	Technology	Ready for up-scaling	
	2.1.14 Sorghum variety Sweet Sorg 4	Technology	Requires validation	
	2.1.15 Sorghum variety Sweet Sorg 14	Technology	Requires validation	
	2.1.16 Sorghum variety Sweet Sorg 17	Technology	Requires validation	
	2.1.17 Sorghum variety Sweet Sorg 21	Technology	Requires validation	
	2.1.18 Sorghum variety Kak Sweet Sorg 1	Technology	Requires validation	
		2.1.19 Sweet sorghum variety EUSS 10	Technology	Requires validation
		2.1.20 Sweet sorghum variety EUSS 11	Technology	Requires validation
<b>2.2 Agronomic management practices</b>	2.2.1 Planting, weeding, thinning, Fertilizer application, pest and disease management, harvesting, storage and own seed selection	Management practice	Ready for up-scaling	
	2.2.2 Use of fertilizers for enhanced yield in sorghum	Management practice	Ready for up-scaling	

	2.2.3 Use of growth Enhancers to improve soil fertility for increased sorghum yields	Management practice	New: Needs validation
	2.2.4 Conservation Agriculture (CA) for sorghum production	Technology	Ready for up-scaling
	2.2.5 Sorghum legume intercropping	Management practice	Requires further research
	2.2.6 Legume intercropping for Striga management in sorghum	Management practice	Requires further research
<b>2.3 Bird Damage Management s</b>	2.3.1 Sorghum Grain Harvest at Soft Dough Stage	Management practice	New: Requires validation
<b>2.4 Mechanization</b>	2.4.1 Mechanization of sorghum production activities (Sorghum Planter, weeding, Harvester)	Innovations	Further research
<b>2.5 Post harvest</b>	2.5.1 Sorghum Thresher	Innovation	Ready for up-scaling
	2.5.2 Sorghum solar drier	Innovation	Validation
<b>2.6 Marketing</b>	2.6.1.The Community Production and Marketing System (COPMAS) sorghum Model	Innovation	Validation
<b>2.7 Value addition</b>	2.7.1 Processing, utilization and value addition	Innovation	Ready for up-scaling
	2.7.2 Sorghum Bread	Innovation	Ready for up-scaling
	Total TIMPS	33	

## 2.0 Detailed Sorghum Value Chain TIMPS

### 2.1 Improved varieties

<b>2.1.1 TIMP Name</b>	<b>Sorghum variety Gadam</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• Low production (3-5 bags/acre)</li> <li>• Low adoption</li> <li>• Low consumption</li> <li>• low commercialization</li> <li>• Inadequate Market opportunities</li> </ul>
What is it? (TIMP description)	Gadam is an open Pollinated variety that was released in 1994 by KARI (KALRO). It is a highly drought, heat tolerant and early maturing (3 months) variety. Recommended for altitude range of 250-1600 m.a.s.l and was originally targeted for coastal and semi-arid lowlands. Features: Chalky white grains but with brown testa. Plants are medium high. Grains yield ranges between 2-2.5 t/ha.
Justification	Well adapted to climate change, It is a farmer acceptable variety, has brewing quality and is already commercialized. It is palatable and well digestible to human and animal consumption. (Need to indicate importance to food security in the ASALS) The most drought resilient variety
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers, Traders, Processors (brewing), Millers, Seed dealers, Researchers, Extension service.</li> </ul>
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Awareness creation by marketers and processors/farmer contracting</li> <li>• Field days</li> <li>• Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Farmer research networks</li> <li>• Partners (ICRISAT, NGOs)</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programmes</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Web material's</li> <li>• Mobile</li> </ul>

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Good Marketing Models and path ways</li> <li>• Seed availability and accessibility</li> <li>• Good seed system to ensure quality</li> <li>• Well organized farmer groups and networks</li> <li>• County and central government support</li> <li>• Funding to adapt to new areas</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. ICRISAT to provide variety, seed and production information</li> <li>• Malting and brewing industries (EABL) and Market agents to create markets</li> <li>• Farmers/farmer groups to produce</li> <li>• County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for farmer organizing and mobilization</li> <li>• Seed companies for quality seed multiplication</li> <li>• Financial institutions e.g. Banks and other credit facilitators for financial solutions</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	<p>Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru, Homabay, Siaya, Kisumu.</p> <p>Some parts of Tanzania and Uganda</p>
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya, Wajir
Challenges in dissemination	<ul style="list-style-type: none"> <li>- Bird damage is a disincentive for all white varieties</li> <li>- Labour intensity in planting, weeding, harvesting and threshing.</li> <li>- Disorganized marketing channels</li> <li>- Weak seed systems leading to mixing and low quality grain and seed.</li> <li>- Lack of seed multipliers and distributors in the new interested counties</li> <li>- Limited processing technologies and consumption diversity at the household level</li> <li>- The variety is not adapted to humid and cold areas leading to low yields in those areas</li> <li>- Inappropriate of production practices</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>- Information dissemination on production practices</li> <li>- Promotion of the variety in the suitable areas</li> </ul>

	<ul style="list-style-type: none"> <li>- Mechanize sorghum production</li> <li>- Promote Proper marketing models that encourage collective production and marketing, honoring contractual agreements</li> <li>- Involve county governments, Extension, marketers and processors</li> <li>- Decentralize seed distribution in the target areas and engage county govern in seed distribution for ease of accessibility</li> <li>- Use partners innovations such as the “Smart food Initiative” by ICRISAT to promote value addition and consumption in local food systems</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>- Private Public Partnership promotion and marketing models have worked once in promotion of Gadam Variety therefore there is possibility of extending to other value chains</li> <li>- Farmers need persistent hands on training in proper agronomic practices, Marketing and value addition for proper impact</li> <li>- Availability of market is key</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Creation of awareness on nutritive and commercial importance of the variety.</li> <li>• Harmonious gender consideration in research, consumption and marketing. It is cultivated mainly by women hence the need to capacity build them.</li> <li>• It is an already “a climate change ready crop” due to its moisture and temperature stress resilience. But should be adapted to the right cultivation areas.</li> <li>• Enabling policy and policy review from time to time</li> <li>• Implementation of the flour blending policy.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	KES 28,800 per acre. Returns =KES 13,800
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Labour intensity in weeding, Thinning, threshing and bird scaring – mostly done by women and youth</li> <li>• Seed multiplication and distribution shortfalls</li> <li>• Land ownership mainly by men who have no interest in sorghum</li> <li>• Financial empowerment, the poor farmers lack funds to start</li> <li>• Slow Information and awareness flow to more farmers</li> <li>• Marketing: Production is done by youth and women but the money goes to the men</li> <li>• Labour intensity in almost all activities affects women. There is need for mechanization.</li> <li>• Youth are mainly sidelined in sorghum value chain</li> <li>• Appropriate training materials and strategies</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth friendly production techniques such as mechanization</li> <li>• Apply enterprising value addition methods for the youth</li> </ul>

	<ul style="list-style-type: none"> <li>• Friendly trading conditions to allow women and youth to participate in marketing</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Unfriendly production practices</li> <li>• Un friendly dissemination methods and documents</li> <li>• Mechanization</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Friendly trading conditions</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	The brewing market demand that encouraged Gadam sorghum commercialization in 2009-2014 that saw increased production and area under production and coming together of public and private organizations to enhance production hence the COPMAS model By smart logistics solution in lower eastern Kenya
Application guidelines for users	<p><b>Reference:</b>  <b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual :</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP)</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2- requires validation; 3-requires further research)	Ready for up-scaling
<b>G. Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rachael Kisilu and C K Kamau
Partner organizations	ICRISAT , Dry land seed company, EABL

<b>2.1.2 TIMP Name</b>	<b>Sorghum Variety KARI Mtama-1</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• Low farm yields (3-5 bags/acre)</li> <li>• Adaptation to dry mid-lowland</li> <li>• Adaptation to new sorghum growing areas: Baringo, Kericho, Wajir, Isiolo, West Pokot</li> </ul>
What is it? (TIMP description)	<p>KARI Mtama-1 is a white sorghum open pollinated variety (OPV) with high malting quality, high yields (3.4t/ha) and sweet (low tannins) for human consumption</p> <p>It was released in 2000 by KARI (KALRO) for areas ranging between 250-1800 m a.s.l.</p>

Justification	KARI Mtama-1 can grow in some dry high lands where Gadam cannot be cultivated. It has good brewing quality. The grain is sweet, palatable and highly digestible to human and animal consumption.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers</li> <li>• Traders</li> <li>• Millers</li> <li>• Processors (brewers)</li> <li>• Seed dealers</li> <li>• Extension service</li> <li>• Researchers</li> </ul>
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Field days</li> <li>• Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Partners (ICRISAT, NGOs)</li> <li>• Farmer net working</li> <li>• Mass media – Agricultural programmes</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Web material</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Seed availability and accessibility</li> <li>• Good seed system to ensure quality</li> <li>• Well organized farmer groups</li> <li>• Good Marketing Models and path ways</li> <li>• County and central government support</li> <li>• Value addition technologies to increase consumption</li> <li>• Funding to adapt to new areas</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. ICRISAT to provide variety, seed and production information</li> <li>• Malting and brewing industries (EABL) and Market agents to create markets</li> <li>• Farmers/farmer groups to produce</li> <li>• County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for farmer organizing and mobilization</li> <li>• Seed companies for quality seed multiplication</li> <li>• Financial institutions e.g. Banks and other credit facilitators for financial solutions</li> </ul>

<b>C: Current situation and future scaling up</b>	
Counties where TIMP will be up scaled	Lower eastern Kenya but not widely adopted due to being slightly late (3.5 months). Also released in Tanzania (include names of counties in Kenya)
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Bird damage leading to low adoption</li> <li>• Laborious production activities</li> <li>• Weak seed systems leading to inaccessibility, mixing, low quality grain</li> <li>• Disconnect between producers and markets</li> <li>• Limited processing technologies and diversity at the household and cottage industry level</li> <li>• The KARI Mtama-1 high yields are rarely reached because of the late maturity, takes 3-3.5 (4) months to mature and due to the scenario of reducing rainfall amounts in the dry regions the variety is classified as late.</li> <li>• Uneconomic seed production because of low demand: multipliers do not benefit</li> <li>• Poor adaptability in humid areas due to high humidity leading to fungal diseases</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on production practices</li> <li>• Promotion only to the suitable areas</li> <li>• Mechanize sorghum and processing</li> <li>• Innovate marketing models that encourage collective production and marketing</li> <li>• Involve county governments, Extension, marketers and processors in participatory approach of dissemination</li> <li>• Decentralize seed multiplication to other KALRO institutes and NARIS in target areas and engage county government in seed distribution to ease accessibility</li> <li>• Use partners innovations such as the “Smart food Initiative” by ICRISAT to promote value addition and consumption in local food systems</li> </ul>
Lessons learned in up scaling	<ul style="list-style-type: none"> <li>• Private Public Partnership promotion and marketing models have worked in promotion of sorghum</li> <li>• Farmers need persistent hands on training in proper agronomic practices, Marketing and value addition for proper impact</li> <li>• Availability of market will stimulate production</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Creation of awareness on nutritive and commercial importance of the variety. Include all gender groups in research, consumption and marketing. It is cultivated mainly by women hence the need to capacity build them.</li> </ul>

	<ul style="list-style-type: none"> <li>• It is an already “a climate change ready crop” due to its moisture and temperature stress resilience. But should be adapted to the right cultivation areas.</li> <li>• Sorghum prices are steady due to huge domestic well organized markets and good policy. But policy review from time to time is important</li> <li>• Implementation of the flour blending policy.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	KES 28,800 per acre. Returns = KES 13,800
Gender issues and concerns in development dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Marketing: Production is done by youth and women but the money goes to the men</li> <li>- Labour intensity in almost all activities affects women. There is need for mechanization.</li> <li>- Youth are mainly sidelined in sorghum value chain</li> <li>- Appropriate training materials and strategies</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>- Women and youth friendly production techniques such as mechanization to increase interest</li> <li>- Apply enterprising value addition methods for the youth</li> <li>- Friendly trading conditions to allow women and youth to participate in marketing</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>- Unfriendly production practices</li> <li>- Un friendly dissemination methods and documents</li> <li>- Mechanization</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>- Friendly trading conditions</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Public The COPMAS/sorghum aggregation model by smart logistics solution in lower eastern Kenya
Application guidelines for users	<p><b>Reference</b></p> <p><b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Extension Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2- requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rachael Kisilu and C K Kamau

Partner organizations	ICRISAT
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<b>2.1.3TIMP Name</b>	<b>Sorghum variety Sila</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• Low farm yields (3-5 bags/acre)</li> <li>• Adaptation to humid and sub humid areas</li> <li>• High bird damage</li> <li>• Adaptation to new sorghum growing areas: Baringo, Kericho, Wajir, Isiolo, West Pokot</li> </ul>
What is it? (TIMP description)	Sila is a white open pollinated variety released by AgriSeedCo Ltd in 2006. It has a high malting quality, good for human consumption and animal fodder. It is a dual purpose with grain yield of 2-4 t/ha, and fodder 4 t/ha, It is suited for altitudes of 250-1800 M.a.s.l.
Justification	Sila has good brewing quality. It is Palatable and digestible for human and animal consumption. Provides fodder also. It is well commercialized for brewing purposes.
Region promoted	Highly promoted in Upper eastern and western Kenya. Also promoted in lower eastern
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers</li> <li>• Traders</li> <li>• Millers</li> <li>• Processors (brewers)</li> <li>• Seed dealers</li> <li>• Extension service</li> <li>• Researchers.</li> </ul>
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars</li> <li>• Awareness creation by marketers and processors</li> <li>• Agricultural shows and Field days</li> <li>• MoA/Extension officers</li> <li>• Partners (ICRISAT, NGOs)</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programs.</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Web material</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Seed availability and accessibility</li> <li>• Good seed system to ensure quality</li> </ul>

	<ul style="list-style-type: none"> <li>• Well organized Farmer groups</li> <li>• Good Marketing Models</li> <li>• County and central government support</li> <li>• Funding to adapt to new areas</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. ICRISAT to provide variety, seed and production information</li> <li>• Malting and brewing industries (EABL) and Market agents to create markets</li> <li>• Farmers/farmer groups to produce</li> <li>• County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for farmer organizing and mobilization</li> <li>• Seed companies for quality seed multiplication</li> <li>• Financial institutions e.g. Banks and other credit facilitators for financial solutions</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Upper eastern and western regions. Also in lower eastern although due to its longer maturity period of 3.5 months it is not well taken in lower eastern
Challenges in dissemination	<p><b>General for all varieties</b></p> <ul style="list-style-type: none"> <li>• Low awareness of management practices</li> <li>• Bird damage</li> <li>• Labour intensity in harvesting and threshing.</li> <li>• Weak seed systems leading in accessibility, mixing and low quality grain</li> <li>• Disconnect of producers and markets</li> <li>• Limited processing technologies and consumption diversity at the household level</li> <li>• Sila has Low yields in very dry hot areas of lower eastern where Gadam survives.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Dissemination of production practices</li> <li>• Promotion of collective production to reduce bird damage impact</li> <li>• Mechanize production activities along the value chain</li> <li>• Well organized seed systems</li> <li>• Promote aggregation models encourage collective production and marketing</li> <li>• Involve county governments, Extension, marketers and processors in dissemination.</li> </ul>

	<ul style="list-style-type: none"> <li>• Promotion the variety in its right areas of production</li> <li>• Promote value addition technologies and use partners innovations such as the “Smart food Initiative” by ICRISAT to promote consumption in local food systems</li> </ul>
Lessons learned if any	<ul style="list-style-type: none"> <li>• Private Public Partnership promotion and marketing models have worked once in promotion of sorghum</li> <li>• Aggregation production and marketing increased yields in eastern Kenya therefore can work in other areas</li> </ul>
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Sorghum is a highly nutritional crop therefore awareness creation for consumption in the society is important. It is cultivated mainly by women hence empowering them will ensure adoption.</li> <li>• It is an already “a climate change ready crop” due to its moisture and temperature stress resilience.</li> <li>• Sorghum prices are steady due to huge domestic well organized markets and policy. The policy on blending is in the process of implementation.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	KES 28,800 per acre. Returns =13,800
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Most farmer groups are women groups therefore men are left out in dissemination</li> <li>• Land ownership, is mainly by men hence getting demonstration land from women is always an issue</li> <li>• The youth are always left out due to lack of participation, resources and low interest in the presented technologies</li> <li>• Mainly women adopt but may not scale up well with little support by men</li> <li>• Marketing: cultivation is done by youth and women but the money goes to the men</li> <li>• Labour intensity in almost all activities</li> <li>• Youth are mainly sidelined in sorghum value chain</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth friendly production techniques such as mechanization will improve production</li> <li>• Apply enterprising value addition methods for the youth</li> <li>• Friendly trading conditions to allow all gender to participate in marketing</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• low access to dissemination forums and documents</li> <li>• Illiteracy can hinder adoption</li> <li>• Financial difficulties in acquiring facilities</li> <li>• Difficulties in market access</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Friendly trading conditions to allow them to participate</li> <li>• Value addition and local marketing of the sorghum products</li> </ul>
<b>E: Case studies/profiles of success stories</b>	

Success stories from previous similar projects	The COPMAS/ sorghum aggregation model by smart logistics solution and other market agents in eastern Kenya
Application guidelines for users	<p><b>Reference:</b>  <b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>For more info:</b> Agri Seed Co.</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rachael Kisilu and C K Kamau
Partner organizations	ICRISAT, Advanta seed Co, East Africa Seed Co. Egerton University

<b>2.1.4 TIMP Name</b>	<b>Sorghum variety SC Smile</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• Low production (3-5 bags/acre)</li> <li>• Less varieties adapted to humid and sub humid areas</li> <li>• High bird damage on current varieties</li> <li>• Less varieties for the new sorghum growing areas: Baringo, Kericho, Wajir, Isiolo, West Pokot</li> </ul>
What is it? (TIMP description)	SC Smile is a red open pollinated variety released by AgriSeedCo Ltd in 2016. It suitable for malting. Has grain yield of 2.5 - 3 t/ha. It is suited for Lowland to medium altitudes – Upto 1500 m.a.s.l e.g. Busia, Kitui, Kisumu, Machakos, Embu, Meru, Homabay, Bomet, Thika, Kilifi, Migori, Baringo, Bungoma & Makueni
Justification	The red grains make it bird tolerant, it is early (3 months) and widely adapted in both western and eastern regions. It also has a malting quality. It has good tolerance to both drought and heat and tolerant to leaf blight and sooty stripe.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers, Traders, Processors (brewing), Millers, Seed dealers, Researchers, Extension service.</li> </ul>

Approaches used in dissemination	<ul style="list-style-type: none"> <li>• Awareness creation by the seed company</li> <li>• Agricultural Extension</li> <li>• Partners (ICRISAT, NGOs)</li> <li>• Farmer to farmer</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Awareness creation of the availability of the variety</li> <li>• Seed availability and accessibility</li> <li>• Good seed system to ensure quality</li> <li>• Farmer groups</li> <li>• Good Marketing Models</li> <li>• County and central government support</li> <li>• Funding</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. ICRISAT to provide variety, seed and production information</li> <li>• Malting and brewing industries (EABL) and Market agents to create markets</li> <li>• Farmers/farmer groups to produce</li> <li>• County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for farmer organizing and mobilization</li> <li>• Seed companies for quality seed multiplication</li> <li>• Financial institutions e.g. Banks and other credit facilitators for financial solutions</li> <li>•</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Not known
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Low promotion of <b>SC Smile</b> variety hence starting from zero awareness</li> <li>• Labour intensity in most of the production activities.</li> <li>• Weak seed systems leading to mixing and low quality grain</li> <li>• Lack of seed multipliers and distributors in the sited counties</li> <li>• Disconnect of producers and markets</li> <li>• Limited processing technologies and consumption diversity at the household level</li> <li>•</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Promotion to create awareness to the variety</li> <li>• Information dissemination on production practices</li> <li>• Mechanize production activities</li> </ul>

	<ul style="list-style-type: none"> <li>• Promote Proper marketing models that encourage collective production and marketing</li> <li>• Involve county governments, Extension, marketers and processors.</li> <li>• Use partners innovations such as the “Smart food Initiative” by ICRISAT to promote value addition and consumption in local food systems</li> </ul>
Lessons learned in up scaling if any	For a new variety on-farm demonstrations and farmer field schools work well in awareness creation and adoption.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Creation of awareness on nutritive and commercial importance of the variety.</li> <li>• Harmonious gender consideration in research, consumption and marketing. It is cultivated mainly by women hence the need to capacity build them.</li> <li>• It is an already “a climate change ready crop” due to its moisture and temperature stress resilience. But should be adapted to the right cultivation areas.</li> <li>• Sorghum prices are steady due to huge domestic well organized markets however policy review from time to time is necessary</li> <li>• Implementation of the flour blending policy.</li> <li>•</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	KES 28,800 per acre. Returns =13,800
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Most farmer groups are women groups therefore men are left out in dissemination</li> <li>• Land ownership, is mainly by men hence getting demonstration land from women is always an issue</li> <li>• The youth are always left out due to lack of participation, resources and low interest in the presented technologies</li> <li>• Mainly women adopt but may not scale up well with little support by men</li> <li>• Marketing: cultivation is done by youth and women but the money goes to the men</li> <li>• Labour intensity in almost all activities</li> <li>• Youth are mainly sidelined in sorghum value chain</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth friendly production techniques such as mechanization will improve production</li> <li>• Apply enterprising value addition methods for the youth</li> <li>• Friendly trading conditions to allow all gender to participate in marketing</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• low access to dissemination forums and documents</li> <li>• Illiteracy can hinder adoption</li> <li>• Financial difficulties in acquiring facilities</li> </ul>

	<ul style="list-style-type: none"> <li>• Difficulties in market access</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Friendly trading conditions to allow them to participate</li> <li>• Value addition and local marketing of the sorghum products</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	The brewing market demand that encouraged Gadam sorghum commercialization in 2009-2014 that saw increased production and area under production and coming together of public and private organizations to enhance production hence the COPMAS model By smart logistics solution in lower eastern Kenya
Application guidelines for users	<p><b>Reference:</b>  <b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>For more info:</b> ICRISAT, Agri Seed Co.</p>
<b>F: Status of TIMP readiness</b> (1-ready for up-scaling;, 2-requires validation; 3-requires further research)	Needs validation because it is not well Known
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rachael Kisilu and C K Kamau
Partner organizations	ICRISAT, Agri seedco limited

<b>2.1.5 TIMP Name</b>	<b>Sorghum variety EUSH1 Hybrid</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<p>Limited varieties for industrial malting &amp; brewing</p> <p>Low yield of available sorghum for malting &amp; brewing</p>
What is it? (TIMP description)	EUSH1 is a high yielding hybrid (4.5 t/ha) with early maturity (3 months) and malting (brewing) qualities. It grows in lower midland (1300-1500 Masl) It was released in 2016 by Egerton university and ICRISAT. The grain is suitable for malting and brewing.

Justification	High yielding, early maturing, can be used for consumption and malting (brewing). Can be adapted to eastern and western and other sorghum areas. There is need to have suitable sorghum varieties to satisfy existing industrial market created by the EABL mainly in Western Kenya. Local farmers will be contracted to produce the grain thereby providing agribusiness venture that will improve rural livelihood
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>Farmers, Traders, Millers, Processors (brewers), Seed dealers, Researchers.</li> </ul>
Approaches used in dissemination	Demonstrations, exhibitions, media
Critical/essential factors for successful promotion	Availability of seed
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>KALRO, National Agricultural Research Institutes (NARIs) and International research organizations e.g. ICRISAT to provide variety, seed and production information</li> <li>Malting and brewing industries (EABL) and Market agents to create markets</li> <li>Farmers/farmer groups to produce</li> <li>County governments, central governments e.g. Chiefs, Agricultural Extension (Formal and informal) for policy, awareness and dissemination</li> <li>NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for farmer organizing and mobilization</li> <li>Seed companies for quality seed multiplication</li> <li>Financial institutions e.g. Banks and other credit facilitators for financial solutions</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Tharaka, Embu
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>No seed for commercial supply due to lack of funds to produce</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>Funding seed production</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>Partnership with stakeholders in solving a challenge quickly yield results</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>Sorghum is cultivated mainly by women hence empowering them is important.</li> <li>Contractual arrangement between EABL and farmers for grain production also works well with farmers</li> </ul>

	<ul style="list-style-type: none"> <li>• Sorghum is an already “a climate change ready crop” due to its moisture and temperature stress resilience.</li> <li>• Sorghum prices are steady due to huge domestic well organized markets. Market is assured by EABL</li> <li>• Policy review from time to time is required</li> <li>• The policy on blending is in the process of implementation.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 Production cost
Estimated returns	20 bags per acre at KES 32 per kg = 57,600 per acre. Net returns 42,600
Gender issues and concerns in development, dissemination, adoption and scaling up	<p>In equality within genders on resources such as land, finances and information knowledge</p> <p>Hybrid seed may be expensive because it requires farmer to buy every season and this may inter women farmers who are resource poor</p> <p>Labour intensity affects other chores mainly done by women</p> <p>The technologies presented may not appeal to the youth</p> <p>Low financial and resource empowerment</p>
Gender related opportunities	<p>High yield of the hybrid increases production and income for all the groups who will adopt</p> <p>Creates employment at production, trading, transportation and processing,</p>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• low access to dissemination forums and documents</li> <li>• Illiteracy can hinder adoption</li> <li>• Resource poor and Financial difficulties in acquiring facilities</li> <li>• Difficulties in market access</li> </ul>
VMG related opportunities	Provides opportunity for agri-business
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	none
Application guidelines for users	<p><b>Reference:</b></p> <p><b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>For more info:</b> ICRISAT, Egerton University</p>
<b>F: Status of TIMP readiness</b> (1-ready for	Needs validation because it is a new hybrid.

upscaling;; 2-requires validation; 3-requires further research)	
<b>G: Contacts</b>	
Contacts	Egerton University, KALRO-Katumani
Lead organization and scientists	Egerton University, Erick Cheruiyot. KALRO, Rachael Kisilu, C K Kamau
Partner organizations	EABL

<b>2.1.6 TIMP Name</b>	<b>Sorghum variety KM 32 -1 (Kamani)</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• Low farm yields</li> <li>• Sorghum varieties with wide adaptation across the sorghum growing areas in Kenya.</li> <li>• Adaptation to new sorghum growing areas: Baringo, Kericho, Isiolo, West Pokot</li> </ul>
What is it? (TIMP description)	KM 32 -1 (Kamani) is a new sorghum variety released in 2019 by KALRO Katumani therefore ready for validation and promotion. Yield: 2.7-3.8 t/acre. Maturity 3 months, Suited for dry low lands and dry cold zones and some humid zones. Stay green stress tolerance. Short and uniform for mechanized harvesting.
Justification	It is drought tolerant, has wide adaptability, suited for dry low lands, dry cold zones and humid zones. Stay green stress tolerance. Short and uniform for mechanized harvesting. Large white seeds with brewing quality and good for human consumption
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers</li> <li>• Processors (brewers)</li> <li>• Seed dealers</li> <li>• Researchers.</li> </ul>
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Field days, Agricultural shows</li> <li>• Mass media – KBC.</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Web material's (ASAL APRP Website)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Seed availability and accessibility</li> <li>• Good seed system to ensure quality</li> <li>• Farmer groups</li> <li>• Good Marketing Models</li> <li>• County and central government support</li> </ul>

	<ul style="list-style-type: none"> <li>• Funding to adapt to new areas</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Market agents and Processors e.g. EABL to create the pull</li> <li>• County governments, central governments e.g. Chiefs for dissemination and promotion</li> <li>• Agricultural Extension for farmer demonstrations and training</li> <li>• Researches (KALRO and NARIS) , CGIARs e.g. ICRISAT for varieties and seed provision</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for farmer mobilization and organization</li> <li>• Seed companies for multiplying and availing quality seed</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Parts of Makueni and Tharaka Nithi
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• It is a new variety that needs awareness creation first</li> <li>• Labour intensity in production</li> <li>• Few farmers producing encourage Bird damage and less market opportunities</li> <li>• Seed has not yet been multiplied for promotion</li> <li>• Limited processing technologies and consumption diversity at the household level</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Awareness creation through Information and dissemination of the variety and production practices</li> <li>• Mechanize harvesting and threshing and other activities</li> <li>• Involve county governments, Extension, marketers, processors and farmer groups to produce in large numbers to reduce bird damage and encourage collective production and marketing</li> <li>• Breeder seed multiplication for the seed companies to promote and disseminate</li> <li>• Decentralize seed multiplication to other KALRO institutions in the target areas and engage county govern in seed distribution for ease of accessibility</li> <li>• Promote value addition techniques and Use partners innovations such as the “Smart food Initiative” by ICRISAT to promote value addition and consumption in local food systems</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Private Public Partnership promotion and marketing models have worked once in promotion of sorghum. This can also work with this new variety</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• The variety market oriented therefore awareness creation for commercialization in the sorghum society is important. It is cultivated mainly by women hence empowering them with its information will ensure adoption.</li> </ul>

	<ul style="list-style-type: none"> <li>• It is an already “a climate smart crop” due to its moisture and temperature stress resilience hence suitable for the environment</li> <li>• Sorghum prices are steady due to huge domestic well organized markets and policy hence this variety will suit well in the market environment. Frequent policy review is important</li> <li>• The policy on blending being developed will be favorable for this variety therefore should be fast-tracked</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	Estimated revenue per acre =KES 48640 per acre Returns = KES 33,640 per acre
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Most farmer groups are women groups therefore men may be left out in dissemination of new variety</li> <li>• Land ownership, is mainly by men hence getting demonstration land from women may be an issue</li> <li>• The youth are left out due to lack of participation, resources and low interest</li> <li>• Mainly women adopt but may not scale up well with little support by men</li> <li>• Marketing: cultivation is done by youth and women but the money goes to the men</li> <li>• Labour intensity in almost all activities</li> <li>•</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The new sorghum is high yielding hence profitable to the famers who will adopt</li> <li>• The variety is short and uniform hence suitable for mechanized harvesting and this will reduce labour for women and youth and improve production</li> <li>• Application of enterprising value addition methods for the youth is possible because the variety has value addition qualities</li> <li>• Friendly trading conditions to allow all gender to participate in marketing are available for the white variety</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• low access to dissemination forums and documents</li> <li>• Illiteracy can hinder adoption</li> <li>• Financial difficulties in acquiring facilities</li> <li>• Difficulties in market access</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Friendly trading conditions to allow them to participate</li> <li>• Value addition and local marketing of the sorghum products</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Sorghum commercialization in Kenya
Application guidelines for users	<b>Reference:</b> <b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. ( <a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a> )

	<p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Needs validation because it's a new variety
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rachael Kisilu, CK Kamau
Partner organizations	ICRISAT, EABL

<b>2.1.7 TIMP Name</b>	<b>Sorghum variety Seredo</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low farm yields Low adaptation and Low adoption Bird damage
What is it? (TIMP description)	<b>Seredo:</b> Brown OPV sorghum, wide adaptation, bird tolerant, good milling capacity, yield 2.7 t/ha. Released in 1970s for 250-1750 Masl by KARI. Matures in 3 months
Justification	This sorghum variety can grow in dry humid areas, and dry low lands. It is well adapted and Known by farmers. It is mainly used to blend with cassava and maize flour in western Kenya. In eastern areas farmers feed directly to chicken. It is not highly damaged by birds due to tannin content in the grain. Well fitted for western counties. The seed is available.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, millers, seed dealers, researchers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Field days</li> <li>• Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Partners Networks (KALRO, ICRISAT, NGOs)</li> <li>• Farmer to farmer</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> </ul>

	<ul style="list-style-type: none"> <li>• Web material's</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Seed availability and accessibility</li> <li>• Good seed system to ensure quality</li> <li>• Farmer well organized</li> <li>• County and central government support</li> <li>• Good value addition and utilization techniques to upgrade up take</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers/farmer groups for production</li> <li>• County governments, central governments e.g. Chiefs for promotion</li> <li>• Agricultural Extension demonstration and training</li> <li>• Researches (NARS) and International research organizations e.g. ICRISAT to provide variety and seed</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for dissemination</li> <li>• Seed companies for seed multiplication</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru, Homabay, Siaya, Kisumu.
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Laikipia, Mandera
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Tannin content that causes protein binding and low digestibility and uptake of nutrients.</li> <li>• Not very palatable</li> <li>• Labour intensity</li> <li>• Few market channels for brown varieties</li> <li>• Limited processing technologies and consumption diversity at the household and cottage industry level</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on production practices</li> <li>• Promote to the suitable areas and avail seed</li> <li>• Identify markets for the brown and red sorghums</li> <li>• Involve county governments and extension, and processors.</li> <li>• Good seed systems to facilitate accessibility</li> <li>• Promote value addition and use partners innovations such as the “Smart food Initiative” by ICRISAT to promote value addition and consumption in local food systems</li> </ul>
Lessons learned in up scaling if any	Bird tolerance is a very important attribute in sorghum adoption therefore should be pursued
Social, environmental, policy and market conditions necessary for development and up scaling	Awareness on the highly nutritional importance of the variety in the community. It is cultivated mainly by women hence empowering them will work. It is an already “a climate change ready crop” due to its moisture and temperature stress resilience.

	<p>Brown sorghum varieties prices have improved due to the white sorghum marketing.</p> <p>The policy on blending is in the process and implementation needs to be in place to facilitate more production</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	<p>Estimated revenue per acre = KES 38,800 per acre</p> <p>Returns = KES 13,800 per acre</p>
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership, financial empowerment, information and awareness, consumption diversity.</li> <li>• Labour intensity in almost all activities affects women. Youth are mainly sidelined in sorghum value chain. Most groups are women therefore men take long to adopt</li> <li>• The variety palatability and colour issues affecting consumption and marketing.</li> <li>• Appropriate training materials and strategies.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth friendly production techniques such as mechanization.</li> <li>• Apply enterprising value addition methods for the youth.</li> <li>• Friendly trading conditions to allow women and youth to participate in marketing.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Unfriendly production practices</li> <li>• Un friendly dissemination methods and documents</li> <li>• Education, poverty, access to markets.</li> </ul>
VMG related opportunities	Value addition and market access
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	<p>This sorghum variety has been adopted and used for a long time by consumers to prepare dishes like Ugali, porridge, traditional beer and for blending with maize and cassava flours. It is also the main chicken feed in traditional chicken rearing setups. It is bird tolerant hence it is important to promote its uptake more.</p>
Application guidelines for users	<p><b>Reference:</b></p> <p><b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>For more information:</b> KALRO Katumani,ICRISAT</p>

<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>F: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO-Rachael Kisilu, CK Kamau
Partner organizations	ICRISAT, Kenya seed company, Dry land seed company

<b>2.1.8 TIMP Name</b>	<b>Sorghum Variety Serena</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low farm yields Low adoption Bird damage
What is it? (TIMP description)	Brown OPV sorghum, early maturity, wide adaptation, bird tolerance, good milling qualities, yield 2.7 t/ha. Released in 1970s by KARI.
Justification	<b>Serena</b> grows in dry low lands as well as dry humid areas. Early maturing. It is well adapted and known by farmers. It is mainly used to blend with cassava and maize flour in the western. In eastern areas farmers feed directly to chicken. It is not highly damaged by birds due to tannin content in the grain. Well fitted for most of the sorghum growing counties. The seed is available.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, traders, millers, processors (brewers), seed dealers, researchers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Field days and Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Partners (ICRISAT, NGOs)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Seed availability and accessibility</li> <li>• Good seed system</li> <li>• County and central government support</li> <li>• Good value addition and utilization techniques to upgrade up take</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers/farmer groups to take part in participatory dissemination</li> <li>• County governments, central governments e.g. Chiefs for awareness creation</li> </ul>

	<ul style="list-style-type: none"> <li>• Agricultural Extension for demonstration and promotion</li> <li>• Researches (NARS&amp; CGIAR) for variety, information and seed provision</li> <li>• NGOs dealing with sorghum Seed companies for mobilization and dissemination</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru, Homabay, Siaya, Kisumu.
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Laikipia, Mandera
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Tannin content that causes protein binding and low digestibility and uptake of nutrients. Low palatability</li> <li>• Labour intensity in production</li> <li>• Few market channels</li> <li>• Limited processing technologies and consumption diversity at the household level.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on production practices</li> <li>• Identify markets for the brown and red sorghums</li> <li>• Involve county governments and extension, and processors.</li> <li>• Good seed systems for brown varieties</li> <li>• Use partners innovations such as the “Smart food Initiative” by ICRISAT to promote value addition and consumption in local food systems.</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Bird tolerance is a very important attribute in sorghum adoption therefore should be pursued.</li> <li>• Farmers need persistent hands on training in proper agronomic practices, Marketing and value addition for proper impact.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<p>Awareness on the highly nutritional importance of sorghum It is cultivated mainly by women hence empowering them will work.</p> <ul style="list-style-type: none"> <li>• It is an already “a climate change ready crop” due to its moisture and temperature stress resilience.</li> <li>• Brown sorghum varieties prices are better due to white sorghum marketing.</li> <li>• The policy on blending is in the process and implementation needs to be in place.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	Estimated revenue per acre = KES 38,800 per acre Returns = KES 13,800 per acre
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership, financial empowerment, information and awareness, consumption diversity, Women farmer groups are more than men therefore women are more reached than men.</li> <li>• Labour intensity in almost all activities affects women. There is need for mechanization.</li> </ul>

	<ul style="list-style-type: none"> <li>Youth are mainly sidelined in sorghum value chain</li> <li>Men adopt slowly because they are not in groups</li> <li>Appropriate training materials and strategies.</li> </ul>
Gender related opportunities	Women and youth friendly production techniques such as mechanization Apply enterprising value addition methods for the youth Friendly trading conditions to allow women and youth to participate in marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>Unfriendly production practices</li> <li>Unfriendly dissemination methods and documents</li> <li>Poverty and low education, in access to market and improved varieties</li> </ul>
VMG related opportunities	Market opportunities and value addition
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	This sorghum variety has been adopted and used for a long time by consumers to prepare dishes like Ugali, porridge, traditional beer and for blending with maize and cassava flours. It is also the main chicken feed in traditional chicken rearing setups. It is bird tolerant hence it is important to promote its uptake more
Application guidelines for users	<p><b>Reference:</b>  <b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>For more information:</b> KALRO Katumani, ICRISAT</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO-Rachael Kisilu and C K Kamau
Partner organizations	ICRISAT, Kenya seed company, dry land seed company

<b>2.1.9 TIMP Name</b>	<b>Sorghum variety E97</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low farm yields Low adaptation and Low adoption Bird damage Low consumption
What is it? (TIMP description)	The variety was released in 2017 by Rongo university and has a yield of 4-4.5 t/ha, matures in 90 days. It is suited for western Kenya (Kakamega county), around the low land areas of Lake Victoria basin (Homabay, migori,siaya, Kisumu, busia,), Eastern Kenya, (Machakos, Kitui, Embu
Justification	It has tolerance to head smut. It is also drought tolerant and moderately tolerant to striga and tolerant to aluminium toxicity and low levels of phosphorous in the soil.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, millers, seed dealers, researchers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm demonstrations</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Farmer field days</li> <li>• Agricultural shows</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Seed availability and accessibility</li> <li>• County and central government support</li> <li>• Funding to adapt to new areas</li> <li>• Agricultural extension</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers/farmer groups to take part in participatory dissemination</li> <li>• County governments, central governments e.g. Chiefs for awareness creation</li> <li>• Agricultural Extension for demonstration and promotion</li> <li>• Researches (NARS&amp; CGIAR) for variety, information and seed provision</li> <li>• NGOs dealing with sorghum Seed companies for mobilization and dissemination</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Newly released therefore needs promotion to the target counties Kisumu, Siaya, ,Baringo, Busia, Kericho, Laikipia,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• It is a new variety hence dissemination will start from zero</li> <li>• Labour intensity in harvesting and threshing.</li> <li>• Weak seed systems leading to mixing and low quality grain</li> </ul>

	<ul style="list-style-type: none"> <li>• Lack of seed multipliers and distributors in the target counties</li> <li>• Few market channels</li> <li>• Limited processing technologies and consumption diversity at the household level.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Validation and adaptation participatory trials to create awareness.</li> <li>• Information dissemination on production practices</li> <li>• Promote to the suitable areas and avail seed.</li> <li>• Involve county governments and extension, and processors.</li> <li>• Good sees multiplication and distribution channels.</li> <li>• Value addition techniques.</li> </ul>
Lessons learned in up scaling if any	Farmers need persistent hands on training in proper agronomic practices, Marketing and value addition for proper impact.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Awareness on the highly nutritional importance of sorghum</li> <li>• It is cultivated mainly by women hence empowering them will work.</li> <li>• It is an already “a climate change ready crop” due to its moisture and temperature stress resilience.</li> <li>• The policy on blending is in the process and implementation needs to be in place.</li> <li>• Policy review on sorghum marketing from time to time.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	Estimated revenue per acre = KES 38,800 per acre Returns = KES 13,800 per acre
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership, financial empowerment, information and awareness, consumption diversity.</li> <li>• Labour intensity in almost all activities affects women. There is need for mechanization.</li> <li>• Youth are mainly sidelined in sorghum value chain due to lack of enterprising innovations.</li> </ul>
Gender related opportunities	Women and youth friendly production techniques such as mechanization Apply enterprising value addition methods for the youth Friendly trading conditions to allow women and youth to participate in marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	Unfriendly production practices Un friendly dissemination methods and documents Financial Issues and low education
VMG related opportunities	Resource empowerment Access to market opportunities Value addition opportunities

<b>E: Case studies/profiles of success stories</b>	
Success stories	
Application guidelines for users	<p><b>Reference:</b></p> <p><b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>For more information:</b> Rongo University</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Needs validation because it's a new technology
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rongo university: -Rachael Kisilu, CK Kamau
Partner organizations	Rongo university

<b>2.1.10 TIMP Name</b>	<b>Sorghum variety BJ28</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Lack of animal feed Low promotion, adaptation and adoption in the target areas
What is it? (TIMP description)	An OPV variety released in 1978 by KARI Lanet for grain (food) and forage. The grain yield is 2.5-3 t/ha and is for dry high lands and High Potential areas (750-2300 m asl). The sorghum variety is well suited to 750-2300 m asl in dry high lands and high potential areas.
Justification	The variety is well adapted to cold dry zones where most sorghum varieties fail. Sorghum harvested at the soft dough stage of development and stored as silage contains 52 to 65% dry matter digestibility, 8 to 12% crude protein, 60 to 75% neutral detergent fiber,

	and 34 to 40% acid detergent fiber. The higher the grain content, the higher the digestibility. Ensiled grain has a digestibility of about 90%.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Livestock farmers, seed dealers, researchers.
Approaches used in dissemination	On farm and on station demonstrations Training workshops, Seminars, Meetings Field days Agricultural shows MoA/Extension officers Farmer to farmer Promotional materials (posters/brochures/leaflets, manuals)
Critical/essential factors for successful promotion	Adaptation to new areas for livestock forage Quality seed availability and Good seed system County government and extension support
Partners/stakeholders for scaling up and their roles	Farmers to take part in participatory dissemination Researches for variety, information and seed provision Extension and Livestock Partners for dissemination
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Nakuru
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	The fodder sorghum are not well adapted for the lower dry lands Seed scarcity because of low demand: multiplication does not benefit seed dealers But there is a high demand for forage sorghum therefore there is a gap between the seed producers and the growers
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Seed multiplication for fodder sorghums</li> <li>• promotion to connect the farmers to the seed sources</li> </ul>
Lessons learned in up scaling if any	Seed multiplication and creation of awareness through dissemination is important after release
Social, environmental, policy and market conditions necessary for development and up scaling	Most small scale farmers practice mixed farming and always need livestock feed. There is need to adapt the available varieties to various environments
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Low cost in starting a sorghum fodder crop
Estimated returns	High due to nutritive value to animals and also sell of fodder to other livestock farmers
Gender issues and concerns in development ,dissemination, adoption and scaling up	Lack of different gender involvement in development and dissemination plans Appropriate training materials and strategies

Gender related opportunities	The high demand of animal feed can be enterprising
VMG issues and concerns in development, dissemination, adoption and scaling up	Un friendly production practices, un friendly dissemination methods and documents Lack of resources In ability to access promotion and dissemination forums
VMG related opportunities	Market opportunities for forage
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Sorghum forage is more nutritious than most fodder grasses and maize
Application guidelines for users	Brochures and leaflets For more details contact KALRO Lanet
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Lanet and Kakamega
Lead organization and scientists	KALRO – Rachael Kisilu, C K Kamau
Partner organizations	Seed companies, ILRI

<b>2.1.11 TIMP Name</b>	<b>Sorghum variety Ikinyaluka</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Lack of enough varieties for forage
What is it? (TIMP description)	<b>Ikinyaluka:</b> For both production of forage 8t/ha in dry high lands and High Potential areas (750-2300 m asl) It was released in 1997 in KARI Kakamega
Justification	It is well adapted to cold dry zones where most sorghum varieties fail. It is well known to farmers for fodder production. Sorghum harvested at the soft dough stage of development and stored as silage contains 52 to 65% dry matter digestibility, 8 to 12% crude protein, 60 to 75% neutral detergent fiber, and 34 to 40% acid detergent fiber. The higher the grain content, the higher the digestibility. Ensiled grain has a digestibility of about 90%.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Livestock farmers, seed dealers, researchers.

Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Field days, Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Farmer to farmer</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Adaptation to new areas for livestock forage</li> <li>• Quality seed availability and Good seed system</li> <li>• County government and extension support.</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers to participate in promotion</li> <li>• Researches to provide variety and seed and management information</li> <li>• Extension and Livestock Partners for dissemination.</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Kisumu, Siaya, Busia,
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• The fodder sorghums are not well adapted for the lower dry lands</li> <li>• Seed scarcity because of low demand: multiplication does not benefit seed dealers</li> <li>• But there is a high demand for forage sorghum therefore there is a gap between the seed producers and the growers.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Introduce fodder sorghums for dry low lands and humid dry western areas</li> <li>• Seed multiplication for fodder sorghums</li> <li>• promotion to connect the farmers to the seed sources.</li> </ul>
Lessons learned in up scaling if any	Lack of awareness of seed source for fodder sorghums has hindered their cultivation by farmers
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• The Livestock farmers will need of resilient fodder crops which can withstand climate change stresses such as sorghum.</li> <li>• Fodder sorghum varieties for various environments where livestock keeping is practised.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Low cost in starting a sorghum fodder crop
Estimated returns	High due to nutritive value to animals and also sell of fodder to other livestock farmers
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Involve gender in dissemination plans</li> <li>• Appropriate training materials and strategies</li> </ul>
Gender related opportunities	The high demand of animal feed can be enterprising

VMG issues and concerns in development, dissemination, adoption and scaling up	Friendly production practices, friendly dissemination methods and documents should be availed
VMG related opportunities	Market opportunities for forage
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Sorghum forage is more nutritious than most fodder grasses and maize
Application guidelines for users	Brochures, leaflets <b>For more details contact: KALRO Kakamega</b>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Lanet and Kakamega
Lead organization and scientists	KALRO – Rachael Kisilu and C K Kamau
Partner organizations	ICRISAT, KALRO Lanet & KALRO Kakamega

<b>2.1.12 TIMP Name</b>	<b>Sorghum variety E 1291 variety</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Lack of sorghum forage varieties
What is it? (TIMP description)	Dual Purpose variety for grain (2.7 t/ha) and forage (2.7 t/ha) It is also good for sorghum beverage. It is well suited to 750-2300 m asl in dry high lands and high potential areas. It was released in 2000 by KARI Lanet
Justification	E1291 is well known to farmers for fodder production. The technologies are ready for promotion and seed is easily available with KALRO Centres. Sorghum harvested at the soft dough stage of development and stored as silage contains 52 to 65% dry matter digestibility, 8 to 12% crude protein, 60 to 75% neutral detergent fiber, and 34 to 40% acid detergent fiber. The higher the grain content, the higher the digestibility. Ensiled grain has a digestibility of about 90%.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	

Users of TIMP	Livestock farmers, seed dealers, researchers.
Approaches used in dissemination	On farm and on station demonstrations Training workshops, Seminars, Meetings Field days Agricultural shows MoA/Extension officers Farmer to farmer Promotional materials (posters/brochures/leaflets, manuals)
Critical/essential factors for successful promotion	Adaptation to new areas for livestock forage Quality seed availability and Good seed system County government and extension support
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers/farmer groups to take part in participatory dissemination</li> <li>• County governments, central governments e.g. Chiefs for awareness creation</li> <li>• Agricultural Extension for demonstration and promotion</li> <li>• Researches (NARS&amp; CGIAR) and seed companies for variety, information and seed provision</li> <li>• NGOs dealing with livestock farmers for mobilization and dissemination.</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Nakuru
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• The fodder sorghum have not well promoted hence no bench mark data.</li> <li>• Seed scarcity because of low demand: multiplication does not benefit seed dealers.</li> <li>• But there is a high demand for forage sorghum therefore there is a gap between the seed producers and the growers.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Introduce fodder sorghums for dry low lands and humid dry western areas</li> <li>• Seed multiplication for fodder sorghums</li> <li>• promotion to connect the farmers to the seed sources</li> </ul>
Lessons learned in up scaling if any	The demand for forage sorghum is high butt there is need to produce seed and connect farmers to forage seed source
Social, environmental, policy and market conditions necessary for development and up scaling	Sorghum is a highly nutritional crop even for livestock consumption. There is need to adapt the available varieties to various environments
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Low cost in starting a sorghum fodder crop

Estimated returns	High due to nutritive value to animals and also sell of fodder to other livestock farmers
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership in equality</li> <li>• Financial empowerment differences ,</li> <li>• Awareness gap</li> <li>• Inequality in resources and knowledge</li> </ul>
Gender related opportunities	The high demand of animal feed can be enterprising
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Un friendly production practices,</li> <li>• unfriendly dissemination methods and documents</li> <li>• Lack of resources</li> <li>• Inability to access production resources and required facilities</li> </ul>
VMG related opportunities	Market opportunities for forage
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Sorghum forage is more nutritious than most fodder grasses and maize
Application guidelines for users	<b>-Technical reports, brochures, leaf lets and fact sheets</b> <b>For more details contact KALRO Lanet</b>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Lanet and Kakamega
Lead organization and scientists	KALRO – Rachael Kisilu and CK Kamau
Partner organizations	ICRISAT, KALRO Lanet & KALRO Kakamega

<b>2.1.13 TIMP Name</b>	<b>Sorghum variety E6518</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Animal fodder
What is it? (TIMP description)	<ul style="list-style-type: none"> <li>• Dual Purpose for grain (3.4 t/ha) and high quality fodder (7.2 t/ha).</li> </ul>

	<ul style="list-style-type: none"> <li>Well suited to 750-2300 m asl in dry high lands and high potential areas.</li> <li>Released by KARI Lanet in 2000 for forage.</li> </ul>
Justification	The variety is well adapted to cold dry zones. Sorghum harvested at the soft dough stage of development and stored as silage contains 52 to 65% dry matter digestibility, 8 to 12% crude protein, 60 to 75% neutral detergent fiber, and 34 to 40% acid detergent fibre. The higher the grain content, the higher the digestibility. Ensiled grain has a digestibility of about 90%.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Livestock farmers, seed dealers, researchers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>On farm and on station demonstrations</li> <li>Training workshops, Seminars, Meetings</li> <li>Field days</li> <li>Agricultural shows</li> <li>MoA/Extension officers</li> <li>Farmer to farmer</li> <li>Promotional materials (posters/brochures/leaflets, manuals)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>Adaptation to new areas for livestock forage</li> <li>Quality seed availability and Good seed system</li> <li>County government and extension support.</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>Farmers/farmer groups to take part in participatory dissemination</li> <li>County governments, central governments e.g. Chiefs for awareness creation</li> <li>Agricultural Extension for demonstration and promotion</li> <li>Researches (NARS&amp; CGIAR) and seed companies for variety, information and seed provision</li> <li>NGOs dealing with livestock farmers for mobilization and dissemination</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Nakuru
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>Seed scarcity because of low demand: multiplication does not benefit seed dealers.</li> <li>The high demand for forage sorghum seed but a gap between the seed producers and the growers.</li> </ul>
suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>Seed multiplication for fodder sorghums</li> <li>promotion to connect the farmers to the seed sources</li> </ul>

Lessons learned in up scaling if any	Forage sorghum are in high demand but farmers are not aware of the improved varieties. Promotion opportunities for varieties after release should be availed to enable awareness
Social, environmental, policy and market conditions necessary for development and up scaling	Sorghum is a highly nutritional crop even for livestock consumption. There is need to promote and adapt the available varieties to the various target areas
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Low cost in starting a sorghum fodder crop
Estimated returns	High due to nutritive value to animals and also sell of fodder to other livestock farmers
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership, financial empowerment, awareness</li> <li>• Inappropriate training materials and strategies</li> <li>• In equality in resources and Knowledge.</li> </ul>
Gender related opportunities	The high demand of animal feed can be enterprising
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Un friendly production practices, dissemination methods and documents</li> <li>• In ability to access promotion forums</li> <li>• Lack of required resources and facilities to adopt</li> </ul>
VMG related opportunities	Market opportunities for forage
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Sorghum forage is more nutritious than most fodder grasses and maize
Application guidelines for users	Brochures and leaflets <b>For more details contact KALRO Lanet</b>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Lanet and Kakamega
Lead organization and scientists	KALRO – Rachael Kisilu, CK Kamau, Erric Cheruiyot
Partner organizations	KALRO Lanet

<b>2.1.14 TIMP Name</b>	<b>Sorghum variety Sweet Sorg 4</b>
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Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>Limited alternative sources of raw materials for industrial ethanol production.</li> <li>Unavailable local sorghum varieties for ethanol production by agro-chemical industries in Kenya.</li> </ul>
What is it? (TIMP description)	This a sorghum variety with a grain yield of 2.9 t/ha and matures within 3 months. Grows in altitudes of 250-1750 masl which includes Mwea, Homabay, Bungoma. It is used for ethanol production and grain for consumption. It was released by Kenya Seed Company in 2016.
Justification	<p>Sweet sorghum are the varieties of sorghum whose stalks have a high sugar content. Sweet sorghum thrives better under drier and warmer conditions and is grown primarily for forage, silage, and syrup production. These sweet sorghum are widely adapted to the various parts of Kenya. There is a gap in production of sweet sorghums which needs to be solved through promotion of the available varieties. Sweet sorghums are used for bagasse, ethanol biofuel from the grain and stem juice, sugar and livestock feed stock.</p> <p>There is need for evaluation, selection and release of suitable sweet sorghum genotypes as feedstock varieties for ethanol. Through contractual arrangement, the producers will be engaged in production which will lead to improved farmer-income and better rural livelihood</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media
Critical/essential factors for successful promotion	Creation of Industrial use opportunities
Partners/stakeholders for scaling up and their roles	Spectre International/ other agrochemical industries to process and create demand
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Information only
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>Low awareness of the varieties and their production practices</li> <li>Low awareness of uses of sweet sorghums</li> <li>Pilot testing by agrochemical industry needed</li> <li>No seed due to lack of funds to produce seed</li> </ul>

Suggestions for addressing the challenges	Information dissemination on the varieties production practices Re-visit initial discussion with Spectre International Funding for seed production
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Sorghum does better than maize in moisture deficit environment, has no negative environmental effect.</li> <li>• Industries should be compelled to use local materials in their manufacturing process.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	
Gender issues and concerns in development and dissemination	Sorghum production has no bias, it can be grown by any group interested in agri-business.
Gender issues and concerns in development, dissemination, adoption and scaling up	Inequality in resources, finances and knowledge.
Gender related opportunities	Creates employment at production, transportation, processing and distribution
VMG issues and concerns in development, dissemination, adoption and scaling up	Low participation in development and dissemination Low empowerment
VMG related opportunities	Opportunity for income generation if market opportunities are there
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual, Kenya seed company</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Validation
<b>G: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO Rachael Kisilu, Erick Cheruiyot, C K Kamau

Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu
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<b>2.1.15 TIMP Name</b>	<b>Sorghum variety Sweet Sorg 14</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Limited alternative sources of raw materials for industrial ethanol production  Unavailable local sorghum varieties for ethanol production by agro-chemical industries in Kenya
What is it? (TIMP description)	This a sorghum variety with a grain yield of 2.9 t/ha and matures within 3 months. Grows in altitudes of 250-1750 masl which includes Mwea, Homabay, Bungoma. It is used for ethanol production and grain for consumption. It was released by Kenya Seed Company in 2016.
Justification	Sweet sorghum are the varieties of sorghum whose stalks have a high sugar content. Sweet sorghum thrives better under drier and warmer conditions and is grown primarily for forage, silage, and syrup production. These sweet sorghum are widely adapted to the various parts of Kenya. There is a gap in production of sweet sorghums which needs to be solved through promotion of the available varieties. Sweet sorghums are used for bagasse, ethanol biofuel from the grain and stem juice, sugar and livestock feed stock.  There is need for evaluation, selection and release of suitable sweet sorghum genotypes as feedstock varieties for ethanol. Through contractual arrangement, the producers will be engaged in production which will lead to improved farmer-income and better rural livelihood
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media Through Agrochemical Industries and media
Critical/essential factors for successful promotion	Industrial use
Partners/stakeholders for scaling up and their roles	Spectre International/ other agrochemical industries to create demand
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Information only

Counties where TIMP will be up scaled	Baring, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Low awareness of the varieties and their production practices</li> <li>• Low awareness of uses of sweet sorghums</li> <li>• Pilot testing by agrochemical industry needed</li> <li>• No seed due to lack of funds to produce seed.</li> </ul>
Suggestions for addressing the challenges	Information dissemination on the varieties production practices Re-visit initial discussion with Spectre International Funding for seed production
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Sorghum does better than maize in moisture deficit environment, has no negative environmental effect.</li> <li>• Industries should be compelled to use local materials in their manufacturing process.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	<ul style="list-style-type: none"> <li>• Further validation to get this is needed</li> </ul>
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of participation of different gender groups in the process</li> <li>• Low and un equal financial, resources and knowledge ability among gender</li> </ul>
Gender related opportunities	Creates employment at production, transportation, processing and distribution with availability of markets
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• In ability to participate in development and dissemination processes.</li> <li>• Lack of financial, resources and knowledge empowerment.</li> </ul>
VMG related opportunities	Opportunity for income generation with availability of markets
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual, Kenya seed company</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires Validation and Market opportunities
<b>G: Contacts</b>	

Contacts	
Lead organization and scientists	KALRO; Rachael Kisilu, Erick Cheruiyot, CK Kamau
Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu

<b>2.1.16 TIMP Name</b>	<b>Sorghum variety Sweet Sorg 17</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>Limited alternative sources of raw materials for industrial ethanol production</li> <li>Unavailable local sorghum varieties for ethanol production by agro-chemical industries in Kenya.</li> </ul>
What is it? (TIMP description)	This a sorghum variety with a grain yield of 2.9 t/ha and matures within 3 months. Grows in altitudes of 250-1750 masl which includes Mwea, Homabay, Bungoma. it is used for ethanol production and grain for consumption. It was released by Kenya Seed Company in 2016.
Justification	<p>Sweet sorghum are the varieties of sorghum whose stalks have a high sugar content. Sweet sorghum thrives better under drier and warmer conditions and is grown primarily for forage, silage, and syrup production. These sweet sorghum are widely adapted to the various parts of Kenya. There is a gap in production of sweet sorghums which needs to be solved through promotion of the available varieties. Sweet sorghums are used for bagasse, ethanol biofuel from the grain and stem juice, sugar and livestock feed stock.</p> <p>There is need for evaluation, selection and release of suitable sweet sorghum genotypes as feedstock varieties for ethanol. Through contractual arrangement, the producers will be engaged in production which will lead to improved farmer-income and better rural livelihood</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media, Through Agrochemical Industries and media
Critical/essential factors for successful promotion	Industrial use
Partners/stakeholders for scaling up and their roles	Spectre International/ other agrochemical industries for demand creation
<b>C: Current situation and future scaling up</b>	

Counties where already promoted if any	Information only
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Low awareness of the varieties and their production practices</li> <li>• Low awareness of uses of sweet sorghums</li> <li>• Pilot testing by agrochemical industry needed</li> <li>• No seed due to lack of funds to produce seed.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on the varieties production practices</li> <li>• Re-visit initial discussion with Spectre International</li> <li>• Funding for seed production.</li> </ul>
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Sorghum does better than maize in moisture deficit environment, has no negative environmental effect</li> <li>• Industries should be compelled to use local materials in their manufacturing process</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	Validation to get cost of production and returns is needed
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of participation of different gender groups in the process</li> <li>• Low and un equal financial, resources and knowledge ability among gender</li> </ul>
Gender related opportunities	Creates employment at production, transportation, processing and distribution with availability of markets
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• In ability to participate in development and dissemination processes</li> <li>• Lack of financial, resources and knowledge empowerment.</li> </ul>
VMG related opportunities	In come generation with availability of market opportunities
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual</li> <li>• Kenya seed company</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires	Requires Validation

validation; 3-requires further research)	
<b>G: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO; Rachael Kisilu, Erick Cheruiyot, CK Kamau
Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu

<b>2.1.17 TIMP Name</b>	<b>Sorghum variety Sweet Sorg 21</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>Limited alternative sources of raw materials for industrial ethanol production.</li> <li>Unavailable local sorghum varieties for ethanol production by agro-chemical industries in Kenya.</li> </ul>
What is it? (TIMP description)	This a sorghum variety with a grain yield of 2.9 t/ha and matures within 3 months. Grows in altitudes of 250-1750 masl which includes Mwea, Homabay, Bungoma. it is used for ethanol production and grain for consumption. It was released by Kenya Seed Company in 2016.
Justification	Sweet sorghum are the varieties of sorghum whose stalks have a high sugar content. Sweet sorghum thrives better under drier and warmer conditions and is grown primarily for forage, silage, and syrup production. These sweet sorghum are widely adapted to the various parts of Kenya. There is a gap in production of sweet sorghums which needs to be solved through promotion of the available varieties. Sweet sorghums are used for bagasse, ethanol biofuel from the grain and stem juice, sugar and livestock feed stock. There is need for evaluation, selection and release of suitable sweet sorghum genotypes as feedstock varieties for ethanol. Through contractual arrangement, the producers will be engaged in production which will lead to improved farmer-income and better rural livelihood
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media, Through Agrochemical Industries and media
Critical/essential factors for successful promotion	Industrial use
Partners/stakeholders for scaling up	Spectre International/ other agrochemical industries
<b>C: Current situation and future scaling up</b>	

Counties where already promoted if any	Information only
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Low awareness of the varieties and their production practices</li> <li>• Low awareness of uses of sweet sorghums</li> <li>• Pilot testing by agrochemical industry needed</li> <li>• No seed due to lack of funds to produce seed</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on the varieties production practices</li> <li>• Re-visit initial discussion with Spectre International</li> <li>• Funding for seed production.</li> </ul>
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Sorghum does better than maize in moisture deficit environment, has no negative environmental effect.</li> <li>• Industries should be compelled to use local materials in their manufacturing process.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	Validation to get this is needed
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of participation of different gender groups in the process.</li> <li>• Low and un equal financial, resources and knowledge ability among gender.</li> </ul>
Gender related opportunities	Creates employment at production, transportation, processing and distribution with availability of markets
VMG issues and concerns in development, dissemination, adoption and scaling up	In ability to participate in development and dissemination processes Lack of financial, resources and knowledge empowerment
VMG related opportunities	In come generation with availability of market opportunities
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires Validation

<b>G: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO; Rachael Kisilu, Erick Cheruiyot, C K Kamau
Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu

<b>2.1.18 TIMP Name</b>	<b>Sorghum variety Kak Sweet Sorg 1</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>Limited alternative sources of raw materials for industrial ethanol production.</li> <li>Unavailable local sorghum varieties for ethanol production by agro-chemical industries in Kenya.</li> </ul>
What is it? (TIMP description)	<b>Kak sweet Sorg 1:</b> White sweet sorghum with a grain yield of 2 t/ha, 16% Brix and 12% total Sugars. It matures within 4-5 months and suitable in regions with 500 – 1800 m asl. Released in 2016 by KALRO NRI for western Kenya: Kakamega, Vihiga, Bungoma and Busia, Nyanza: Siaya, Migori, Homabay and Kisumu, Nakuru, Kericho, Naivasha, Kajiado, Narok, Bomet, Baringo, Elgeyo Marakwet, West Pokot, and Turkana, Nyeri and Nyandarua.
Justification	<p>Sweet sorghum are the varieties of sorghum whose stalks have a high sugar content. Sweet sorghum thrives better under drier and warmer conditions and is grown primarily for forage, silage, and syrup production. These sweet sorghum are widely adapted to the various parts of Kenya. There is a gap in production of sweet sorghums which needs to be solved through promotion of the available varieties. Sweet sorghums are used for bagasse, ethanol biofuel from the grain and stem juice, sugar and livestock feed stock.</p> <p>There is need for evaluation, selection and release of suitable sweet sorghum genotypes as feedstock varieties for ethanol. Through contractual arrangement, the producers will be engaged in production which will lead to improved farmer-income and better rural livelihood</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media, Through Agrochemical Industries and media
Critical/essential factors for successful promotion	Industrial use

Partners/stakeholders for scaling up and their roles	Spectre International/ other agrochemical industries for demand creation
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Information only
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Low awareness of the varieties and their production practices</li> <li>• Low awareness of uses of sweet sorghums</li> <li>• Pilot testing by agrochemical industry needed</li> <li>• No seed due to lack of funds to produce seed.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on the varieties production practices</li> <li>• Re-visit initial discussion with Spectre International</li> <li>• Funding for seed production</li> </ul>
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	<p>Sorghum does better than maize in moisture deficit environment, has no negative environmental effect</p> <p>Industries should be compelled to use local materials in their manufacturing process</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	Validation to get cost of production and returns is needed
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of participation of different gender groups in the process</li> <li>• Low and unequal financial, resources and knowledge ability among gender.</li> </ul>
Gender related opportunities	Creates employment at production, transportation, processing and distribution with availability of markets
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• In ability to participate in development and dissemination processes.</li> <li>• Lack of financial, resources and knowledge empowerment.</li> </ul>
VMG related opportunities	In come generation with availability of market opportunities
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual</li> <li>• Kenya seed company</li> </ul>

<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires Validation
<b>G: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO; Rachael Kisilu, Erick Cheruiyot, CK Kamau
Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu

<b>2.1.19 TIMP Name</b>	<b>Sweet sorghum varieties EUSS 10</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<p>1) Limited alternative sources of raw materials for industrial ethanol production</p> <p>2) Unavailable local sorghum varieties for ethanol production by agro-chemical industries in Kenya</p>
What is it? (TIMP description)	<p>EUSS 10: Suitable sweet sorghum genotype as feedstock varieties for ethanol. Stalk rich in fermentable sugars, good for ethanol production and animal feed</p> <ul style="list-style-type: none"> <li>- Grain yield 1.3 t/ha</li> <li>- Stalk yield 40t/ha</li> <li>- Ethanol yield; 644 L/ha</li> </ul>
Justification	<p>Molasses which is a by-product in sugar factories is no longer available to agrochemical industries because most factories have diversified into ethanol production. An alternative source for ethanol production is sweet sorghum but none had been recommended for use in Kenya. The two released varieties with considerable good yield of ethanol will go a long way in meeting the demand of agro-chemical industries. Through contractual arrangement, the producers will be</p>

	engaged in production which will lead to improved farmer-income and better rural livelihood.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media, Through Agrochemical Industries and media
Critical/essential factors for successful promotion	Industrial use
Partners/stakeholders for scaling up and their roles	Spectre International/ other agrochemical industries for demand creation
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Information only
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Low awareness of the varieties and their production practices</li> <li>• Low awareness of uses of sweet sorghums.</li> <li>• Pilot testing by agrochemical industry needed</li> <li>• No seed due to lack of funds to produce seed.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Information dissemination on the varieties production practices</li> <li>• Re-visit initial discussion with Spectre International</li> <li>• Funding for seed production.</li> </ul>
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Sorghum does better than maize in moisture deficit environment, has no negative environmental effect.</li> <li>• Industries should be compelled to use local materials in their manufacturing process.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	<ul style="list-style-type: none"> <li>i) Stalk yield 40 t/ha</li> <li>ii) Ethanol yield; 644 L/ha</li> </ul>
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of participation of different gender groups in the process</li> <li>• Low and un equal financial, resources and knowledge ability among gender</li> </ul>
Gender related opportunities	Creates employment at production, transportation, processing and distribution with availability of markets

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• In ability to participate in development and dissemination processes</li> <li>• Lack of financial, resources and knowledge empowerment.</li> </ul>
VMG related opportunities	In come generation with availability of market opportunities
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual</li> <li>• Kenya seed company</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires Validation
<b>G: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO; Rachael Kisilu, Erick Cheruiyot, CK Kamau
Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu

<b>2.1.20 TIMP Name</b>	<b>Sweet sorghum variety EUSS 11</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<p>1) Limited alternative sources of raw materials for industrial ethanol production.</p> <p>2) Unavailable local sorghum varieties for ethanol production by agrochemical industries in Kenya.</p>
What is it? (TIMP description)	<p><b>EUSS 11:</b> Suitable sweet sorghum genotype as feedstock variety for ethanol. Stalk rich in fermentable sugars, good for ethanol production and animal feed</p> <ul style="list-style-type: none"> <li>i) Grain yield 2.4 t/ha</li> <li>ii) Stalk yield 44 t/ha</li> <li>iii) Ethanol yield; 838 L/ha</li> </ul>
Justification	Molasses which is a by-product in sugar factories is no longer available to agrochemical industries because most factories have

	diversified into ethanol production. An alternative source for ethanol production is sweet sorghum but none had been recommended for use in Kenya. The two released varieties with considerable good yield of ethanol will go a long way in meeting the demand of agro-chemical industries. Through contractual arrangement, the producers will be engaged in production which will lead to improved farmer-income and better rural livelihood.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Agrochemical Industries and sorghum farmers
Approaches used in dissemination	Demonstrations, exhibitions, media, Through Agrochemical Industries and media
Critical/essential factors for successful promotion	Industrial use
Partners/stakeholders for scaling up and their roles	Spectre International/ other agrochemical industries for demand creation
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Information only
Counties where TIMP will be up scaled	Baringo, Busia, Kericho, Kisumu, Laikipia, Mandera, Siaya,
Challenges in dissemination	Low awareness of the varieties and their production practices Low awareness of uses of sweet sorghums Pilot testing by agrochemical industry needed No seed due to lack of funds to produce seed
Suggestions for addressing the challenges	Information dissemination on the varieties production practices Re-visit initial discussion with Spectre International Funding for seed production
Lessons learned in up scaling if any	Partnership with stakeholders in solving a challenge quickly yield results
Social, environmental, policy and market conditions necessary for development and up scaling	Sorghum does better than maize in moisture deficit environment, has no negative environmental effect  Industries should be compelled to use local materials in their manufacturing process
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	350/- per kg of seed
Estimated returns	i) Stalk yield 44 t/ha ii) Ethanol yield; 838 L/ha
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of participation of different gender groups in the process</li> <li>• Low and un equal financial, resources and knowledge ability among gender.</li> </ul>

Gender related opportunities	Creates employment at production, transportation, processing and distribution with availability of markets
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• In ability to participate in development and dissemination processes.</li> <li>• Lack of financial, resources and knowledge empowerment.</li> </ul>
VMG related opportunities	In come generation with availability of market opportunities
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	In Brazil, China, USA
Application guidelines for users	<ul style="list-style-type: none"> <li>• Sorghum growers manual</li> <li>• Kenya seed company</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires Validation
<b>G: Contacts</b>	
Contacts	
Lead organization and scientists	KALRO; Rachael Kisilu, Erick Cheruiyot, CK Kamau
Partner organizations	Kenya Seed Company, Egerton University, Spectre International, Kisumu

### **Research Gaps in sorghum varieties**

1. The seed system is very weak. A newly released will not be taken up easily by the formal and informal seed system for seed multiplication. There is need to establish an alternate seed production and supply system.
2. There is disconnect between research and the end users on the type of varieties needed in the target areas. The solution will be working with stakeholders in technology development.
3. There is no resistance for pests especially Fall army warm, shoot fly and Striga.
4. Information of fodder sorghum on nutrition, digestibility and HCN contents.
5. Breeding for cold tolerance and humid adaptability is important due to the demand for sorghum in cold high lands and humid areas even within semi-arid areas.
6. There is need to breed for varieties for desired uses and specific markets (Malting and brewing, baking, food and feed formulation, agrochemicals, fodder, intercropping).

## **2.2 Agronomic management practices**

<b>2.2.1 TIMP Name</b>	<b>Variety selection, Seed acquisition or Own Seed Selection, Planting, Weeding, Thinning, Fertilizer Application, Pest and Disease Management, Harvesting, Storage and.</b>
Category (i.e. technology, innovation or management practice)	Management Practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<ul style="list-style-type: none"> <li>• Low sorghum production</li> <li>• Poor management and agronomic practices at farm level</li> <li>• Disease and pest damage (including birds)</li> <li>• Low grain quality due to poor harvesting practices</li> </ul>
What is it? (TIMP description)	<p>-This includes :-</p> <p><b>Variety selection:</b> Planting the recommended improved sorghum variety suitable for target area and end use</p> <p><b>Seed acquisition:</b></p> <ul style="list-style-type: none"> <li>• Certified seed or training on proper own selection</li> </ul> <p><b>Planting:</b></p> <ul style="list-style-type: none"> <li>• Fine land preparation and Early planting,</li> <li>• Spacing: mono-cropping 90×15 cm ox plough and 75×20 cm manual</li> <li>• Depth 5 cm.</li> <li>• Seed rate 3-4KG/acre mon-ocrop</li> </ul> <p><b>Weeding:</b></p> <ul style="list-style-type: none"> <li>• two weeks after germination</li> </ul> <p><b>Thinning:</b></p> <ul style="list-style-type: none"> <li>• after 3 weeks to single plant per hole</li> </ul> <p><b>Pest &amp; disease management:</b></p> <ul style="list-style-type: none"> <li>• Spraying recommended pesticides for shoofly, stem borer and Fall Army Worm (FAW).</li> <li>• Spraying recommended agrochemicals against fungal and bacterial diseases.</li> <li>• Birds scaring, harvesting at dough stage, using bird escaping varieties, collective planting to increase acreage</li> </ul> <p><b>Fertility and water management:</b></p> <ul style="list-style-type: none"> <li>• Basic fertilizer 50kg/acre, top-dress 50Kg/acre</li> <li>• Tied ridges to control runoff</li> </ul> <p><b>Harvesting:</b></p> <ul style="list-style-type: none"> <li>• Dry and thresh on tarpaulin to maintain quality.</li> <li>• Dry to 13% moisture.</li> </ul> <p><b>Post-harvest:</b></p> <ul style="list-style-type: none"> <li>• Put into hermetic bags and store in dry ventilated stores.</li> <li>• For selling to breweries dusting is not recommended</li> </ul>
Justification	Training farmers on how to manage a orghum crop increases yields at farm level
<b>B: Assessment of dissemination and scaling up/out approaches</b>	

Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers</li> </ul>
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Field days</li> <li>• Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Partners (ICRISAT, NGOs)</li> <li>• Mass media – Agricultural programs</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Quality seed for planting</li> <li>• Availability of affordable labor</li> <li>• Mechanization</li> <li>• County and central government support</li> <li>• Funding</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Agricultural Extension : Farmer sensitization, On farm and on station demonstrations</li> <li>• Farmer leaders : Group organization</li> <li>• NGOs dealing with sorghum : Dissemination of the practices</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru, Homabay, Siaya, Kisumu, Busia.
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	Bird scaring is expensive and time consuming Labour intensity in thinning, harvesting and threshing. Few consumption options for sorghum
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Encourage collective/cluster planting to ease birds impact, and create market pull</li> <li>• Mechanize planting, weeding, harvesting and threshing</li> <li>• Devise effective ways of bird scaring</li> <li>• Bird escaping varieties?</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Farmers need persistent hands on training in proper agronomic practices, for them to accept and practice</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Sorghum cultivated mainly by women hence empowering them with information and mechanization will ease the labor intensity</li> <li>• Community seed production should be encouraged with proper training to ensure quality</li> <li>• Frequent Policy review to maintain marketability</li> <li>• The policy on blending should be implemented</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 15,000 per acre
Estimated returns	Estimated revenue per acre = KES38,800-15,000= 23,800

Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Traditional practices are valued by farmers but do not increase yield</li> <li>• Rejection of fertilizer due to belief that it destroys soil</li> <li>• Rejection of thinning because it is seen as destruction of the crop</li> <li>• Classification of sorghum as poor man’s crops yet does not need much input</li> <li>• Labour intensity in almost all activities affects women. There is need for mechanization.</li> <li>• Youth are mainly sidelined in sorghum value chain</li> <li>•</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Women and youth friendly production techniques such as mechanization</li> <li>• Apply enterprising value addition methods for the youth</li> <li>• Friendly trading conditions to allow women and youth to participate in marketing</li> <li>• Value addition to create SMEs for farmers</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Labour intensity</li> <li>• Un friendly dissemination methods and documents</li> <li>• Illiteracy, poverty, market access problems</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Value addition, enabling market access</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Increase of yields from 5 bags per acre to 10 bags per acre when a farmer followed proper management at Makueni, Kitui, Tharaka Nithi and Meru Counties
Application guidelines for users	<p><b>Reference:</b>  <b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p> <p><b>Sorghum brochure:</b> Sorghum technologies for the drylands. Rachael Kisilu. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2- requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO, Rachael Kisilu, C K Kamau, Erick Cheruiyot
Partner organizations	ICRISAT, Egerton University

## Gaps in agronomic Practices

1. Lack of mechanized process in sorghum production (sowing, weed management, harvesting). Currently we don't have seed drills, weeders and harvesters).
2. Lack of suitable herbicides for weed management in sorghum.
3. Screen varieties tolerant to different soil contentions such as salinity, aluminum toxicity, acidity.

<b>2.2.2 TIMP Name</b>	Use of fertilizers for enhanced yield in sorghum
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low soil fertility resulting in low sorghum productivity
What is it? (TIMP description)	Application of external nutrients into the soil can enhance sorghum productivity
Justification	<p>Soils in sorghum growing areas have been degraded leading to low crop yields if no additional external nutrients are supplemented. Many farmers in the region apply less than 10 Kg of N per hectare on sorghum crop against a recommendation of about 50 Kg. The situation in sorghum is even worse because farmers believe the crop does not require fertilizer. This has led to continuous reduction of sorghum grain yield to an average of 0.5 t/ha instead of about 4 t/ha.</p> <p><b>Basic fertilizer:</b> 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.</p> <p>Apply the fertilizer in the planting rows or holes then mix with soil to protect the seed from scotching. Plant and cover the seed.</p> <p><b>Top-dressing:</b> CAN fertilizer is used for top dressing when the crop is knee high. Weeding and thinning should be done before top dressing. Apply at the rate of 50Kg/ha. The fertilizer is applied around the crop avoiding direct contact to protect the crop from scotching.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum farmers, researchers, environmentalists, county governments, input stockists.
Approaches used in dissemination	On-farm trials, demo plots, ASK shows, print media, brochures, conferences and journals
Critical/essential factors for successful promotion	Availability of inputs (recommended variety seed) Farmer groups
Partners/stakeholders for scaling up and their roles	<p><b>Scientists:</b> Fertilizer application recommendations</p> <p><b>Extension agents (both private and public):</b> Farmer mobilization, participatory training</p> <p><b>County governments:</b> Fertilizer awareness, policy and credit</p>

<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru, Homabay, Siaya, Kisumu.
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Resource poor farmers may not have the ability to invest on improved seed and fertilizer because of high cost</li> <li>• The myth that fertilizers make the soil hard</li> <li>• Belief that sorghum does not need fertility</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Provision of credit to purchase seed and fertilizer and subsidizing input prices by the county governments</li> <li>• Awareness about the merits of fertilizer use on sorghum yields</li> <li>• Encourage use of organic fertilizers</li> </ul>
Lessons learned in up scaling if any	Fertilizer use increases sorghum yield
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Need for structured markets to enhance financial returns to the farmer.</li> <li>• County NEMA officials to certify that the fertilizers have no adverse effect to the environment.</li> <li>• Farmers to be trained on safe handling of the fertilizers.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	About kshs 20,000 per acre
Estimated returns	About Kshs 50,000 per acre
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Labour intensity in application.</li> <li>• Financial inability, low awareness, lack of education by women farmers.</li> <li>• Land ownership hinders right to use fertilizer.</li> </ul>
Gender related opportunities	Sorghum is mainly cultivated by women hence increased yield will benefit them
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Less skills and knowledge.</li> <li>• Low income hence low purchasing power.</li> </ul>
VMG related opportunities	Access and use of fertilizer will increase yield hence household income
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Fertilizer use doubles sorghum yields inn semiarid areas
Application guideline for users	<p><b>Reference:</b></p> <p><b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p>

<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO Katumani
Lead organization and scientists	KALRO. Rachael Kisilu , C K Kamau, Erick Cheruiyot
Partner organizations	

### **Gaps in fertilizers use in sorghum**

1. Lack of specific nutrient requirement for sorghum to inform fertilizer application rates

<b>2.2.3 TIMP Name</b>	<b>Use of growth Enhancers to improve soil fertility for increased sorghum yields</b>
Category (i.e. technology, innovation or management practice)	Management Practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low production
What is it? (TIMP description)	<p>Growth hormone or bio stimulants enhance plant growth, and yield. These products contain auxins, Cytokinins, polyamines, abscisic acid, gibberellins and brassinosteroids. They trigger cell division, enlargement and elongation. The main source of growth hormones is a fast growing seaweed Kelp <i>Ecklonia maxima</i>. Zinc trace element required by crops in seed production.</p> <p><b>Recommended rate:</b> 2% zinc foliar +25 ppm growth enhancer or 2% zinc foliar+ 50 ppm growth enhancer as a foliar spray when sorghum plants are at 4-5 leaf stage.</p> <p><b>Method:</b></p> <ul style="list-style-type: none"> <li>• Apply 50 kg DAP fertilizer at planting</li> <li>• Mix growth enhancer to water in the ration of 1:2 (use 10 litres of the mixture in water for one acre)</li> <li>• Add 960 g of 2% zinc mineral.</li> <li>• Apply when the sorghum is at 4-5th leaf stage as top- dress.</li> <li>• Also apply CAN (50kg per acre).</li> </ul>
Justification	<p>Currently, grain yield in ASALs is 2-4 (90kg) bags per acre with a Break even above 5 (90kg) bags per acre.</p> <p>Use of growth enhancers supplemented with zinc mineral can improve grain yield by and return to investment.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, researchers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• MoA/Extension officers</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programmes.</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• KALRO Website</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Farmer organizations for participatory promotion</li> <li>• Availability of the required inputs</li> </ul>
Partners/stakeholders for scaling up and their roles	<p>KALRO: to provide the recommendation  Agricultural extension: dissemination  Other research Organizations (ICRISAT), NGOs: Mobilization</p>

<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Few parts of Makueni and Kitui
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Acquisition of the growth enhancers and zinc mineral fertilizer.</li> <li>• Reluctance to adopt a new technology</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Partner with fertilizer dealers and encourage packaging of the enhancers</li> <li>• Involve county governments and extension, for support</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• The combination of growth enhancers and zinc minerals increased Gadam sorghum yield at Makueni farms from 500 kg/ha to 3500 kg/ha</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Acceptance by the farmers</li> <li>• Growth enhancers and zinc are not harmful to environment</li> <li>• Use of fertilizer application recommendation</li> <li>• Good markets for sorghum</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Cost Approximately KES 25,000
Estimated returns	Returns Approximately KES 79,000 Profit= KES 54,000
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Farmer groups should involve women because they are the sorghum farmers in most communities</li> <li>• Appropriate techniques of training should favour all gender.</li> </ul>
Gender related opportunities	Increased yields to benefit women sorghum farmers
VMG issues and concerns in development, dissemination, adoption and scaling up	In ability to access the required inputs
VMG related opportunities	Increased yields food and income
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	-
Application guidelines for users	<b>Reference:</b> Kathuli, P., Kisilu R., Karanja D.R., Mweki, R. and A.O. Adongo. 2017. Growth Enhancers Increase Yield and Profitability of Gadam Sorghum in ASALs. ebsite: <a href="http://www.kalro.org/asal-aprp">www.kalro.org/asal-aprp</a>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires validation because it's a new recommendation
<b>G: Contacts</b>	

Contacts	KALRO-Katumani P.O. Box 340-90100 Machakos, Kenya,
Lead organization and scientists	KALRO-Katumani. Peter Kathuli, Rachael Kisilu
Partner organizations	Growth enhancers suppliers

<b>2.2.4 TIMP Name</b>	Conservation Agriculture (CA) for sorghum production
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	<ul style="list-style-type: none"> <li>• Low adoption of CA technology leading to low production of sorghum among smallholder farmers</li> <li>• Declining soil fertility leading to decreased sorghum productivity</li> <li>• Increased soil moisture stress</li> <li>• Increased soil erosion and biodiversity losses.</li> </ul>
What is it? (TIMP description)	<p>CA is a set of soil management practices that minimizes disruption of soil structure, composition and natural biodiversity.</p> <p>The Technology combines 3 practices; reduced soil disturbance, crop rotation and permanent/continuous soil cover</p> <p>To convert from conventional to CA, one needs to change the mindsets.</p> <p>The process:</p> <ol style="list-style-type: none"> <li><b>1. First season</b> <p><b>Choose the field :</b> Start with a field with good potential</p> <p><b>Start small:</b> Start with one field, Seek advice from extension service providers. Use animal/tractor - drawn sub-soiler or ripper to remove hardpan. Remove rocks or tree stumps.</p> <p><b>Cover the soil:</b> Use mulch. Plant cover crops such as lablab.</p> <p><b>Control weeds:</b> Hand-pulling or slashing or use herbicide.</p> <p><b>Do not plough:</b> Direct-plant the sorghum through the mulch, or dig planting basins on which crops are sown</p> <p><b>Grow crops:</b> Grow the sorghum and a legume intercrop</p> </li> <li><b>2. Second and following seasons</b> <p><b>Check the weeds:</b> Hand-pull, slash or use of herbicides.</p> <p><b>Crop Residues:</b> Ensure there is enough crop residues in the field</p> <p>Repeat planting as first season</p> </li> </ol>
Justification	<p>CA has potential to improve crop yields, while enhancing the long term environmental and financial sustainability of farming.</p> <p>It is still a relatively new technology in sub-Saharan Africa, hence its low adoption. Our farmers lack adequate skills and knowledge to practice it.</p> <p>In the developed world, especially Australia, USA, Argentina and Brazil crop yields and environmental sustainability have increased exponentially due to its wide adoption.</p> <p>The benefits of CA that favour adoption by the smallholder resource poor farmers include:</p>

	<ul style="list-style-type: none"> <li>• Reduction in costs and labour</li> <li>• Increased organic matter, soil water infiltration and soil quality</li> <li>• Reduced soil erosion</li> <li>• Reduced pest and diseases by breaking infection cycle through rotation enhanced carbon sequestration.</li> </ul>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum farmers, researchers, environmentalists, county governments
Approaches used in dissemination	On-farm trials, Demonstration plots, ASK shows, print media, brochures, conferences, journals, FFS, Mass media, social media
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of inputs (tools, herbicides), practical demonstrations</li> <li>• Favorable uptake of CA practices</li> <li>• Enhance PPP model to support and showcase conservation agriculture with agro-forestry</li> </ul>
Partners/stakeholders for scaling up and their role	<p>Scientists (local and international): Source of information</p> <p>Extension agents (both private and public): Dissemination</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Machakos, Nyandarua, Nyeri, West Pokot , Makueni, and western Kenya
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Unavailability of specialized tools for CA</li> <li>• competition for stover between livestock and retention on the field</li> <li>• low yields during the first few initial seasons may not go down well with farmers,</li> <li>• Change of mindset</li> <li>• land tenure (farmers reluctant to invest in CA where they do not have clear land rights.</li> </ul>
Suggestions for addressing the challenges	Contracting tool fabricators to make the tools en-mass; Talking and convincing farmers about the low yields at the beginning and the overall benefits of the technology; probably paying farmers for the losses during the initial seasons
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Negative Mind sets about CA can hinder uptake</li> <li>• Difficulty to apply in mixed farming set ups however once farmers see the benefits adoption is enhanced</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<p>Farmer feelings should be taken into consideration</p> <p>As a way of safeguarding the environment, a policy paper should be developed to ensure mass adoption of the technology in the region;</p> <p>Need for structured markets to enhance financial returns to the farmer</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<ul style="list-style-type: none"> <li>• First season basic costs are high because of purchase of specialized tools and knapsack sprayer</li> <li>• However there is Reduction of costs associated with tillage-induced soil erosion and degradation i.e. 40% of land degradation</li> </ul>

Estimated returns	<ul style="list-style-type: none"> <li>• Estimated financial returns during the first season and probably second season will be low, but environmental return will be big.</li> <li>• Returns on conserving soil exceeding 150 ton/hectare annually and associated increased productivity</li> </ul>
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land ownership, financial and resource poor women and youth, unwillingness to change by male farmers</li> <li>•</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• CA with trees is a technology that can be easily adopted by women and VMGs</li> <li>• CA with agroforestry provides opportunities for SMEs e.g. tree nurseries. The technology therefore renders itself to easy adoption by women, youth groups and VMGs</li> <li>•</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs and youth, are resource poor and may not own land and required equipment,</li> <li>•</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• SMEs such as tree nurseries for increased resilience</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Farmers and agro-pastoralists who adopt the technology have had sustainable source of income and increased resilience
Application guideline for users	Adopters of CA will need training: Brochures, manuals, website
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	KALRO
Lead organization and scientists	KALRO: Rachael Kisilu, C K Kamau, Erick Cheruiyot
Partner organizations	

<b>2.2.5 TIMP Name</b>	<b>Sorghum legume intercropping</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	

Problem to be addressed	Low farm yields: Crop diversification, declining soil fertility, nitrogen fixation, pest management ( <b>push pull cropping</b> ), water management
What is it? (TIMP description)	<p>Intercropping is a multiple cropping practices involving growing two or more crops in proximity. 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.</p> <p><b>Single row intercropping cropping;</b> involves the component sorghum and the legume arranged in alternate single rows. Spacing. The space between the two sorghum rows is 120cm and the legume is planted in between so that between legume and sorghum row is 60cm.</p> <p><b>Strip intercropping:</b> multiple rows, or a strip, of the legume is alternated with single or several rows of sorghum. Spacing. The inter row spacing between legume is 50-60cm and legume to sorghum is 60 cm. The space between two sorghum rows is 60-75cm.</p> <p><b>Control of pest through intercropping</b></p> <p><b>Push-pull cropping,</b> this is a mixture of trap cropping and repellent intercropping. An attractant crop attracts the pest and a repellent crop is also used to repel the pest away.</p> <p><b>Trap cropping,</b> this involves planting a crop nearby that is more attractive for pests compared to the production crop, the pests will target this crop and not the production crop.</p> <p><b>Repellent intercrops,</b> an intercrop that has a repellent effect to certain pests can be used. This system involved the repellent crop masking the smell of the production crop in order to keep pests away from it.</p>
Justification	<p>Fertilizers tend to be expensive, unavailable and unaffordable for the predominant smallholder farmers in such regions of sub-Saharan Africa. Legumes provide these farmers with an important alternative to diversify their farming systems and improve soil fertility via symbiotic N<sub>2</sub>-fixation. Legumes also represent an important source of protein and supplemental income</p> <p>Additionally, reducing the homogeneity of the crop can potentially increase the barriers against biological dispersal of pest organisms through the crop.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers,
Approaches used in dissemination	Onfarm demonstrations during farmer field schools. Training in workshops.
Critical/essential factors for successful promotion	Availability of legume varieties that are compatible with sorghum Package on appropriate planting practices on the intercrops. A package on appropriate fertilization rates and regimes.
Partners/stakeholders for scaling up and their roles	Farmers to participate in groups training Extension to disseminate

	Researches to provide the correct recommendations on intercropping
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru,
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	Lack of the targeted area specific sorghum legume appropriate intercropping recommendations
Suggestions for addressing the challenges	Research to develop the correct recommendations of intercropping for the different legumes used by farmers
Lessons learned in up scaling if any	This is a technology that done by farmers widely. It depends on: different farmer goals and objectives. However there is limited knowledge on control of pest and diseases in intercropping. There is need for proper documented recommendations
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Socially acceptable</li> <li>• Environmentally friendly</li> <li>• Increased productivity will provide supply to the markets</li> <li>• Supporting frameworks/policies to be made available.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	This is a low cost technology though technically demanding especially where the objective is to control pest through intercropping.
Estimated returns	Increased productivity has been reported.
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Land issues, financial issues, male and female preferences in the choice of crop to cultivate, traditional intercropping methods.</li> <li>• The practice is low cost but technically intense if intercropping is done to manage pests and diseases affecting adoption.</li> </ul>
Gender related opportunities	Intercropping places emphasis on the importance of using available land space to grow a diverse of food, increase biodiversity, pest management thus the practice is economically viable.
VMG issues and concerns in development, dissemination, adoption and scaling up	Lack of resources, I ability to reach training facilities and forums, low awareness.
VMG related opportunities	Intercropping places emphasis on the importance of using available land space to grow a diverse of food, increase biodiversity, pest management thus the practice is economically viable. The practice is available and cost effective to the advantage of VMG.
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Farmers have reported improved soil conditions, reduced runoff and nutrient loss, soil moisture retention in the soil and generally increased crop production following application of this widely used and readily available technology.

Application guidelines for users	<p><b>Reference:</b></p> <p><b>Sorghum production manual:</b> Enhancing sorghum production and Marketing in semi-arid Kenya. (<a href="http://www.kalro.org/asal-aprp">http://www.kalro.org/asal-aprp</a>)</p> <p><b>Sorghum Training Manual:</b> Enhanced Sorghum Production for Food Security and Increased Incomes (KCEP).</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires Further Research
<b>G: Contacts</b>	
Contacts	KALRO
Lead organization and scientists	KALRO-: Rachael Kisilu, CK Kamau, Eric Cheruiyot
Partner organizations	ICRISAT, Universities

### Gaps in sorghum legume intercropping

1. Limited research and documentation on sorghum legume intercrop

<b>2.2.6 TIMP Name</b>	<b>Legume intercrop for Striga management in sorghum</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Striga weed damage to sorghum crop leading to low yield
What is it? (TIMP description)	The control of <b>striga weed</b> by practicing trap cropping which involves planting a legume species in an infested field that will induce the <i>Striga</i> seeds to germinate but will not support attachment of the parasite. This method has been used in sorghum plantations by planting legume between the sorghum rows. Cotton, ground nuts, sunflower, linseed and cowpea are effective trap crops. Planting <i>Desmodium</i> inhibits striga seed germination and has worked effectively intercropped with cereals
Justification	<b>Striga weed commonly known as Witch weed</b> causes considerable crop losses in sorghum especially in western Kenya. It is a difficult weed to control due to its life cycle and parasitic habit to sorghum plants. Control by use of trap and catch method has been effective.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum farmers, researchers, environmentalists, county governments, input stockists

Approaches used in dissemination	On-farm trials, demo plots, print media, brochures, conferences and journals
Critical/essential factors for successful promotion	Availability of inputs for practical demonstrations
Partners/stakeholders for scaling up and their roles	Scientists to provide proper recommendations extension agents (both private and public) to disseminate
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Few areas in Busia
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	Limited knowledge on the technology by farmers
Suggestions for addressing the challenges	Validation and awareness creation
Lessons learned in up scaling if any	Ground nut intercrop reduced striga weed to zero in ICRISAT trials at Busia
Social, environmental, policy and market conditions necessary for development and up scaling	Acceptance by farmers as a control method is important Legume intercrop is environment friendly
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Low
Estimated returns	Estimated financial returns will be high; labour saved; environment conserved
Gender issues and concerns in development ,dissemination, adoption and scaling up	All issues will be incorporated; all gender will participate in development and dissemination of the technology New skills concerning the technology should be focused on women since traditionally, it is women who mostly plant sorghum
Gender related opportunities	Women farmers have better opportunities in the technology. Traditionally, sorghum cultivation is a woman's activity.
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs and youth, just as in women, should receive more skills and knowledge to enhance adoption and scaling up
VMG related opportunities	More household income, less labour required
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Documented for both sorghum and maize
Application guideline for users	<b>Catch and trap crop</b> Selection of the legume crop: Cotton, cow pea or desmodium for western Kenya Can intercrop with sorghum of practice rotation

	Brochures and manuals, technical reports
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires Further Research
<b>G: Contacts</b>	
Contacts	KALRO
Lead organization and scientists	KALRO Rachael Kisilu, CK Kamau, Eric Cheruiyot
Partner organizations	ICRISAT

### Gaps on Striga control using legume intercrop

1. Effect of *Desmodium Sp* on striga is well documented however, the contribution of other legumes also need to be done. They include (but not limited to) cowpea, soybean and dolichos.

### 2.3 Bird damage management

<b>2.3.1 TIMP Name</b>	<b>Sorghum Grain Harvest at Soft Dough Stage</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low farm yields due to bird damage on white sorghums
What is it? (TIMP description)	<p>This is the option of harvesting sorghum grain at soft dough stage when the grain is mature and drying away from the farms until the requires moisture is attained</p> <ul style="list-style-type: none"> <li>• Harvest grain sorghum when colour changes from green to cream white</li> <li>• Sun-dry the panicles to attain 11-12% moisture content.</li> <li>• Thresh the seed and store well.</li> </ul>
Justification	<p>Bird damage, is the major constraint, and it is the main reason why farmers shy away from sorghum cultivation. It can lead to 60% yield loss even when human scares are and 100% without scaring. When sorghum grain is harvested at early grain hardening dough stage as the grain turned cream white up to 100% sorghum can be salvaged from bird damage if harvested early and when the grain is physiologically mature followed by drying. At this stage seed viability is over 90%. Warm and dry environmental conditions has a significant influence on grain quality.</p>

<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Farmers, researchers.
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Field days</li> <li>• Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programmes.</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Well planned training workshops and demonstrations</li> <li>• Under stable farmer leaflets</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Extension to disseminate</li> <li>• Researches to provide the information.</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Few parts of Makueni, Kitui and Machakos.
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Willingness of farmers to harvest and take time in drying well</li> <li>• Contamination during drying</li> <li>• Seed viability- need for correct timing of harvest.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Proper Information dissemination on the sorghum early harvest technology to extension partners and farmers</li> <li>• Involve county governments and Extension in promotion.</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Early harvesting of sorghum can salvage 100% of grain from bird damage.</li> <li>• It reduces the time taken in guarding.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Labour for women and youth is reduced. They are the main bird scarers.</li> <li>• Save even for the birds rather than repellants and poisons.</li> <li>• Sorghum has ready markets and good market policy bur time to time policy review in needed.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	
Estimated returns	
Gender issues and concerns in development , dissemination, adoption and scaling up	Amy be added labour to women due to required skills in proper drying.
Gender related opportunities	Women and youth friendly because it relieves them to do other beneficial activities
VMG issues and concerns in development,	Low education may hinder acquiring of proper skills to practice the innovation

dissemination, adoption and scaling up	
VMG related opportunities	<ul style="list-style-type: none"> <li>• Marketing opportunities for sorghum</li> <li>• The technology is advantageous to all groups. Sorghum is grown by marginalized and vulnerable communities in the dry areas.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Sorghum yields were saved up to 90% in demonstration fields in Makueni, Kitui and Machakos.
Application guidelines for users	<p><b>Reference:</b> Sorghum manual, Sorghum brochure in the KALRO ASAL APRP website.</p> <p>Mutisya, D, L., Karanja, D. R., <b>Kisilu, R. K.</b> (2016). Economic advantage of sorghum harvest at soft dough to prevent bird damage. <i>Cogent Food &amp; Technology</i>, 2: 1259141.  <a href="http://dx.doi.org/10.1080/23311932.2016.1259141">http://dx.doi.org/10.1080/23311932.2016.1259141</a></p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	KALRO-Katumani
Lead organization and scientists	KALRO- Dr. Daniel Mutisya, Rachael Kisilu
Partner organizations	ICRISAT

## 2.4 Mechanization

<b>2.4.1 TIMP Name</b>	Mechanization of sorghum production activities (Sorghum Planter, weeding, Harvester)
Category (i.e. technology, innovation or management practice)	Innovations
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	<p>Slow and tedious processes of planting, weeding and harvesting in the commercialized sorghum commodity</p> <p>Reduced labour</p>
What is it? (TIMP description)	Sorghum mechanization equipment such as planter, weeding implements and harvesters reduce labour and time used in thinning, weeding and manual cutting of panicles

Justification	To make sorghum production activities less tedious and more effective. Attract the youth to agribusiness through operation of the machines
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum Farmers and researchers
Approaches used in dissemination	Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	Fabrication of affordable machines
Partners/stakeholders for scaling up and their roles	KALRO, universities for information Machinery fabricators NGO supporting farmers for dissemination
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Lack of the machines</li> <li>• High cost for small-scale farmer when fabricated.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Fabrication of affordable sorghum production machines</li> </ul>
Lessons learned in up scaling if any	Mechanization in agriculture increases production
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Creation of awareness on mechanization importance in the community.</li> <li>• Include all gender groups in research, and validation.</li> <li>• Good Policy on cost of agricultural mechanization</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Not yet
Estimated returns	Not yet
Gender issues and concerns in development ,dissemination, adoption and scaling up	Gender Unfriendly and expensive machines Sorghum machines should be designed for easy start and operation. Up-scaling should targets all the gender Affordability to all gender
Gender related opportunities	Creates employment especially for youth Reduces drudgery for women farmers as well as men

VMG issues and concerns in development, dissemination, adoption and scaling up	Facilitation to access information Affordability and easy to maintain machines
VMG related opportunities	Can create employment for VMG at local level
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Mechanization has enabled increased production in other crops such as maize, wheat and rice
Application guidelines for users	<ul style="list-style-type: none"> <li>• Demonstrations and training</li> <li>• User manuals</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires further research
<b>G: Contacts</b>	
Contacts	KALRO Katumani, Egerton University
Lead organization and scientists	KALRO, Egerton University, Erick Cheruiyot, Rachael Kisilu, CK Kamau
Partner organizations	Local Fabricators

## 2.5 Post harvest

<b>2.5.1 TIMP Name</b>	Sorghum Thresher
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Slow and tedious processes of Manual threshing and winnowing of sorghum Quality of grain
What is it? (TIMP description)	It is a machine that simultaneously threshes, polishes and winnows sorghum
Justification	To make sorghum threshing and winnowing faster, less tedious and more effective. Attract the youth to agribusiness through operation of the machines.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum Farmers and agribusiness entrepreneurs

Approaches used in dissemination	Field Demonstrations and training, Agricultural shows (ASK) and other exhibitions
Critical/essential factors for successful promotion	Use by Farmers
Partners/stakeholders for scaling up and their roles	Machinery fabricators NGO supporting farmers(AGGRA)
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Meru, Thraka Nthi, Kitui, Kisumu
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Relatively High cost for individual small-scale farmer.</li> <li>• Limited awareness of the existence of machine by the farming community.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Encourage group/cooperative ownership</li> <li>• Launch and awareness campaign through demonstrations and trainings</li> </ul>
Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation.</li> <li>• Good Policy on cost of agricultural mechanization</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Sorghum thresher 125,000 KES per unit
Estimated returns	Capacity of 4-5 bags of 90 Kg/ hour, 20 bags per day while moving from house to house. Fuel 1 litre /hr (4-5 bags) Needs 2 operators per time Threshing charges: KES 300 per bag Requires 1 season to return the KES 125,000 purchase price
Gender issues and concerns in development ,dissemination, adoption and scaling up dissemination	Sorghum Thresher designed for easy start and operation. Men have been drawn to sorghum threshing by the machine. This task was predominantly for women before the introduction of the machine.
Gender related opportunities	Creates employment at production, transportation, processing and distribution

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Training on local use and transportation will make it more usable.</li> <li>• Thresher is affordable and could help VMGs exploit</li> </ul>
VMG related opportunities	Can create employment for VMG at local level
<b>E: Case studies/profiles of success stories</b>	
Success stories	It has reduced labour for farmers in Tharaka nithi, Kitui, and Kisumu for sorghum contracted farmers
Application guidelines for users	<ul style="list-style-type: none"> <li>• Demonstrations and training</li> <li>• User manuals</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	Egerton University
Lead organization and scientists	Egerton University, Musa Njue and Erick Cheruiyot, Rachael Kisilu, CK Kamau
Partner organizations	Tecsols Ltd - Nakuru

<b>2.5.2 TIMP Name</b>	<b>Sorghum solar drier</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	To reduce postharvest grain loss due to molds and other fungal diseases
What is it? (TIMP description)	A simple metallic structure with a translucent sheet on top to allow solar radiation that will rapidly dry harvested sorghum panicles, while allowing free flow of air. The sorghum panicles dry in 4 to 5 days to acceptable grain moisture content.
Justification	<p>Sorghum reaches biological maturity at moisture content of about 30 %. It is recommended that sorghum be harvested at moisture content of about 20 %. This is optimal moisture content in terms of minimizing post-harvest losses and drying expenses. Safe storage moisture content for sorghum is 10% to 12 %.</p> <p>The greatest advantage of the crib is that it is a dryers as well as a storage facility. There is no need to keep moving the product in and out as is with outdoor drying, which is currently the practise by farmers.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	

Users of TIMP	<ul style="list-style-type: none"> <li>• Farmers, Traders, Processors, Millers, Seed dealers, Researchers.</li> </ul>
Approaches used in dissemination	<ul style="list-style-type: none"> <li>• On farm and on station demonstrations</li> <li>• Training workshops, Seminars, Meetings</li> <li>• Awareness creation by marketers and processors</li> <li>• Field days</li> <li>• Agricultural shows</li> <li>• MoA/Extension officers</li> <li>• Partners (ICRISAT, NGOs)</li> <li>• Farmer to farmer</li> <li>• Mass media – Agricultural programmes.</li> <li>• Promotional materials (posters/brochures/leaflets, manuals)</li> <li>• Web material's</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• High Production</li> <li>• Use by Farmers</li> <li>• County and central government support</li> <li>• Funding to promote</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers/farmer groups to participate</li> <li>• Agricultural Extension (Formal and informal) for dissemination</li> <li>• Researches (NARIS) for backstopping</li> <li>• International research organizations e.g. ICRISAT for backstopping</li> <li>• NGOs dealing with sorghum e.g. Africa Harvest, Farm Africa for mobilization</li> <li>•</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	-
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Relatively High cost for individual small-scale farmer.</li> <li>• Limited awareness of the existence of machine by the farming community.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Encourage group/cooperative ownership</li> <li>• Launch and awareness campaign through demonstrations and trainings</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Products from local/indigenous crops attract huge market, yet very little is being done to promote growth</li> <li>• Mechanization is key to increased production</li> </ul>

Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> <li>• Creation of awareness on mechanization importance in the community. Include all gender groups in research, and validation.</li> <li>• Good Policy on cost of agricultural mechanization</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 120, 000
Estimated returns	Validation to know returns needed
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> <li>• Reduced grain damage, increased quality hence better returns</li> <li>• It is gender friendly</li> </ul>
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Up-scaling should target all the gender but should be affordable</li> <li>•</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• An Opportunity for Youth to enterprise</li> <li>•</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• There is need for friendly dissemination methods and documents</li> <li>• Affordability</li> <li>• Easy to use</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Can be used to create employment</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Still Under promotion
Application guidelines for users	<b>Reference:</b> <ul style="list-style-type: none"> <li>• Demonstrations and training</li> <li>• User machine manual</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Requires Validation
<b>G. Contacts</b>	
Contacts	Egerton University
Lead organization and scientists	Egerton University, Musa Njue and Erick Cheruiyot, Rachael Kisilu
Partner organizations	Tecsols Ltd - Nakuru

## 2.6: Marketing

<b>2.6.1 TIMP Name</b>	<b>The Community Production and Marketing System (COPMAS) sorghum Model</b>
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Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Sorghum Marketing
What is it? (TIMP description)	COPMAS: Community Production and Marketing System
Justification	<p>Sorghum cultivation has not been fetching farmers any good financial return. Beer factories, especially Kenya Breweries now utilizes sorghum to produce beer. Under this arrangement they contract farmers to cultivate sorghum and they take at very reasonable cost immediately at maturity. This needs an organized production and marketing for the benefit of the small scale farmers</p> <p>COPMAS promotes the following conditions within a community:</p> <ul style="list-style-type: none"> <li>• Sustainable use of natural resources</li> <li>• Food and nutrition security</li> <li>• Women and youth empowerment</li> <li>• Employment opportunities</li> <li>• Access to information for all members of the community</li> <li>• Opportunities for economic advancement</li> <li>• Incentives for group</li> <li>• Good rewards</li> <li>• Assured Buyer</li> <li>• Knowledge by community members of their own rights and the ability to advocate for themselves.</li> </ul>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum farmers, researchers, county governments, input stockists, market agents, credit facilities and processors
Approaches used in dissemination	On-farm trials, farmer training workshops, conferences and journals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of quality seed</li> <li>• Proper training on production practices</li> <li>• Well organized farmer groups</li> <li>• Marketing trainers</li> </ul>
Partners/stakeholders for scaling up and their roles	<p>Scientists to backstop</p> <p>extension agents (both private and public): dissemination</p> <p>county governments: Policy</p> <p>beer companies, market agents to create demand</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya

Challenges in dissemination	<ul style="list-style-type: none"> <li>• Unavailability of the required sorghum seed</li> <li>• In cohesiveness of farmer groups</li> <li>• resource poor farmers</li> <li>• Mistrust between farmers and sorghum buyers</li> <li>• Low quality sorghum produce</li> </ul>
Suggestions for addressing the challenges	<p>Provision of credit or subsidy on seed</p> <p>Formation of strong farmer organization through involving county governments and extension partners</p> <p>Train farmers on production and marketing</p> <p>Creation of PPP for sorghum commercialization and sustainability</p>
Lessons learned in up scaling if any	Success in Gadam sorghum commercialization model in Eastern Kenya
Social, environmental, policy and market conditions necessary for development and up scaling	<p>Well organized farmer groups</p> <p>Availability of a very structured marketing system</p> <p>Good policy on sorghum pricing</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	KES 7 per Kg
Estimated returns	Estimated revenue = KES 32 per Kg =25
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Gender unfriendly marketing strategies to allow women and youth participation</li> <li>• Sorghum prices should favour all</li> <li>• Women and youth produce but men get the money</li> <li>• New skills concerning the marketing should be focused on women since traditionally, it is women who mostly plant sorghum.</li> </ul>
Gender related opportunities	Women farmers have better opportunities in the management of sorghum crop. Traditionally, sorghum cultivation is a woman's activity. Therefore they should be involved in Marketing
VMG issues and concerns in development, dissemination, adoption and scaling up	<p>VMGs and youth, just as in women, should receive more skills and knowledge to enhance adoption and marketing</p> <p>Accessible markets for all groups should be availed</p>
VMG related opportunities	More household income
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	COPMAS model has been effective in lower eastern Kenya for sorghum and cereal marketing
Application guideline for users	<p>This is the system of entrenching the use of structured marketing using aggregation centers. Community can mean different things in different contexts. Teams doing activities create a definition that is helpful where they work. Some common elements that define community are:</p> <ul style="list-style-type: none"> <li>• Individuals or groups who share a common geographic location.</li> <li>• Individuals or groups who have common language, culture or values</li> </ul>

	<ul style="list-style-type: none"> <li>• How the groups or individuals interact or have relationships with each other.</li> <li>• How members of the community use common resources and make decisions.</li> </ul> <p>COPMAS is a community of farmers who are in the same geographic location who come together mainly for production and marketing of agricultural produce i.e. white sorghum. Each COPMAS has five (5) Business units with 10 Farmer groups. Each farmer group is made of average 20 members and hence each COPMAS has at least 1000 farmers. Each farmer group provides a farmer leader who becomes a member of the COPMAS committee. This committee coordinates aggregation of produce, collection by market agents and payment of farmers through banks after getting an individual warehouse receipt. Each farmer is paid as an individual.</p> <p><b>Reference:</b> Smart Logistics Solution, The Grain Bulking Centre, Machakos Rd, off Mombasa Rd, P.O. Box 7590-00100, Nairobi, Kenya +254 20 2644533, +254 702 644 921</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	KALRO Katumani, Smart logistics Solution
Lead organization and scientists	KALRO. Rachael Kisilu
Partner organizations	Smart Logistics Solution

### Gaps in Marketing

1. The available varieties are not linked to specific market/uses. Hence the need to develop varieties for specific markets (malting and brewing, baking, food and feed).
2. Enabling policies to enable marketing and consumption of sorghum are lacking e.g. the blending policy should be fast tracked.

## 2.7 Value addition

<b>2.7.1 TIMP Name</b>	<b>Processing, utilization and value addition</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Sorghum consumption at household level is very low and market opportunities for products are minimal
What is it? (TIMP description)	Recipes for the utilization and values added products for home consumption and small scale businesses
Justification	Sorghum utilization and consumption options are few among many communities Sorghum traditional dishes are not palatable to youth and children Promotion of value added products will enhance adoption and production
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Sorghum farmers, researchers, youth
Approaches used in dissemination	Training workshops, recipe brochures and journals
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of inputs</li> <li>• Well organized farmer groups</li> <li>• Value addition trainers</li> </ul>
Partners/stakeholders for scaling up and their roles	Scientists and extension agents (both private and public) to train on value addition Farmers groups to be trained in value addition NGOs and market agents to create opportunities for trained groups
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Makueni, Kitui, Machakos, Tharaka-Nithi, Embu, Meru, Homabay, Siaya, Kisumu.
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Unavailability of the required inputs</li> <li>• In cohesiveness of farmer groups</li> <li>• resource poor farmers</li> </ul>
Suggestions for addressing the challenges	Formation of strong farmer organization through involving county governments and extension partners Train farmers on production and value addition Markets for value added products
Lessons learned in up scaling if any	Many farmer groups have been trained in sorghum value addition but they lack market opportunities hence there is no progress after training
Social, environmental, policy and market conditions necessary for	Acceptance of sorghum food products by all social classes To expand sorghum uses a policy on blending and baking with sorghum is needed

development and up scaling	
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Low
Estimated returns	High: Nutrition, income
Gender issues and concerns in development ,dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>Youth and children may not like sorghum foods but value addition may help</li> <li>Sorghum Value addition enterprises are few</li> <li>Sorghum requires a lot of processing to prepare food hence women may avoid in favour of maize or rice.</li> </ul>
Gender related opportunities	Women farmers have better opportunities in the value added products because they feed the community
VMG issues and concerns in development, dissemination, adoption and scaling up	Complicated time consuming value addition methods Financial issues
VMG related opportunities	More household nutrition security and income
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Some households are consuming sorghum products after training in value addition. More urban families are consuming sorghum due to health aware ness creation
Application guideline for users	<p>Different sorghum dishes such as:</p> <ul style="list-style-type: none"> <li>Sorghum Pilau</li> <li>Sorghum Githeri</li> <li>Sorghum Cakes</li> <li>Sorghum cookies</li> <li>Sorghum pops.</li> </ul> <p>The recipes can be sourced from KALRO utilization and values addition programmes More recipes can be sourced from “<b>Smart Food Initiative</b>” program by ICRISAT and partners</p>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling;, 2-requires validation; 3-requires further research)	Ready for upscaling
<b>G: Contacts</b>	
Contacts	KALRO Katumani,
Lead organization and scientists	KALRO. Rachael Kisilu, Erick Cheruiyot, CK Kamau
Partner organizations	ICRISAT (Smart Food Initiative) , Africa Harvest, Egerton University

### Research Gaps in value addition

1. Identification of varieties for specific value added products
2. We don't have a variety of value added products.

<b>2.7.2 TIMP Name</b>	<b>Sorghum Bread form selected Sorghum varieties</b>
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low production and up-take of sorghum
What is it? (TIMP description)	Evaluation and selection of sorghum genotypes suitable for baked food products
Justification	Identifying and utilizing the diverse uses of sorghum as drivers for increasing production and uptake of sorghum in Kenya  To take advantage of the health benefits associated with sorghum; mineral nutrients, antioxidant properties and dietary fibre.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Producers of grain sorghum and consumers of baked food products
Approaches used in dissemination	Use of supermarkets, demonstrations, media advertisements
Critical/essential factors for successful promotion	Pilot testing by supermarkets
Partners/stakeholders for scaling up and their roles	Egerton university for dissemination of the variety to be grown by farmers Millers and Bakeries to create demand Leading supermarket chains to sell the bread
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Nakuru (Kay Supermarket)
Counties where TIMP will be up scaled	Baringo, Busia, Isiolo, Kericho, Kisumu, Laikipia, Mandera, Siaya
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Producer-market link yet to be established</li> <li>• Inadequate seed (of selected genotype) for grain production</li> <li>• The bread variety is not being grown by farmers</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Funding for adaptation and promotion to farmers</li> <li>• Piloting in lead bakeries and supermarket chains</li> <li>• Funds for seed production</li> </ul>

Lessons learned in up scaling if any	Products from local/indigenous crops attract huge market, yet very little is being done to promote growth Carefully selected sorghum genotypes can give good baked food products
Social, environmental, policy and market conditions necessary for development and up scaling	The proposed policy of composting conventional with local/indigenous grain in milling flour by local millers should be implemented  This will spur increase of sorghum production and provide consumers with access to benefits of sorghum in foodstuff
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Sorghum bread (400 gms) cost 50/-, and (600 gms) is 70/-
Estimated returns	
Gender issues and concerns in development ,dissemination, adoption and scaling up	Sorghum production has no bias, it can be grown by any group interested in agri-business but the right varieties for baking are not available Besides bread, other baked products such as <i>chapatti</i> , <i>mandazi</i> , cakes can be baked and consumed in homes but up-scaling should be accessible to all the gender Affordable training needed for women and youth in baking Few opportunities to markets for women and youth
Gender related opportunities	Creates employment at production, transportation, processing and distribution.
VMG issues and concerns in development, dissemination, adoption and scaling up	Access of the right variety for baking Access to training facilities and forums Market access
VMG related opportunities	Can create employment for VMG at local level
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	The development of baking variety by Egerton university and sale of the bread in Nakuru
Application guidelines for users	<ul style="list-style-type: none"> <li>• Good baked food products can only be obtained by using selected sorghum genotypes – and which can be availed by Egerton University</li> </ul>

	<ul style="list-style-type: none"> <li>Composting of sorghum flour with wheat flour has different ratios for different products: bread 12-16 % of sorghum while cake can take 18-20 %</li> </ul>
<b>F: Status of TIMP readiness</b> (1-ready for upscaling; 2-requires validation; 3-requires further research)	Ready for upscaling
<b>G: Contacts</b>	
Contacts	Egerton University
Lead organization and scientists	Egerton University, Erick Cheruiyot, Lucy Mariera, James Owuoche
Partner organizations	KAYS supermarket - Nakuru

**Gaps in sorghum bread**

1. Limited grain supply to the bakeries for EUS 130 sorghum variety that is used to make flour for this bread. There is need to promote the variety to farmers for production.
2. It has not gone into the mainstream supermarkets therefore needs promotion