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

Compiled by

Kuria S. G., W. N, Mnene B P Ogillo, D Kubasu, J C Bii, B K Koir, J Kimutai, B K Kidake,
P M Njuguna, L M Wambulwa, & P N Katiku

Kenya Agricultural and Livestock Research Organization

Under

**KENYA CLIMATE SMART AGRICULTURE PROJECT
(KCSAP)**

June 2019

PASTURE & FODDER TECHNOLOGIES, INNOVATIONS, COMPLEMENTARY TECHNOLOGIES & INFORMATION

Definition of terms and summary tables of Pasture and Fodder Technologies, Innovations and Information (TIMPS)

1.0 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)

1.1 Summary of Inventory of TIMPs in the Pasture and Fodder Value Chain

The inventory process resulted in a total of 15 TIMPs including 2 technologies, 1 innovation and 12 management practices, distributed among 4 sub-themes, as indicated in Table 1.

Table 1. TIMPs in the Pasture and Fodder Value Chain

Commodity/VC	Sub-Theme	Technologies	Innovations	Management Practices
Pasture and Fodder	Natural Pasture Improvement	0	1	1
Pasture and Fodder	Pastoral and Agro-pastoral Seed Systems	2	0	2
Pasture and Fodder	Supplementary Feeding of Range Livestock	1	0	4
Pasture and Fodder	Pastoral and Agro-pastoral Information System	0	0	4
Overall Total	15	3	1	11

1.2 Summary of Status of TIMPs in Pasture and Fodder Value Chain

The inventory process resulted in a total of 10 TIMPs that are ready for up scaling, 1TIMP that require validation and 4 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
Pasture and Fodder	Natural Pasture Improvement	1	0	0
	Pastoral and Agro-pastoral Seed Systems	2	0	3
	Supplementary Feeding of Range Livestock	4	0	1
	Pastoral and Agro-pastoral Information System	3	1	0
Overall Total		10	1	4

Table 3: Inventory of Pasture and Fodder TIMPs by Category and Status

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.1 Natural Pasture Improvement	Natural pasture improvement through reseeded	Management practice	Ready for up scaling
2.2 Pastoral and agro-pastoral seed Systems	Kiboko Range pits for water harvesting for pasture production	Innovation	Ready for up scaling
	Community based range grass seed bulking and management practices	Management practice	Ready for up scaling
	Irrigated forage production in ASALs	Management practice	Require further research
	New Cenchrus ciliaris (CECI) ecotypes i.e. Kiboko (KBK1), Magadi (MGD3) and Kilifi (KLF1)	Technology	Require further research
	New Eragrostis superba (ERSU) ecotypes Kiboko 1(KBK1), Kiboko 2 (KBK2) & Kilifi 1 (KLF1)	Technology	Require further research

2.3 Supplementary Feeding of Range Livestock	<i>Acacia tortilis</i> supplement for weaner goats and sheep	Management practice	Ready for up scaling.
	<i>Prosopis juliflora</i> pods flour for improved livestock productivity	Management practice	Ready for up scaling.
	Cotton seedcake as supplementary feed for beef cattle	Management practice	Ready for up scaling
	Cost effective feed conservation structure	Management practice	Ready for up scaling
	AZOLLA blended feeds for improved beef production and productivity	Management practice	Require further research
2.4 Pastoral and Agro-pastoral Information System	Socio economics of reseeding rangelands in Kenya	Management practice	Ready for up scaling
	Matching livestock production with the market needs	Management practice	Ready for up scaling
	Utilization of traditional indicators for weather prediction in pastoral and agro-pastoral systems	Management practice	Require validation and proper documentation
	Estimating carbon sequestration in rangelands	Management practice	Ready for up scaling

Note: These TIMPs are relevant in: West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit and Tana River counties.

Ready to go TIMPs

TIMP Name	Kiboko Range pits for water harvesting for pasture production
Category	Innovation
A: Description of technology, innovation or Management practice	
Problem to be addressed	Inadequate rainfall (<250mm seasonally)/ moisture for pasture production
What is it? (TIMP description)	Range pits are crescent (half-moon) shaped pits placed in staggered rows to harvest runoff water in the arid and semi-arid lands (ASALs) receiving 250mm of rainfall and below. The pits trap runoff and allows more infiltration leading to great moisture retention that enable higher pasture establishment.
Justification	Runoff is retained on site in the rage pits thus allowing greater infiltration and higher soil moisture. The resulting improvements supports better pasture establishment in these regions.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small scale livestock keepers
Approaches to be used in dissemination	Field days, posters, brochures, demonstrations
Critical/essential factors for successful promotion	Communities with a history of land tillage adopt pitting compared to largely pastoral ones. Works better on land with sandy clay and loam soils and 5% slope
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> – MoALF&I, to assist in funding and capacity building. – County governments, to provide extension support, funding, capacity building and planting materials – NGOs and CBOs involved in livestock development and improvement to provide extension services, advocacy, planting materials and funding mobilize farmers to seek and apply TIMP.
C: Current situation and future scaling up	
Counties where already promoted if any	Kajiado, Taita Taveta, Makueni, Machakos
Counties where TIMP will be up scaled	Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River, West Pokot, Baringo, Laikipia, Lamu
Challenges in dissemination	– Laborious, must be made along contours

TIMP Name	Kiboko Range pits for water harvesting for pasture production
	<ul style="list-style-type: none"> – An implement for making the pits is needed for efficiency – Cannot work in slopes exceeding 8% (testing for higher slopes is necessary) – Developed with the rhodic and orthic soils and it is necessary to test with black cotton, sandy soils etc. which are common in ASALs
Suggestions for addressing challenges	<ul style="list-style-type: none"> – Work in groups from farm to farm (merry-go-round); Consult community based trainers – Develop an ox or power operated implement – Identify areas with the requisite gradient and soils and exploit them for this TIMP
Lessons learned in up scaling if any	Farmers conversant with using ox-ploughs prefer furrows than pitting, steep slopes benefit from a cutoff drain at the head of the land
Social, environmental, policy and market conditions necessary for development and up scaling	Most pastoralists find it hard to adopt land tillage, technology okay with agro-pastoralists Good market for pasture & pasture seeds, milk, live animals
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	KES. 15,000/ha/year; USD 167/ha/year (includes fencing)
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Pitting done mainly by men. Men, women, youth can get involved although their level of access to land varies.
Gender related opportunities	In agro pastoral settings women and youth tend to do most of the land tilling and are bound to profit more from the technology
VMG issues and concerns in development, dissemination, adoption and scaling up	Pitting is difficult for VMGs – particularly for the physically challenged. Unlikely to benefit much owing to limited adoption.
VMG related opportunities	Limited
E: Case studies/profiles of success stories	
Success stories from similar previous projects	Kavatini Pasture & Livestock Improvement Group (KAPALIG), a CIG in Makueni successfully used the technology jointly with run-off harvesting to establish/pasture fields

TIMP Name	Kiboko Range pits for water harvesting for pasture production
Application guidelines for users	Select appropriate hoe and shovel, mark the pits facing up slope, Line up along the contour, Dig the pit starting from the Centre working out wards, making sure the Centre is deeper (max 0.15m) and ends shallow. The span should be 1 metre and the pits should be dug along contours. Spacing within row = half meter, between rows = 1 metre. Pile most of the soil in the middle. Ram the inside slope of the crescent with the back of the shovel. Grass seeds are placed on the crescents. Staggering of the pits allows overflow of runoff to pits down slope. Technology is developed for rhodic (redish) and orthic (brown) soils and works best in slopes of >8%.
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling under the conditions it was developed. However, it requires further research in areas with steeper slopes and other types of soil.
G: Contacts	
Contacts	Dr. W. N Mnene; Institute Director ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 Centre Director Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254722289697
Lead organization and scientists	KALRO ARLRI Kiboko Dr. W. Ngoyawu Mnene, Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	MoALF&I, County governments, CIGs and other Farmers' groups

Gaps

1. An implement to facilitate adoption of the Kiboko Range Pits TIMP is needed – fabrication, validation and dissemination.
2. Require validation for different slope gradients and soils.

TIMP Name	Natural pasture improvement through reseedling
Category	Management Practice
A: Description of technology, innovation or Management practice	
Problem to be addressed	Feed shortage
What is it? (TIMP description)	Degraded natural pasture is fenced and over sown with selected grasses with micro catchments such as furrows made by oxen plough or pits. Through the reseedling degraded pastures are improved to continue supporting livestock faster than if natural regeneration was allowed to take its course.
Justification	There is need to reduce degradation of rangelands and increase natural pasture production. With faster pasture regeneration, the rangelands are not only able to support increased livestock but also land holding capacity and livestock productivity.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Ranchers and small scale farmers
Approaches to be used in dissemination	Field days, posters, demonstrations on-station and on-farm, CBOs
Critical/essential factors for successful promotion	Capacity building of technology users including demonstrations, availability of viable seeds
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> – MoALF&I capacity building and funding – County governments to train farmers and help them access the seeds – KEPHIS to provide seed certification to facilitate commercialization of the seed system – NGOs to assist in capacity building of farmers and provide financial support

TIMP Name	Natural pasture improvement through reseeded
	<ul style="list-style-type: none"> – Farmer groups lobby members to adopt TIMP and engage in commercial seed production and marketing – Commercial multipliers and seed merchants to stock and distribute certified seed
C: Current situation and future scaling up	
Counties where already promoted if any	Moyale, Mandera, Wajir, Isiolo, Narok, Kajiado, Taita Taveta, Machakos, Mwingi, Makueni
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	Limited availability of viable seeds, cultural practices with respect to control and access to land, inadequate extension services, unreliable rains and land tenure
Recommendations for addressing the challenges	Improved extension, training of trainers, bulking and germination testing of seeds
Lessons learned in up scaling if any	Use of micro catchments aid in better establishment, fencing necessary, best at onset of short rains, use more than one grass species to spread the risks, utilization should be at the end of second growing season
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> – Under communal land tenure community consensus is necessary – Pastoralists resist micro catchments involving tillage and prefer seed broadcasting into existing vegetation and some fencing – Awareness creation about importance of protection of the over-sown area is necessary especially among the pastoralists otherwise some will complain of being denied access to the natural pastures – Extensive fencing necessary to facilitate establishment – Testing of soils before planting to establish the soil condition (PH, Nutrients) is required – In weed management, integrated pest management will be used and in situations where herbicides and pesticides must be used, only those recommended by pesticides control board and cleared by the world bank will be used – Reliable market for livestock is good incentive for technology adoption

TIMP Name	Natural pasture improvement through reseedling
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	KES. 35,000/ha; USD389/ha
Estimated returns	Cost/benefit ratio is 1.7 after only one growing season
Gender issues and concerns in development, dissemination, adoption and scaling up	Men, women, youth can get involved although preparation of the water harvesting structures remains a challenge for women. Men, women, youth can get involved though their level of access to land varies.
Gender related opportunities	<ul style="list-style-type: none"> – There is opportunity for women to make money from increased milk sales, men from increased off take. – Youth will have more milk to consume for improved health.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> – VMGs stand to make more money from livestock and could therefore hire labour to reseed the pastures. – With improved production livestock, VMGs may get more animal products for their consumption hence improved health
VMG related opportunities	Substantial benefits.
E: Case studies/profiles of success stories	
Success stories from similar previous projects	<ul style="list-style-type: none"> – Utheu Wa Aka women group in Kibwezi successfully used the technology to improve their natural pastures thus enhancing capacity to feed their livestock – KAPALIG (KAVATINI Pasture and Livestock Improvement group) also successfully used the technology.
Application guidelines for users	Target areas with bimodal mean annual rainfall of 600 mm, 18-32°C in southern rangelands; 250-400 mm and up to 36°C in northern rangelands. Soils that are mostly sandy, sandy clay and sandy loam are better. Fence area using locally available material, construct micro-catchments, broadcast seed evenly or place on crescents of pits or between ox plough furrows at onset of the rains, monitor periodically, allow 1 st season seed fall for self- seeding, open for light use at end of 2 nd growing season. Always stock moderately and allow periods of rest to avoid future degradation.
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling

TIMP Name	Natural pasture improvement through reseedling
G: Contacts	
Contacts	<p>Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207</p> <p>CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697</p>
Lead organization and scientists	<p>KALRO ARLRI Kiboko Dr. W. Ngoyawu Mnene, Bryan P. Ogillo, Peter Mweki, John K. Manyeki, Bosco Kidake, Dennis Kubasu</p>
Partner organizations	County governments; CBOs e.g. KAPALIG, MoALF&I

Gaps

1. National Performance Trials and Distinctiveness Uniformity and Stability of the grass varieties needed to facilitate registration and formal release by KEPHIS. This will facilitate formal marketing of the range grass seeds, thus adoption of the Community based range grass seed bulking TIMP.
2. There is need to conduct feeding trials for all the range grass varieties being promoted to check on animal performance. This has not been done even on the indigenous grasses that are already being promoted for establishment of new pasture fields and rehabilitation of degraded rangelands. Results of the trials would provide evidence for farmers to adopt the grass varieties.
3. There is need to expand capacity of Kiboko Centre to bulk seeds to complement work by farmer groups and also enable it conduct quality control. Virtually all the 17 ASAI counties will require grass seeds. This would support/facilitate adoption of the various indigenous range grasses as well as the new varieties that are being developed.

TIMP Name	<i>Acacia tortilis</i> pods supplement for weaner goats and sheep
Category	Complementary Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Slow growth rate for kids and lambs
What is it? (TIMP description)	Use of <i>Acacia tortilis</i> pods to supplement natural pasture grazing for weaner goats and sheep to hasten growth of kids and lambs in the ASAL and increase productivity.
Justification	<i>Acacia tortilis</i> pods are rich in protein (16 – 20%) and are readily available and accessible in ASALs. They enhance growth of kids and lambs if appropriately used in the ASAL regions.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Large and small scale livestock keepers
Approaches to be used in dissemination	Field days, posters, brochures, farmer groups tours
Critical/essential factors for successful promotion	Availability of the pods, farmer willingness to participate
Partners/stakeholders for scaling up and their roles	Farmers – apply the TIMP and improve their livestock performance County governments – capacity building of farmers MoALF&I – capacity building of extension staff NGOs and CBOs - Assist with capacity building of farmers, funding Farmer groups – collection and distribution of pods to farmers, champion conservation of the tree
C: Current situation and future scaling up	
Counties where already promoted if any	Kajiado, Makueni and Marsabit
Counties where TIMP will be up scaled	West Pokot, Baringo, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	Inadequate availability of pods
Recommendations for addressing challenges	Need to establish and protect/conservate the existing trees
Lessons learned in up scaling if any	Involvement of frontline extension staff and CBOs is crucial; target the correct gender

TIMP Name	<i>Acacia tortilis</i> pods supplement for weaner goats and sheep
Social, environmental, policy and market conditions necessary for development and up scaling	Target women, women groups and youth who mostly care for young stock
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	KES. 20/goat/day (USD 0.22)
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> – Involvement of women and youth stand a chance to register higher levels of adoption due to their availability. – Involvement of men alone may register lower level of success.
Gender related opportunities	More milk for children, more cash women and men from milk and goat sales
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> – Pods are readily available and can be easily collected by VMGs – Collection of the pods is a challenge for the disabled
VMG related opportunities	More milk for children, more cash women and men from milk and goat sales
E: Case studies/profiles of success stories	
Success stories from previous similar projects	A farmer group in Oloibelbel in Ilbisil Kajiado successfully used the technology to raise goats and sheep
Application guidelines for users	Collect the pods, place in several feeding troughs, release the goats and ensure each weaner goat/sheep consume about 100g/day for 18 weeks.
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	– Ready for up scaling
G: Contacts	
Contacts	Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207

TIMP Name	<i>Acacia tortilis</i> pods supplement for weaner goats and sheep
	CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Mr. Korir, R K; Bii J C, Katiku P; Kuria S G
Partner organizations	County governments, MoALF&I, Farmer groups

Gaps

1. Explore the pods as possible ingredient in the formulation of more balanced supplementary feed rations for finishing beef in ASALs.
2. Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP.

TIMP Name	Community based range grass seed bulking & management practices
Category	Complementary Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Unavailability of range grass seeds
What is it? (TIMP description)	This is a package of management practices for production, harvesting, processing, storage and viability testing of range grass seeds for small scale producers.
Justification	Community based range grass seed management and bulking is an essential management practice that ensures successful restoration of degraded rangelands. The approach when done well to involve a big part of the community, guarantees availability and marketing of good quantity and quality seed locally and beyond. The areas are managed to ensure regeneration and this makes the rangelands more productive and resilient to continue supporting livestock. The training the community receives and the joint approach on what sites to close and qualities of seeds to bulk maintains collection and bulking of quality seed. Besides, it is a source of household income when the seeds are sold and income shared among members.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	County governments, Common Interest Groups (CIGs), Individual farmers, MoALF&I
Approaches to be used in dissemination	Training of CIGs, Farmers, ToTs, On-farm demonstrations
Critical/essential factors for successful promotion	Business orientation of the farmers, availability of initial seeds, land to establish the seed bulking fields, adequate moisture, availability of seed germination testing services, availability of viable markets for the seeds
Partners/stakeholders for scaling up and their roles	County governments – training of farmers, funding

TIMP Name	Community based range grass seed bulking & management practices
	Common Interest Groups (CIGs) – produce and market the seeds, train farmers, Individual farmers – produce and market seeds MoALF&I – train extension personnel, funding
C: Current situation and future scaling up	
Counties where already promoted	Makueni, Taita Taveta, Kajiado, Narok, Tana River
Counties where TIMP will be up scaled	West Pokot, Baringo, Lamu, Machakos, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> – Cost benefit analysis of the technology not done – Inadequate support of extension staff by county governments to carry out the dissemination work – Poor group dynamics – Limited availability of starter seeds.
Recommendations for addressing challenges	<ul style="list-style-type: none"> – County governments to provide more support to extension staff – Provision of more resources to KALRO staff to train more CIGs – Address group dynamic issues – Conduct cost benefit analysis of the technology
Lessons learned in up scaling if any	Building capacity of farmers to engage in commercial seed bulking not only helps in rehabilitating degraded rangelands but can also positively transform the lives of farmers through the generated revenue.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> – Strong group dynamics is important for success of the group activities – Untrained groups should not engage in the activity otherwise they spoil the markets for the trained groups by offering seeds of questionable quality. – Availability of market for the seeds to motivate the farmers is crucial. – Registration and formal release of grass varieties by KEPHIS is crucial to facilitate formal marketing of the seeds. – Registering the producer groups as seed merchants with KEPHIS to facilitate marketing is necessary. – Testing of soils before planting to establish the soil condition (PH, Nutrients) is required. – In weed management, integrated pest management should be used and in situations where herbicides and pesticides must be used, only those

TIMP Name	Community based range grass seed bulking & management practices
	recommended by pesticides control board and cleared by the World Bank will be used.
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	The enterprise involves all but women and youth may be disadvantaged because they are given other roles.
Gender related opportunities	There are employment opportunities for the youth, men and women
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> – Initial establishment is a challenge to VMGs – Associated activities are manually done including land preparation, planting, harvesting and shelling which presents a challenge to the VMGs in terms of adoption and scaling up.
VMG issues and concerns in	
VMG related opportunities	There are employment opportunities for the VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The success registered by Kavatini Pastoralists Livestock Improvement Group (KAPALIG) is worth telling. Some members have completely transformed their lives using proceeds from seed sales. The members have also succeeded in training other farmers and are invited to go and train other farmers outside Makueni County.
Application guidelines for users	A guiding manual has been published and is available
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling.
G: Contacts	
Contacts	Dr. W. N Mnene; ID ARLRI Kiboko

TIMP Name	Community based range grass seed bulking & management practices
	P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Dr. W. Ngoyawu Mnene, Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	County governments, Farmer groups, MoALF&I

Research Gaps

1. However, it requires registration of the seeds by KEPHIS for wider formal marketing
2. Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP.

TIMP Name	<i>Prosopis juliflora</i> pods flour for improved livestock productivity
Category	Complementary Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Poor livestock performance, wide spread of the invasive <i>Prosopis juliflora</i> shrub.
What is it? (TIMP description)	Use of ground <i>Prosopis juliflora</i> pods to formulate feed ration based on type of livestock and production objective. This exploitation of an otherwise noxious weed enable ASAL communities derive an income from it in a sustainable manner
Justification	The pods of <i>Prosopis Juliflora</i> are rich in protein which is a major limiting factor in livestock production in ASALs. The plant is a menace and removal of its pods and

TIMP Name	<i>Prosopis juliflora</i> pods flour for improved livestock productivity
	milling reduces its spread in the ASALs. Exploitation of the plant in this manner is sustainable and financially beneficial to the ASAL communities.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Agro-pastoralists and Pastoralists where <i>Prosopis</i> exists
Approaches to be used in dissemination	On farm demonstration, posters, conferences and field days
Critical/essential factors for successful promotion	Availability of <i>P. Juliflora</i> , availability of affordable and efficient milling machines
Partners/stakeholders for scaling up and their roles	County governments' extension staff – training farmers on the TIMP NGOs promoting livestock production – funding training of farmers, helping farmers access the pods Feed manufacturers – Use the pods to manufacture livestock feeds
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Tana North and Taveta sub-counties
Counties where TIMP will be up scaled	West Pokot, Baringo, Lamu, Machakos, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> – Profitability of using the technology not determined – Inadequate skills in ration formulation among producers – Labor intensive (harvesting and storage) – Negative attitude towards <i>P. juliflora</i> limits acceptance
Recommendations for addressing challenges	<ul style="list-style-type: none"> – Capacity build pastoral and agro-pastoral communities on feed formulation – Develop an efficient pod harvesting technique – Sensitization on use of <i>P. juliflora</i> – Conduct cost benefit analysis
Lessons learned in up scaling if any	<i>P. juliflora</i> is a resource which if well managed provide raw materials for feed formulation.
Social, environmental, policy and market conditions necessary for development and up scaling.	Attitude change
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	

TIMP Name	<i>Prosopis juliflora</i> pods flour for improved livestock productivity
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, , dissemination, adoption and scaling up	Target women and youth, Milling of pods done by men
Gender related opportunities	Development of cottage industries by communities if technology is refined esp. the milling of <i>P.juliflora</i>
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs may be disadvantaged in terms of lacking capital to establish milling plants
VMG related opportunities	Good business opportunity especially in the milling
Success stories from previous similar projects	<i>P. juliflora</i> flour been incorporated in commercial feeds e.g. Sigma Feeds
Application guidelines for users	210g of <i>Prosopis juliflora</i> pods flour mixed 810 g of chopped Sudan grass and 380 g of ground maize cobs fed to each goat per day during the dry season.
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	<ul style="list-style-type: none"> • Ready for up scaling • Requires further research with respect to formulation of livestock finishing strategy in ASALs
G: Contacts	
Contacts	<p>Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207</p> <p>CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697</p>
Lead organization and scientists	KALRO ARLRI Kiboko Katiku P, Koror B K, Bii J c, Kuria S G
Partner organizations	MoALF&I, County governments, Farmers' groups

Gaps

1. Explore the pods as possible ingredient in the formulation of more balanced supplementary feed rations for finishing beef in ASALs
2. Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP

TIMP Name	Cotton seedcake as supplementary feed for beef cattle
Category	Complementary Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low milk yield and slow growth rate of beef cattle in ASALs resulting in low beef animals productivity and beef supply
What is it? (TIMP description)	It is the supplementary feeding of 600g of cotton seed cake every morning to beef animals before releasing them for grazing on the low quality range pastures.
Justification	Cotton seedcake is available as a by-product in cotton ginneries. It is rich in protein and relatively cheap compared to other commercial protein supplements.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Agro-pastoralists and Pastoralists
Approaches to be used in dissemination	On farm demonstration, posters, conferences, field days
Critical/essential factors for successful promotion	Availability of financial resources to support dissemination activities, Availability of the cakes
Partners/stakeholders for scaling up and their roles	Cotton ginneries – providing the cakes County governments – training the farmers, facilitating farmers to access the cakes MoALF&I – training extension staff Farmers – applying the TIMP to improve livestock productivity
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Kitui, Taita Taveta
Challenges in dissemination	– Cost of cotton seedcake is high – Inadequate skills in ration formulation
Recommendations for addressing challenges	– Capacity building – Backstopping/facilitation of contact farmers as demonstration units – Access to credit facility to hire labor
Lessons learned in up scaling if any	Cotton seed cake if available and appropriately used can increase livestock productivity in ASALs

TIMP Name	Cotton seedcake as supplementary feed for beef cattle
Social, environmental, policy and market conditions necessary for development and up scaling	Policy to improve cotton production locally, improve cotton producer prices, subsidize cotton production inputs
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	KES. 650/bag of 50kg
Estimated returns	KES 80/kg/day
Gender issues and concerns in development, dissemination, adoption and scaling up	To target women in dissemination Need to involve men especially in pastoralist communities
Gender related opportunities	More milk for women and children, animals attain market weight faster thus benefitting the men
VMG issues and concerns in development, dissemination, adoption and scaling up	Application of the technology is not cumbersome if deliberate effort is made to train VMGs
VMG related opportunities	Good business opportunity because of increased production of milk and value of animals.
E: Case Studies/profiles of success stories	
Success stories from similar previous projects	No on-farm experience.
Application guidelines for users	600 g of cotton seed cake fed to the animals in the morning. The animals are then fed 2kg of grass hay indoors attaining 360g/day daily weight gain.
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling Requires further research with respect to formulation of livestock finishing strategy in ASALs
G: Contacts	
Contacts	Dr. W. N Mnene; Institute Director ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207

TIMP Name	Cotton seedcake as supplementary feed for beef cattle
	Centre Director, KALRO ARLRI. Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko J C Bii, B K Korir, S G Kuria, P Katiku, J K. Manyeki
Partner organizations	County governments, Extension Agents, NGOs, feed manufacturers

Gaps

1. Explore the cake as possible ingredient in the formulation of more balanced supplementary feed rations for finishing beef in ASALs.
2. Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP.

TIMP Name	Irrigated forage production in ASALs
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Inadequate quantity and quality feed for livestock in ASALs due to inadequate moisture
What is it? (TIMP description)	It is the growing of ASAL grass species known to perform well under irrigation. Candidate grasses (<i>Cenchrus ciliaris</i> and Sudan grass) which do well both in rain-fed regimes and irrigated.
Justification	Growing of forage in pastoral communities under irrigation reduces land and resource use conflict especially during drought. Irrigation enables the producers to get at least three harvests in a year. Irrigated fodders could be in areas near permanent water sources and could be stockpile for release when needed. Alternatively, it may be suitable for counties with farmer groups that may establish feedlots for fattening animals. Initially, dry season grazing areas were planted with maize which benefit only a few households.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Agro pastoralists and pastoralists
Approaches to be used in dissemination	On-farm Demonstration
Critical/essential factors for successful promotion	Reliable sources of water is a must
Partners/stakeholders for scaling up and their roles	MoALF&I – Training extension personnel on the TIMP, providing funds for dissemination County governments – extension staff to train farmers, NGO and CBOs supporting livestock development – train farmers, facilitate farmers to access the TIMP and additional funds
C: Current situation and future scaling up	
Counties where already promoted if any	Marigat (Baringo), Tana North (Tana River), TaitaTaveta, Mbalabala (Garissa) sub-counties in Kenya and North West Tanzania
Counties where TIMP will be up scaled	Garissa, Tana river, Mandera and wherever else there is reliable water

Challenges in dissemination	<ul style="list-style-type: none"> – Low availability and high cost of grass seed – High start-up capital for irrigation infrastructure – Underdeveloped fodder value chain – Minimal mechanization.
Suggestions for addressing challenges	Avail seed at affordable cost and provision of financial services
Lessons learned in up scaling if any	<ul style="list-style-type: none"> – Irrigated forage production in ASALs is profitable, Irrigated forage production cushions livestock during drought – Promote mechanized ways of making the furrows or adopt overhead irrigation
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> – Avoid conflict between pastoralists and agro-pastoralists, over abstraction of water can lead to drying up of water sources, good market for hay is a good motivation for investors. – Testing of soils before planting to establish the soil condition (PH, Nutrients) is required. – In weed management, integrated pest management will be used and in situations where herbicides and pesticides must be used, only those recommended by pesticides control board and cleared by the World Bank will be used.
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	KES.7,000 (US\$83) and 14,000 (US\$165) using draught power or tractor per acre excluding cost of water pump
Estimated returns	About KES. 30,000 (US\$ 360) /ha
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> – Access to land and funds may limit the technology to men. – Training should target men, women and youth so that they can complement each other at the family level.
Gender related opportunities	<ul style="list-style-type: none"> – Reduces length of time women take in looking for feed for young stock. – Technology presents an opportunity for men, women and youth to make money.
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> – VMGs may exploit the technology if supported to work in groups or retail outlets. – VMGs may need mechanization to make the furrows or plant.
VMG related opportunities	<ul style="list-style-type: none"> – Good business opportunity

E: Case Studies/profiles of success stories	
Success stories from previous similar projects	Case of Korio Farm and Biskidera Jabesa group in Tana North, Singale Buradanza Tiltil Farms in Mbalabala, Garissa. These groups used the technology to successfully establish pastures.
Application guidelines for users	Prepare land normally as per the guidelines in the pasture production manual (available). Dig furrows of maximum depth 0.15m piling the soil evenly on both sides. Place the grass seeds on the edges of furrows at a rate of 4kg/ha and irrigate twice per week
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	<ul style="list-style-type: none"> – Ready for up scaling – Requires further research to determine the water requirement per unit of land – Cost/benefit analysis of mechanizing the technology needs to be done
G: Contacts	
Contacts	<p>Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207</p> <p>Centre Director. KALRO ARLRI Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697</p>
Lead organization and scientists	KALRO ARLRI Kiboko Dr. W. Ngoyawu Mnene, Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	TALIRI in MABUKI Tanzania; OARI in Yabello Ethiopia

Gaps

Requires further research to determine the water requirement per unit of land

TIMP Name	Socio economics of reseeding rangelands in Kenya
Category	Management practice
A: Description of technology, innovation or Management practice	
Problem to be addressed	Low adoption; Social and economics (gross margin and cost benefit ratio) of improving natural pasture
What is it? (TIMP description)	It is the analysis of all costs associated with rangeland reseeding activities and also benefits that comes with reseeding for purposes of determining profitability of the activity. The analysis gives confidence and assure potential investors in NAPI through reseeding of positive returns.
Justification	High demand for forage improvement materials, Low adoption of reseeding technology, Inadequate information on socioeconomic of reseeding, Lack of elaborate marketing systems of natural pasture products, Low priority given to range management and sown pasture by farmers and the government.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Research/University institutions Agro pastoralists and pastoralists
Approaches to be used in dissemination	Training and feedback workshops
Critical/essential factors for successful promotion	
Partners/stakeholders for scaling up and their roles	MoALF&I – Training of county extension staff, funding the dissemination activities County governments – training farmers NGOs, CBOs – training farmers, facilitate training of extension staff
C: Current situation and future scaling up	Linking to KEPHIS for seed certification
Counties where already promoted if any	Makueni, Taita Taveta, Kajiado
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate quantity of range grass seed • Informal marketing of grass seed
Recommendations for addressing challenges	Linking to KEPHIS for seed certification

Lessons learned in up scaling if any	Intensive training on NaPI technologies, provision of grass seed and field days are crucial for success of NaPI
Social, environmental, policy and market conditions necessary for development and up scaling	All gender involvement Formal market for range grass seed
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Average = KES 12,625.58 per hectare
Estimated returns	Average KES 94,052.10 per acre
Gender issues and concerns in development, dissemination, adoption and scaling up	The men, women and youth should all be involved
Gender related opportunities	Target youth more for quick adoption
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	VMGs can also use the information to invest in NAPI
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Not documented
Application guidelines for users	Not done
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Dr. W. N Mnene; Institute Director. KALRO ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 CD Kiboko simon.kuria@kalro.org

	Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Manyeki J K Cell: +254 714204584; Kimutai Janet Cell: +254 725509145
Partner organizations	County governments, CBOs e.g. (KAPALIG), MoALF&I

TIMP Name	Cost effective feed conservation structure
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Loss of quality and quantity of conserved pastures in ASALs
What is it? (TIMP description)	A grass thatched or iron sheets roofed, cool, dry and well-ventilated store for livestock feed material in ASALs. The structure protect hay and other feed material from rain water, direct sunlight, pests, stray domestic and wild animals, foreign materials.
Justification	Poor feed material storage result in loss of feed in terms of quantity and quality. These losses which negatively affect livestock productivity can be effectively managed through adoption of an appropriate feed conservation structure. Such a structure ensure availability of palatable, quality feed during dry seasons and drought periods which maintains livestock in productive state for the benefit of pastoralists and agro-pastoralists living in ASALs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Agro pastoralists and pastoralists
Approaches to be used in dissemination	Training workshops, field demonstrations
Critical/essential factors for successful promotion	Availability of pastures, big herd sizes, local availability of required building material
Partners/stakeholders for scaling up and their roles	MoALF&I, County governments, NGO, CBOs
C: Current situation and future scaling up	
Counties where already promoted if any	Agro pastoral and pastoral areas in Tana North, Marigat, Taveta, Turkana west Sub-counties
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> • Low literacy levels, inadequate adoption of the technology • Cost benefit analysis of the technology not done

Suggestions for addressing challenges	<ul style="list-style-type: none"> • Intensive awareness creation about the structure • Generate and make available economics data for using the structure
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Livestock feed storage structures need not be expensive • Feed conservation is not common in ASALs • Changing climate is increasing urgency for adoption of feed conservation in ASALs
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Strong social structures to guard against theft of stored feeds • Moderate heat and low moisture conditions • Availability of market for conserved pasture/feeds • Men, women and youth should all be involved
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Quality and quantity of conserved feed provide forage for animals and a source of income for men, women and youth
Gender issues and concerns in development, dissemination, adoption and scaling up	The men, women and youth are all comfortable with the technology and should all be targeted for quick adoption.
Gender related opportunities	Fodder trade by youth, women and men.
VMG issues and concerns in development, dissemination, adoption and scaling up	Capacity building of VMGs on need for conserved feeds to provide feed for livestock throughout the year.
VMG related opportunities	Business opportunity for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Dr. W. N Mnene; Institute Director, KALROARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org

	William.mnene@kalro.org Cell: +254 724468207 Centre Director, KALRO ARLRI Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO_ARLRI-Kiboko Dr. W. Ngoyawu Mnene, Bryan P. Ogillo, Peter Mweki, John K. Manyeki, Bosco Kidake, Dennis Kubasu
Partner organizations	County governments, CBO (KAPALIG), MoALF&I

Research Gaps

Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP

TIMP Name	Matching livestock production with the market needs
Category	Management practice
A: Description of technology, innovation or Management practice	
Problem to be addressed	Marketing for cattle, sheep and goats
What is it? (TIMP description)	Market requirements for cattle and shoats. Producers need to understand specifications of the livestock demanded by the consumers in terms of age, size, entire or castrates, quality of milk etc so that they produce for sale and not to sell.
Justification	Mismatch between supply and demand of beef, sheep and goat meat due to inadequate production and market planning leading to market failure'. There is need to address the causes of market failure and develop an efficient red meat value chain
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists and agro-pastoralists rearing cattle, sheep and goats
Approaches to be used in dissemination	Field days , shows and conferences
Critical/essential factors for successful promotion	Commercially oriented livestock production in pastoral and agro-pastoral systems, knowledge on factors of supply and demand, finished animals for sale and livestock traders
Partners/stakeholders for scaling up and their roles	County governments – training farmers MoALF&I – training extension staff, funding dissemination activities Farmers – applying the information to produce for markets KMC – buy livestock from farmers KLMC – Source for livestock markets for farmers and lobby for good prices, link farmers to the markets
C: Current situation and future scaling up	
Counties where already promoted if any	Makueni and Kajiado counties
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate extension information on export/local market requirements for cattle and shoats • High illiteracy levels of pastoralists

	<ul style="list-style-type: none"> • Seasonal supply of finished animals for sale
Suggestions for addressing challenges	Extension information on market requirements
Lessons learned in up scaling if any	Need to package and share current information on different livestock market quality requirement/ standards
Social, environmental, policy and market conditions necessary for development and up scaling	Strong social and peaceful environment are most conducive for all market stakeholders to get involved in marketing
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	N/A
Estimated returns	Producer and trader of animals get fair prices where adequate information is available
Gender issues and concerns in development, dissemination, adoption and scaling up	The men, women and youth should all be involved
Gender related opportunities	Male livestock trader get good prices for their animals, women get fair prices for their milk and milk by-products
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	Current and adequate market information enable the VMGs to sufficiently participate in the market
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Not done
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	<p>Dr. W. N Mnene; Institute Director KALRO-ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207</p>

	Centre Director, KALRO -ARLRI Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO, ARLRI-Kiboko Mr. John Manyeki, Janet Kimutai
Partner organizations	County governments, MoALF&I

TIMP Name	Estimating carbon sequestration in rangelands
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Green House Gas accumulation in the atmosphere
What is it? (TIMP description)	Biomass based carbon sequestration estimation in the rangelands The technology is used to assess potential of grasslands in semi -arid areas to sequester carbon.
Justification	Amount of Carbon sequestered is variable in different ecosystems depending on land use, season and vegetation impact. on carbon storage and budget
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Range managers, governments, NGOs, institutions involved in climate change issues, environmental organizations, policy makers
Approaches to be used in dissemination	Feedback meetings and Publications
Critical/essential factors for successful promotion	Strong support by county governments, universities, NGOs and CBOs involved in environmental conservation
Partners/stakeholders for scaling up and their roles	County governments – training farmers on the TIMP Research organizations (ILRI) – help farmers benefit from carbon credit Universities – teach about the TIMP National Drought Management Authority – also assist farmers access carbon credit
C: Current situation and future scaling up	
Counties where already promoted if any	Southern Ethiopia and northern Kenya
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> • Profitability of using the technology not determined • Low literacy level limiting understanding and application among ASAL communities
Suggestions for addressing challenges	<ul style="list-style-type: none"> • Conduct cost/benefit analysis of the technology • Capacity building of community members

TIMP Name	Estimating carbon sequestration in rangelands
Lessons learned in up scaling if any	Rangeland ecosystems are important in climate change mitigation through carbon absorption and it is important to properly conserve them. Production systems can be tailored to meet both livestock demands as well as environmental conservation.
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Low literacy level is a social issue that negatively affect adoption • Concentrating high number of livestock in an area causing degradation is an environmental issue and county governments should formulate policies to control rangeland degradation.
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Low literacy level is a big problem among the female. The very low literacy among female gender VMGs adversely affects adoption by women
Gender related opportunities	The technology motivate VMGs to rehabilitate degraded rangelands not only for climate change mitigation but also for improved livestock productivity
VMG issues and concerns in development, dissemination, adoption and scaling up	Low literacy level is also a big problem among the female VMGs The very low literacy among female gender adversely affects adoption by women
VMG related opportunities	The technology motivate VMGs to rehabilitate degraded rangelands not only for climate change mitigation but also for improved livestock productivity
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Project ongoing Similar work undertaken elsewhere especially in agricultural environments yielding positive results in Africa through payments of carbon credits.
Application guidelines for users	Quantify the biomass stocks in different ecosystem components (vegetation and soils) to help estimate carbon sequestration. Vegetation use carbon to manufacture food through photosynthesis which is distributed to all parts of the plant (leaves, fruits, stem and roots).The higher the biomass, the higher the volume of sequestered carbon which is good for climate change mitigation.

TIMP Name	Estimating carbon sequestration in rangelands
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling but the Cost benefit analysis information should be generated
G: Contacts	
Contacts	Dr. W. N Mnene; Institute Director, KALRO- ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 Centre Director Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Mr. Bosco Kidake, Bryan Ogilo
Partner organizations	County governments, MoALF&I, farmer groups

Research Gaps

Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP

TIMP Name	Utilization of traditional indicators for weather prediction in pastoral and agro-pastoral systems
Category	Management practice
A: Description of technology, innovation or Management practice	
Problem to be addressed	Limited coverage of the conventional weather forecast information
What is it? (TIMP description)	Specific traditional indicators used to forecast weather
Justification	<ul style="list-style-type: none"> • Density of weather stations in pastoral and agro-pastoral systems is low and inadequate • High temporal and spatial variability of weather in pastoral and agro-pastoral system • Communities have used traditional knowledge for years • Traditional knowledge on weather forecasting disappearing fast
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Agro pastoralists and Pastoralists
Approaches to be used in dissemination	Feedback meetings, Community meetings and Bulletins
Critical/essential factors for successful promotion	Community understanding of indicators in their respective areas
Partners/stakeholders for scaling up and their roles	Meteorology – validation of the ITK NGOs, CBOs – funding training of extension staff
C: Current situation and future scaling up	
Counties where already promoted if any	Baringo, Tana North, Taveta, Kenya, Yabello in Ethiopia, Noth West Tanzania
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate institutionalization • Effects of climate change on indicators • Increasing settlements and cultivation leading to loss of the indicators • Cost of receiving and using inaccurate information not determined
Suggestions for addressing challenges	Institutionalization

TIMP Name	Utilization of traditional indicators for weather prediction in pastoral and agro-pastoral systems
	Development of database and continuous monitoring of the indicators Need to conserve the indicators through live herbarium etc Estimate cost of wrong forecast
Lessons learned in up scaling if any	<ul style="list-style-type: none"> • Communities in the ASALs consider traditional indicators more reliable • Some communities depend only on traditional indicators for weather forecasting • ITK knowledge is getting lost due to religious, education and generational change • Some communities have seers for weather forecasting
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Acknowledgement and respect for indigenous technical knowledge (ITK) is a critical policy issue • Seers perceived as witches which may discourage them from releasing the information • Conservation of the indicators has a positive bearing on environmental integrity
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Most of the youth disregard the ITK ITK is a domain for only a few aged men and women The youth need to be educated on ITK in weather forecasting
Gender related opportunities	Youth to identify with the ITK for sustainable resource use and conservation
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	Can use the knowledge to improve livestock and crop production ITK can be tapped from VMGs, documented, published and the books used to generate income
E: Case studies/profiles of success stories	

TIMP Name	Utilization of traditional indicators for weather prediction in pastoral and agro-pastoral systems
Success stories from previous similar projects	Tana North experience where the community have one elder known across the Orma community as the seer on weather forecasting and it works
Application guidelines for users	Timely consultation with the seers and taking appropriate action
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Ready for up scaling, However, validation of the ITK and proper documentation is necessary
G: Contacts	
Contacts	Dr. W. N Mnene; Institute Director, KALRO- ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 Centre Director, KALRO- ARLRI Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO-ARLRI Kiboko Dr. David K Musembi, Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	TALIRI, MABUKI Tanzania and OARI, Yabello , Ethiopia

Research gaps

The ITK requires validation and proper documentation

TIMPs Requiring Validation

TIMP Name	New <i>Cenchrus ciliaris</i> (CECI) ecotypes i.e. Kiboko (KBK1), Magadi (MGD3) and Kilifi (KLF1)
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Feed shortage, low livestock productivity and rangeland degradation
What is it? (TIMP description)	These are higher performing and better adapted ecotypes selected from indigenous <i>Cenchrus ciliaris</i> . The varieties have higher crude protein (up to 10.5%), are tolerant to grazing and are preferred by farmers because of high dry matter yield. KLF1 is early maturing and preferred by farmers, KBK1 & MGD1 are late maturing and higher dry matter yielders.
Justification	The indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, tolerance to grazing etc has not been good enough to satisfy the feeds needs of grazing livestock leading to declining productivity of the livestock. This makes it necessary to explore ways of improving performance of the grasses and one of the options is that identifying and promoting superior ecotypes while other options would include breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers for further work including breeding, Extension personnel, farmer groups, CIGs and individual farmers ,
Approaches to be used in dissemination	N/A
Critical/essential factors for successful promotion	Adaptation trials in different locations and, Registration of the ecotypes with KEPHIS
Partners/stakeholders for scaling up and their roles	KEPHIS = certification of the varieties County governments – training farmers on the varieties, assist farmers access the seeds Farmer groups – use the varieties to produce feed for their livestock or sale

TIMP Name	New <i>Cenchrus ciliaris</i> (CECI) ecotypes i.e. Kiboko (KBK1), Magadi (MGD3) and Kilifi (KLF1)
C: Current situation and future scaling up	
Counties where already promoted if any	Not promoted
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	Not yet captured
Suggestions for addressing challenges	N/A
Lessons learned in up scaling if any	N/A
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Land availability is a must in ASAL area • The ecotypes/varieties should be registered with KEPHIS in order to be sold through formal channels • Testing of soils before planting to establish the soil condition (PH, Nutrients) is required • In weed management, integrated pest management will be used and in situations where herbicides and pesticides must be used, only those recommended by pesticides control board and cleared by the world bank will be used
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Higher productivity of the forages stand to increase both milk yield and quality of beef thus increasing household income, women included.
Gender related opportunities	There are income generating opportunities for the youth, men and women
VMG issues and concerns in development, dissemination, adoption and scaling up	Increased livestock productivity is expected to improve the diets and incomes of VMGs
VMG related opportunities	Income generation through production and sale of the hay and seeds
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The <i>CECI</i> ecotypes is a perennial grass that is well adapted and grazing tolerant. No experience at farmer level.
Application guidelines for users	Not developed

TIMP Name	New <i>Cenchrus ciliaris</i> (CECI) ecotypes i.e. Kiboko (KBK1), Magadi (MGD3) and Kilifi (KLF1)
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Requires further research including cost benefit analysis of using the varieties
G: Contacts	
Contacts	Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Dr. W. Ngoyawu Mnene, Everlyne Kirwa, Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	KEPHIS, County governments, farmers and farmer groups

Research Gaps

1. National Performance Trials and Distinctiveness Uniformity and Stability of the grass varieties needed to facilitate registration and formal release by KEPHIS.
2. Need to develop improved varieties by crossing the Kiboko 1 (KBK1), Magadi 3 (MGD3) and Kilifi 1 (KLF1) ecotypes to facilitate adoption of the CECI ecotypes.

3. There is need to conduct feeding trials for all the range grass varieties being promoted to gauge on animal performance. This has not been done even on the indigenous grasses that are already being promoted for establishment of new pasture fields and rehabilitation of degraded rangelands. Results of the trials would provide evidence for farmers to adopt the grass varieties.
4. As improvements in the quality and quantity of range pastures through application of the TIMPs on Natural Pasture Improvement; Community based range grass seed bulking; *Cenchrus ciliaris* and *Eragrostis superba* ecotypes continue, it is worth noting that these pastures alone cannot finish beef livestock in a way that they would attain market weights early enough while the meat is still tender. It is therefore imperative to develop more comprehensive beef and goat/sheep finishing strategies based on locally available material.
5. There are a number of naturally occurring legumes in ASALs which need to be explored with a view of domesticating, bulking the planting material and disseminating the same to producers for use as protein sources in finishing beef, mutton and chevon.
6. Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP.

TIMP Name	New <i>Eragrostis superba</i> (ERSU) ecotypes Kiboko 1(KBK1), Kiboko 2 (KBK2) & Kilifi 1 (KLF1)
Category	Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Feed shortage, low livestock productivity and rangeland degradation
What is it? (TIMP description)	These are high performing, well adapted, livestock preferred and good seeder ecotypes selected from indigenous <i>Eragrostis superbas</i> . The ecotypes are more productive in terms of dry matter and crude protein (9-11.5%) levels. They have higher digestibility than existing forages besides being more adaptable to moisture.
Justification	The indigenous range grass species have been used by livestock producers in the ASALs for a long time. However, performance of the grasses in terms of biomass yield, nutritive value, drought tolerance, tolerance to grazing etc has not been good enough to satisfy the feeds needs of grazing livestock leading to declining productivity of the livestock. This makes it necessary to explore ways of improving performance of the grasses and one of the options is that identifying and promoting superior ecotypes while other options would include breeding to develop completely new varieties.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Researchers for further work including breeding, Extension personnel, farmers, farmer groups and county governments ,
Approaches to be used in dissemination	N/A
Critical/essential factors for successful promotion	Adaptation trials in different locations and, Registration of the ecotypes with KEPHIS
Partners/stakeholders for scaling up and their roles	KEPHIS = certification of the varieties County governments – training farmers on the varieties, assist farmers access the seeds Farmer groups – use the varieties to produce feed for their livestock or sale
C: Current situation and future scaling up	
Counties where already promoted if any	Not promoted

TIMP Name	New <i>Eragrostis superba</i> (ERSU) ecotypes Kiboko 1(KBK1), Kiboko 2 (KBK2) & Kilifi 1 (KLF1)
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	Not yet captured
Suggestions for addressing challenges	N/A
Lessons learned in up scaling if any	N/A
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> • Land availability is a must in ASAL area and the ecotypes/varieties should be registered with KEPHIS in order to be sold through formal channels • Testing of soils before planting to establish the soil condition (PH, Nutrients) is required • In weed management, integrated pest management will be used and in situations where herbicides and pesticides must be used, only those recommended by pesticides control board and cleared by the world bank will be used
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Expected to be gender friendly
Gender related opportunities	There are income generating opportunities for the youth, men and women
VMG issues and concerns in development, dissemination, adoption and scaling up	None
VMG related opportunities	Income generation through production and sale of the hay and seeds
E: Case studies/profiles of success stories	
Success stories from previous similar projects	<i>ERSU</i> is a perennial grass that is well adapted to the ASALs. No experience at farmer level.
Application guidelines for users	Not developed

TIMP Name	New <i>Eragrostis superba</i> (ERSU) ecotypes Kiboko 1(KBK1), Kiboko 2 (KBK2) & Kilifi 1 (KLF1)
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	Requires further research including the cost benefit analysis of using the technology
G: Contacts	
Contacts	Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Dr. W. Ngoyawu Mnene, Everlyne Kirwa, Bryan P. Ogillo, Bosco Kidake, Dennis Kubasu
Partner organizations	KEPHIS, County governments

Research Gaps

1. National Performance Trials and Distinctiveness Uniformity and Stability of the grass varieties needed to facilitate registration and formal release by KEPHIS.
2. Need to develop improved varieties by crossing the ecotypes Kiboko 1(KBK1), Kiboko 2 (KBK2) & Kilifi 1 (KLF1) ecotypes to facilitate adoption of the ERSU ecotypes

3. There is need to conduct feeding trials for all the range grass varieties being promoted to check on animal performance. This has not been done even on the indigenous grasses that are already being promoted for establishment of new pasture fields and rehabilitation of degraded rangelands. Results of the trials would provide evidence for farmers to adopt the grass varieties.
4. As improvements in the quality and quantity of range pastures through application of the TIMPs on Natural Pasture Improvement; Community based range grass seed bulking; *Cenchrus ciliaris* and *Eragrostis superba* ecotypes continue, it is worth noting that these pastures alone cannot finish beef livestock in a way that they would attain market weights early enough while the meat is still tender. It is therefore imperative to develop more comprehensive beef and goat/sheep finishing strategies based on locally available material
5. There are a number of naturally occurring legumes in ASALs which need to be explored with a view of domesticating, bulking the planting material and disseminating the same to producers for use as protein sources in finishing beef, mutton and chevon.
6. Cost/benefit analysis of community based range grass seed bulking need to be undertaken to facilitate adoption of the TIMP

TIMP Name	AZOLLA blended feeds for improved beef production and productivity
Category	Complementary Technology
A: Description of technology, innovation or Management practice	
Problem to be addressed	Poor livestock performance
What is it? (TIMP description)	Azolla is nutritious plant that grows naturally in paddy rice fields. It is harvested and blended with locally available low quality feed material and fed to livestock for improved performance
Justification	Azolla produces about 347 tons/ha of fresh material; Has high nutritive value (CP 25-35%), moderate energy (1759 kcal ME/kg), high DM digestibility (79.6%) and rich in trace minerals; it improves feed quality thus reducing GHG emission by animal and from feed wastes due to increased intake. Azolla provides an opportunity to utilize what is produced in rice growing areas but not utilized there
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Producers; Livestock feed manufacturers
Approaches to be used in dissemination	N/A
Critical/essential factors for successful promotion	Availability of Azolla Assessment of effect of Azolla harvesting on the rice is needed Need to find out whether it can be grown outside paddy rice fields
Partners/stakeholders for scaling up and their roles	Rice farmers – supplying the Azolla County governments – training farmers on the TIMP Farmer groups – growing the Azolla outside paddy rice fields and supplying to livestock producers
C: Current situation and future scaling up	
Counties where already promoted	Not promoted
Counties where TIMP will be up scaled	West Pokot, Baringo, Laikipia, Machakos, Lamu, Taita Taveta, Kajiado, Mandera, Wajir, Garissa, Isiolo, Marsabit, Tana River
Challenges in dissemination	Not captured
Suggestions for addressing challenges	N/A

TIMP Name	AZOLLA blended feeds for improved beef production and productivity
Lessons learned in up scaling if any	Azolla is indeed a good feed resource that has not been used in the past
Social, environmental, policy and market conditions necessary for development and up scaling	<ul style="list-style-type: none"> – Testing of soils before planting to establish the soil condition (PH, Nutrients) is required – In weed management, integrated pest management will be used and in situations where herbicides and pesticides must be used, only those recommended by pesticides control board and cleared by the world bank will be used.
D: Economic, gender, vulnerable, and marginalized groups (VMGs) considerations	
Basic costs	KES. 6,000 in labour cost to collect and dry a ton from rice fields
Estimated returns	With 1.5 – 2 kg of Azolla, a farmer gets 15 – 20% increase in milk yield and live weight gain
Gender issues and concerns in development, dissemination, adoption and scaling up	Development is gender blind but gender issues relating to dissemination are yet to be established Both men and women stand to make income from this venture.
Gender related opportunities	All gender can harvest the Azolla and sell to users for money
VMG issues and concerns in development, dissemination, adoption and scaling up	Being a new technology the youth are likely to embrace based on its novelty. Business opportunity for VMGs
VMG related opportunities	VMGs can also harvest the Azolla and sell to users for money
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The improvement in rumen microbial population, feed intake, digestibility and animal growth at experimental level is in itself a success story.
Application guidelines for users	1.5–2 Kg of Azolla combined with regular feed daily
F: Status of the TIMP readiness (1. Ready for up scaling 2. Requires validation 3. Requires further research)	<ul style="list-style-type: none"> – Requires further research to determine effect of harvesting the Azolla on rice yields – Determine whether it can be grown and perform well outside the paddy rice fields – Proper cost benefit analysis needed

TIMP Name	AZOLLA blended feeds for improved beef production and productivity
G: Contacts	
Contacts	Dr. W. N Mnene; ID ARLRI Kiboko P.O. Box 12 90138 Makindu, Kenya directorarlri@kalro.org William.mnene@kalro.org Cell: +254 724468207 CD Kiboko simon.kuria@kalro.org Kuriasg@gmail.com +254 722289697
Lead organization and scientists	KALRO ARLRI Kiboko Mr. Korir, R K; Bii J C, Kuria S G, Katiku P
Partner organizations	County governments, MoALF&I, farmer groups

Research gaps

1. Need to understand effect of harvesting the Azolla on rice yield
2. Need to test growing the Azolla outside the paddy rice fields
3. Proper cost benefit analysis needed.