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PASTURE AND FODDER PLANTING MATERIALS SCOPING STUDY REPORT *July 2018*



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KCDMS | Kenya Crops and Dairy
Market Systems Activity

Feed the Future Kenya Crops and Dairy Market Systems Activity

TECHNICAL REPORT: PASTURE AND FODDER PLANTING MATERIALS

Submitted July 12, 2018

Cooperative Agreement No. AID-615-A-17-00006

Prepared for Harrigan Mukhongo
United States Agency for International Development/Kenya
C/O American Embassy
United Nations Avenue, Gigiri
P.O. Box 629, Village Market 00621
Nairobi, Kenya

Prepared by Agri-Experience for
RTI International
P.O. Box 12194
Research Triangle Park-NC
27709-2194
<http://www.rti.org>

Kenya Crops and Dairy Market Systems Activity (KCDMS)
The Westwood Office Building, 8th Floor-Westlands
P.O. Box 1181 Village Market, 00621
Nairobi, Kenya

Photo Caption

Front Cover: Brachiaria Xares and Basilik nursery at Malika Farm in Makueni County
Back Cover: Various field activities across KCDMS counties of operations

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LIST OF ABBREVIATIONS AND ACRONYMS

ATC	Agricultural Training Centre
CBO	Community-based organization
CEC	Chief Executive Committee
FtF	Feed the Future
HCD	Horticultural Crops Directorate
ICRAF	World Agroforestry Centre
ICT	Information and communication technology
ILRI	International Livestock Research Institute
KALRO	Kenya Agricultural and Livestock Research Organization
KCDMSD	Kenya Crops and Dairy Market Systems Development (Activity)
KEPHIS	Kenya Plant Health Inspectorate Services
MOALF	Ministry of Agriculture, Livestock and Fisheries
MT	Metric ton
NGO	Non-governmental organization
P&F	Pasture and fodder
PGS	Pure germinating seed
RTI	Research Triangle Institute
SHF	Smallholder farmers
SN/SNs	Seedling nursery/ies
USAID	United States Agency for International Development

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BRIEF ON THE ASSIGNMENT

Introduction

The Kenya Crops and Dairy Market Systems Activity (KCDMS) is a five-year (Oct 2017– Sept 2022) program of the United States Agency for International Development (USAID). It is funded as part of Feed the Future, the U.S. Government's global hunger, and food security initiative that helps to increase agricultural production and reduce poverty and malnutrition in Kenya. KCDMS activity is being implemented in 12 counties and is designed to spur competitive, resilient market systems in Kenya's horticulture and dairy sectors. KCDMS also seeks to improve access to information and productivity-enhancing agricultural inputs for smallholder farmers through sustainable commercial supply channels. RTI has contracted Agri Experience, Ltd (a Kenyan consulting firm focused on seed systems development) to conduct five scoping studies as part of a seed and inputs sector assessment. Agri- Experience began work on the scoping studies in mid-February.

This report presents the final findings and recommendations for increasing the volume and quality of planting material (seed, seedlings, splits and cuttings, etc.) for pasture and fodder crops in support of dairy sector development.

Scope of work

The scope of work for this study was to address the following questions.

Scoping Activity: Conduct a scoping mission for seed for pastures and improved dairy fodder nationally, and in priority counties

- A. What are the key feed and fodder crops suitable for dairy producers in these locations?
- B. What are the current and potential sources of supply for seed/planting materials?
- C. How does availability compare with demand?
- D. What are the critical constraints in supply of this planting material?
- E. How effective are the distribution channels for the seed?
- F. What needs to be done to solve constraints in the supply chain with respect to availability, distribution, price, and quality control?

In addition, Agri Experience was asked to provide specific recommendations for consideration by the KCDMSD team. The product was directed to be an approximately 15-page report with relevant appendices.

Methodology and interview list

The methodology employed for the work has consisted of the following:

1. Development of key informant interview list
2. Overview of relevant literature (generally less than 7 years old)
3. Development of data requests
4. Conducting interviews with KCDMSD partners
5. Conducting national and county-based interviews
6. Regular team brainstorming regarding findings, information gaps, and recommendations
7. Review of draft findings with KCDMSD leaders and partners
8. Development of final report and recommendations

Expertise from a broad range of interviewees has been tapped for the study, including national institutions such as Kenya Agricultural and Livestock Research Organizations (KALRO) and Kenya Plant Health Inspectorate Services (KEPHIS), county based agricultural officials, leading experts including other donor programs, and a wide range of private sector market actors, ranging from input supply companies to input users. The list of literature reviewed is included in Annex 1. The list of interviewees contributing to the study is included in Annex 2.

INTRODUCTION

Pasture and fodder (P&F) crops for dairy animals come in many forms and varieties. Some crops and varieties are locally bred and produced, while others are imported after being officially released in Kenya. Some are unable to be produced in Kenya (e.g. *Brachiaria* seeds) due to photosensitivity challenges given Kenya's location close to the equator, while others cannot be produced locally due to owner concerns about intellectual property rights. Some can be hand sown and harvested repeatedly for up to ten years, or more, while others are shrubs and bushes that will last indefinitely if managed properly. Some are mere fillers for cattle, consisting mostly of carbohydrates, while others contain significant levels of proteins and nutrients. Some are excellent for producing dried animal feed such as hay, to provide food during the dry seasons, while other must be foraged live.

A key thread connecting this great diversity is farmer choice. Farmers will choose pasture and fodder crops based on the size of their herd, the purpose and hopes for their herd, the size and other uses of their land, their specific agro ecology, whether they are exposed to advice on how to plant and use it properly, other P&F options available to them, cost, experience, and the other activities on the farm.

At present, the formal sector for planting material for pasture and fodder crops in Kenya can best be described, hopefully, as emerging. There are low volumes of certified seed. Imported seed is expensive and packaged in large expensive pack-sizes¹, and still insufficient to meet demand. Farmer knowledge about their options, and the suitability of their options, is low. Many farmers learn about pasture and fodder options through informal networks or donor project-based activities. There is little local private sector production of pasture and fodder crops, with most production being done by parastatals. Yet, demand is very high.

¹ Many of the fodder crops are sold in minimum 1 kg pack sizes for KES 4,000 or above. Additionally, many farmers do not need a whole kg of seed to start planting fodder on their land and would not plant on the area that can be used with a whole kg. As such, commercial fodder seed is only bought by large commercial farmers and/or NGOs and as such is out of the reach of emerging small-holder farmers. If seed was sold in packets of 50 g or 100 g for KES 200 or KES 400, this would overcome the barriers for many farmers to plant. The benefit and challenge of this is that once they have accessed the seed on a small area, they can often expand on their own. As such, KES 200 could be sufficient to grow into a significant area of fodder. However, the same benefit means that for the private-sector seed companies, selling in smaller pack sizes may not lead to graduation to larger pack sizes and greater sales.

SUMMARY OF KEY FINDINGS

As background, it is helpful to understand the language related to P&F crops, in addition to the legal status of P&F varieties. P&F crops fall into the following broad categories:

Table 1: Overview of pasture and fodder crops

Category	Examples	Comments	Local or Imported
Fodder crops	Sorghum, maize, oats, sweet potato vines, yams, and pigeon pea	Can be bred for fodder or can be dual purpose. Seed is primary source of planting material except for sweet potato (vines) and yams (seed yams)	Local, imported
Pasture lays	Boma Rhodes, Brachiaria, and Seteria	Certified seed is primary source of planting material	Local, imported
Fodder grasses	Napier, Brachiaria, Maasai love grass, horse tail grass, panicum maximum (guinea grass), African foxtail, kikuyu grass, and enteropogon macrostachyus (Rye grass)	Propagated via seeds and splits.	Local, imported
Fodder Legumes	Lucernes, Desmodium, Sweet lupins, dolichos, Stylosanthes guyanensis, and Purple vetch	Certified seed and cuttings is primary source of planting material	Imported
Fodder trees and shrubs	leucaena leucocephala, sesbania sesban Leucaena trichandra, tree Lucerne, and calliandra calothyrsus	Non-certified seed and seedlings are primary sources of planting material	Local
Byproducts	Rice husks, sugar cane tops, cassava leaves, wheat germ, maize bran, and sunflower cake	Availability and use will be specific to counties focusing on underlying crop	Local
Scavenged grasses and shrubs	Forest grasses and shrubs	Gathered by livestock owner	Local
Others	Banana leaves and stock	Availability and use will be specific to counties focusing on underlying crop	Local

Source: Agri Experience compilation from interviewees, literature

P&F crops that are propagated as seed are required to be formally released, and production subsequently regulated, by KEPHIS. A total of approximately 45 P&F crop varieties have been released in Kenya (compared to over 250 varieties of maize.) Eighteen of these varieties have been released in the last 12 years, with 11 of the 18 in the last six years. A full list of the P&F varieties that have been released is provided in Annex 3.

A. What are the key feed and fodder crops suitable for dairy producers in these locations?

The crops currently preferred by smallholder farmers (SHF) in the target counties are:

Table 2: Pasture and fodder crops preferred by smallholders

County	Current Preferred P&F Crop(s)	Small Holder Farmer Benefit	Varieties Preferred
Eastern Region			
Kitui	Grasses, Sweet potato vines, Sorghum, Lablab	African fox-tail and Maasai love grass are drought tolerant and suited for grazing and cutting. Sorghum increases animal productivity and can be conserved as hay to be used during dry season but poses a risk of bloat and animal-death if not well-managed, dual purpose crop.	Grasses (African fox-tail (Nthata Kivumbu in Kamba), Maasai love grass or Mbweetwa in Kamba), and Sweet potato (Mungande, KSP 20)
Taita Taveta	Grasses, Sweet potato vines, Sorghum, Lablab	African fox-tail and Maasai love grass are drought tolerant and suited for grazing and cutting. Sorghum increases animal productivity and can be conserved as hay to be used during dry season, dual purpose crop.	Grasses (African fox-tail and Maasai love grass), and Sorghum (E6518, BJ28, E1291)
Makueni	Grasses, sweet potato vines, sorghum, lablab	Guinea and columbus grass is drought tolerant and suited for grazing and cutting. Sorghum increases animal productivity and can be conserved as hay to be used during dry season, dual purpose crop.	Grasses (Guinea grass, Columbus grass), Sorghum (E6518, BJ28, E1291), Sweet potato (Mungande, KSP 20)
Western Region			
Busia	Napier grass, Sweet potato vines, Brachiaria	Napier grass requires small land for growing, sweet potato vines is used for weaning calves	Napier grass (Kakamega 1&2), Sweet potato (Mungande)
Bungoma	Napier grass, Sweet potato vines	Napier grass requires small land for growing, sweet potato vines is used for weaning calves	Napier grass (Kakamega 1&2), Sweet potato (Mungande)
Kakamega	Napier grass, Sweet potato vines, Brachiaria	Napier grass requires small land for growing, sweet potato vines is used for weaning calves	Napier grass (Kakamega 1&2), Sweet potato (Mungande)
Vihiga	Napier grass, Sweet potato vines, Brachiaria	Napier grass requires small land for growing, sweet potato vines is used for weaning calves	Napier grass (Kakamega 1&2), Sweet potato (Mungande)
Nyanza Region			
Kisumu	Sugar Cane tops, Napier grass, Brachiaria	Farmers use sugar cane tops as fillers after harvesting by adding molasses and feeding to cattle, napier grass requires small land for growing	Napier grass (Kakamega 1&2)

County	Current Preferred P&F Crop(s)	Small Holder Farmer Benefit	Varieties Preferred
Migori	Napier grass, Sesbania, Leucaena	Napier grass requires small land for growing while sesbania and leucaena have high protein content and are drought tolerant	Napier grass (Kakamega 1&2)
Siaya	Napier grass, Brachiaria	Requires small land for growing	Napier grass (South Africa, Ouma 1&2)
Homabay	Napier grass, Brachiaria	Requires small land for growing	Napier grass (South Africa, Ouma 1&2)
Kisii	Napier grass, calliandra	Napier grass requires small land for growing, calliandra improves soil fertility and provide fodder for cattle	Napier grass (South Africa)

Source: Interviewees and ILRI FEAST county reports

All crops but sugar cane (tops) and rice (husks) are suitable for production in all counties, although suitability does vary. It is important to also recognize that not all areas in each county are suitable for production of planting materials. Suitability of various crops for target counties and a summary of special attributes are presented in Table 3, below. Climate smart varieties are also noted.

Table 3: Special attributes of, and target counties for, pasture and fodder crops

Category	Crop	Special Attributes	Potential Target Counties	Climate Smart Varieties
Fodder Crop	Fodder Sorghum	Wide adaptability, dual purpose, red seed resistant to bird damage, high quality forage	All 12 counties	E6518, BJ28, E1291, Ikinyaluka
Fodder Crop	Cassava leaves	Good for weaning calves	All 12 counties	
Fodder Crop	Sweet Potato vines	Good for weaning calves	All 12 counties	Kenspot -4, Mungande, KSP 20, Saliboro, SPK 013 among others.
Fodder Crop	Sugar Cane tops	Used as fillers by most dairy farmers when they harvest their cane. Has no nutritional value.	Migori, Kisumu, Kakamega, and Bungoma	
Fodder Crop	Fodder Maize	Good tolerance to MSV, GLS and Blight, strong green stems at harvest for use as cattle fodder	All 12 counties	KH 500-43A, Pan 691, DKC 8990,
Fodder Crop	Napier Grass	High protein content of 9%, requires small space to be grown	All 12 counties	South Africa, Ouma 1 & 2, Kakamega 1&2
Fodder Crop	Desmodium	High crude protein levels, rich in minerals and vitamins, improve soil fertility through nitrogen fixation, stop striga weed growth on farms	All 12 counties	Green Leaf, Silver Leaf
Fodder Crop	Rice husk	Used as fillers by most dairy farmers. Has little nutritional value	Kisumu (Ahero)	

Category	Crop	Special Attributes	Potential Target Counties	Climate Smart Varieties
Fodder Crop	Yams	Good for weaning calves	All 12 counties	
Fodder Crop	Pigeon Peas	Good for weaning calves	Kitui and Makueni	
Fodder Crop	Oats	Suitable for forage and grain milling, tolerant to stem rust	All 12 Counties	3 varieties (Kenya Seed)
Fodder Legumes	Lucerne	Very palatable, nutritious and can sustain high milk production levels when fed to dairy cattle, can last up to four years under good management. However, it is difficult to establish – especially on acidic soils that are prevalent in the target Counties.	All 12 counties	
Fodder Trees	Calliandra calothyrsus, Leucaena leuco- cephal, Sesbania	Leaves from these nitrogen-fixing trees provide high-protein supplement to fodder. Many of these fodder trees can make productive use of hedge space if well managed. Deep roots mean they can continue providing high-protein fodder into the dry season. Used for reforestation, provides soil stabilization on sloping sites, and provides useful high-quality fodder for livestock.	All 12 counties	Leucaena leucocephala, Sesbania sesban
Pasture Lays	Rhodes Grass	High seed and forage yield, wide adaptation. Easy to manage	All 12 counties	Boma Rhodes, Elmba Rhodes, and Mbarara Rhodes
Pasture Lays	Setaria	Drought tolerant and good forage.	All 12 counties	Nandi setaria, Nasiwa Setaria, and Colored guinea
Pasture Lays	Grasses	Good for producing hay	All 12 counties	Horse tail grass, Maasai love grass, African Foxtail, Panicum maximum
Pasture Lays	Brachiaria	An apomictic hybrid Brachiaria grass, high tolerance to drought and acidic and low-fertility soils. Can maintain over 83% soil cover even four years after establishment, high regrowth capacity and good tolerance to water logging, highly nutritional quality fodder and has good qualities for preservation in form of hay.	All 12 counties, although evidence shows it struggles in the drier parts of Kitui and Makueni	Cayman, Cobra, Mulato II, Crescent Sunn, Piata, Xaraes, and Basilisk

Source: Interviewees and KEPHIS variety release list

All the target counties offer potential for dairy activity and thus will require feed for dairy cattle. However, in each county the areas suitable for dairy activities are not necessarily the areas suitable for producing planting material for P&F crops. As a result, and depending upon the economics of dairy planting material production and the land available to do it, certain dairy feed crops such as Boma Rhodes may need to be sourced from a suitable production region outside the county if there is local farmer demand. Other dairy feed crops, such as napier grass, can generally be produced locally on farms along borders and as dividers. Suitable crops for each county will generally vary based on what is most preferred, as farmer preferences often go well beyond what is merely suitable, encompassing factors such as price/cost, labor required to maintain crop, and if the off taker will pay for the increased milk quality driven by higher quality feed.

B. What are the current and potential sources of supply for seed/planting materials?

The sources of supply for seed and other planting materials are fragmented. There is no established company with a strong primary focus on pasture and fodder crops, and most private sector companies offer only a few varieties of a single crop. There are some parastatals that also sell seed and planting material, with Kenya Seed Company and KALRO being the foremost. A significant number of the newer, more exciting varieties are imported, and there are several additional varieties in the release pipeline. Table 4 summarizes the formal sector providers of P&F planting material, both locally produced as well as imported, and notes what is in the pipeline for the companies. To be classified as a formal sector provider, the seed company must be registered with KEPHIS, or with Kenya's Horticultural Crops Directorate (HCD) for trees and seedlings and all applicable certification requirements must be met.

In addition to the varieties listed below, some farmers have favorite varieties of maize, sorghum or other staple crops that they are using for animal feed. While coming from the formal sector, these varieties may not, however, have been bred as fodder or even dual-purpose crops and are thus not listed below.

Table 4: Formal sources of currently available and pipeline varieties

Seed Company	P&F varieties Locally Produced	Varieties Imported	What's in the Pipeline (Number in brackets are # of varieties)
Kenya Seed	Boma Rhodes, Elmba grass, Nandi Seteria, Nasiwa Seteria, Narok Seteria, Colored Guinea, Columbus grass, Sudan grass, Pokot Rhodes, Makueni guinea, oats, Baffel grass, Maasai love grass, Congo signal	Desmondium, Lucerne,	Soya beans,
Advantage Seed		Brachiaria, Desmondium	Panicum maximum cv Mombasa, Brachiaria hybrid cv GP3025, Brachiaria hybrid cv GP0465
Simlaw Seed	Desmodium (possibly others)	Greenleaf	
Hygrotech		Lucerne	
Western Seed	Maize (WH 505)		
Pannar/Pioneer	Maize (P3253, 30G19, P3812, PAN 691, PAN 14 (yellow))		Maize (PAN 12 (yellow) and 30B50 (yellow)), Sorghum (Silage King)

Seed Company	P&F varieties Locally Produced	Varieties Imported	What's in the Pipeline (Number in brackets are # of varieties)
KALRO Seed Unit	Napier grass (Ouma I&2, South Africa Kakamega I&2), Sorghum,	Brachiaria (Mulato II, Xares)	Sweet Potato (3), Brachiaria (3), Range grass (2)
Advanta Seed	Fodder Sorghum		
Egerton University	Boma Rhodes		
Kenya Highland Seed		Lucerne (Sugar graze, Nutri-Feed)	Lucerne (3)
Leldet Seed	Fodder sorghum (E6518, BJ28, E1291)		
Amiran	Brachiaria	Cayman, Mulato II	
Monsanto	Fodder Maize		
Simlaw		Kikuyu grass	
East African Seed	Silage maize		
VetAgro E.A Ltd	Possible -TBD		
Cooper K. Brand Ltd		Lucerne	

Source: Field interviews and company literature

Some of the planting material producers listed above employ SHF or even large or medium-sized contract growers to produce planting material for them. For example, KALRO Kakamega has developed a sustainable business model based on small scale multipliers in Kakamega, Siaya, Homabay, Busia and Bungoma. Ikinyukia community based organization, a private P&F multiplication organization in Nyahururu, also multiplies for KALRO. In addition to formal sector producers and importers, there are many other producers and/or distributors who are relevant. Table 5 provides a selection of key examples of these entities and their areas of operation. In some cases, the entity produces informally and sells the P&F material, and in other cases they are only distributors. Donor-funded projects are also included. A parastatal entity such as the Rift Valley Institute of Agriculture and Technology produces seed for its own use and sells the excess to farmers. They are not, however, registered as a seed company by KEPHIS.

Table 5: Selected other sources of P&F planting materials

Organization	P&F Varieties Distributed	Counties
Donor funded production and/or distribution		
VI Agroforestry	Calliandra, malberry, leucanea, sesbania, desmodium	Kisumu, Bungoma, Trans Nzoia, Siaya
CIAT in collaboration with Lisha Bora	Brachiaria (Piata, Xaraes, MD4, Basilik)	Bungoma, Kakamega, Busia
ILRI	Brachiaria (Piata, Xaraes, Basilik)	Makueni, Homabay, Siaya
ILRI-supported Village Based Agents (through FIPS) ² and Peer Farmer Trainers (through Heifer International)	Napier grass (South Africa and Ouma-I&H) and Brachiaria (Mulato II)	Homabay, Siaya, Migori, Kisumu, Vihiga, Busia,

² These independent smallholder farmers are not selling. They produce and share with farmers in their villages.

Informal government production and distribution		
Rift Valley Institute of Agriculture and Technology	Boma Rhodes	Nakuru
Informal private sector production and distribution		
Delamare Farm	Boma Rhodes	Naivasha
Ikinyukia CBO	Boma Rhodes, Brachiaria, Desmodium, Oats, and Lucerne	Nyahururu
BAMATO tree nurseries	Tree Lucerne, calliandra, malberry, sesbania, lupin, double bean, and tri-Candria	Nakuru, Busia, Bungoma, and Kakamega
Malika Farm and Association	Brachiaria (Piata, Xares, Basilik)	Makueni, Kirinyaga, Muranga, Machakos, Kitui, and Meru

Source: Agri Experience compilation based on field interviews

It is highly likely that many large farmers provide informal/uncertified P&F seed to other farmers, perhaps even on a barter or non-commercial basis.

Parastatals, primarily Kenya Seed Company/Simlaw and KALRO, play the dominant roles in provision of locally produced planting material for P&F crops with respect to both seed for grasses and cuttings for Napier grass. Private sector companies are, however, increasingly importing seed and are introducing new varieties for official release. Most of these new varieties must be imported, however, due to lack of local production and expertise for production. Private sector companies that have tried local production have often been stymied by out growers' side-selling seed they produce, or otherwise not honoring contracts. This is often a sad side effect of market dynamics where demand significantly outstrips supply.

C. How does availability compare with demand?

For most crops, demand for planting material materially outstrips supply. This is particularly true of Boma Rhodes and Lucerne's, which are growing in importance to farmers. Napier grass continues to be popular, but entities such as KALRO are noted for making significant contributions to supply for SHF. At present, large, and growing, amounts of P&F seed are being imported, which is evidence of the strong demand. Interviewees all agreed that supply was far lower than demand, with estimates of the gap ranging from 40% on the low side (only one respondent) to 300+ percent on the high side. Most respondents estimated that the gap was 200% - 250%. It is important to recognize, however, that when seed and planting material supply becomes regularly available with high quality, past the initial stage of growth, demand rises even further. It is likely that this second wave of demand growth is not being considered, which would push the potential volume even higher. Current volumes of certified seed for P&F crops are low. According to KEPHIS annual reports, the volumes certified were 200, 352, 279 and 184 MT in the years ending 2014, 2015, 2016 and 2017 respectively. Seed for Lucerne, desmodium and brachiaria, and other crops are imported and are not produced locally. Total imports were 27, 25, 55 and 13 MT in the years ending 2014, 2015, 2016 and 2017 respectively. Detailed figures for KEPHIS certified seed are included in Annex 4.

Essentially, demand is still below potential because:

- Farmers have little knowledge or practical experience growing it;
- Seed comes in very expensive large packs for a whole acre; and
- The seed is difficult to access.

By doing demonstrations and effective practical farmers trainings and selling seed in small packs, there is potential to massively increase demand for the 'easy-to-grow' and 'easy-to-establish' fodders.

Some non-governmental organizations (NGOs) and international organizations are creating awareness of new P&F varieties. For example, ILRI, FIPs, AVCD and ICIPE are promoting new varieties of Napier grass, Brachiaria and to some extent Desmodium to farmers in the western Kenya region.

With activities such as these, demand is likely to grow further. A senior P&F scientist from KALRO estimated that unmet demand for napier grass is approximately four times current supply. Volume information from private sector players is not easy to obtain. However, Table 6 below illustrates some of the volumes, both public and private, that were conveyed by interviewees.

Table 6: Examples of private and parastatal production volumes

Company	Crop	Production Volume (Year)	Sales	Estimated Demand
KALRO	Napier Grass	500 tons	500 tons	4,000 tons
Company A	Fodder Sorghum	10-15 tons	10 tons	
Company A	Boma Rhodes		50,000 bales	
Company B	Brachiaria	Imported 2-3 MT		4-6 tons
Company C	Oats	50 tons	50 tons	300 tons
Company C	Guinea grass	100 tons	100 tons	300 tons

Source: Agri Experience interviews

To put these volumes in context, it is important to understand planting and refreshing rates, such as those provided in Table 7, below. Many P&F crops do not need to be replanted for many years, if managed properly. However, many (and perhaps most) SHF do not understand how to manage these crops and therefore view the initial investment in planting material as very expensive.

Table 7: Planting and refreshing rates for P&F crops

Crop	Planting Rate (per acre)	Yield (per acre)	Refreshing Rate (Seasons)
Sorghum	2 Kg	0.5 tons	4
Rhodes	4 Kg	300 bales	5
Napier Grass	5000 cuttings	15 tons	More than 10 years so long as you add fertilizer
Brachiaria	3 Kg ³	20 tons	5
Sweet potato	11,000 vines	10 tons	3

Source: Agri Experience interviews and literature review

The supply situation is complicated by the fact that frequently locally produced certified seed for popular grasses such as Boma Rhodes is of low quality and does not establish well due to low germination. Germination rates for grasses are also low, relative to other types of certified seed. The KEPHIS minimum standard germination rate for popular grasses such as Boma Rhodes and Seteria is 50% compared to popular pasture legumes such as Lucerne and Desmodium that have a minimum standard germination rate of 75% and 70% respectively as outlined in Table 8. In addition, grass seed has a minimum purity standard of 40%, which when combined with the minimum germination gives another KEPHIS measure of Pure Germinating Seed (PGS). The standard for this is 20%.

³ Direct seeding. Less if planted in nurseries and transplanted.

Table 8: KEPHIS quality standards for P&F crops

Species	Minimum purity % by weight	Minimum germination %	PGS %
Grasses			
Blue stem grass	40	50	20
Buffel grass	40	50	20
Cock's foot	40	50	20
Paspalum	40	50	20
Rye grass	40	50	20
Seteria	40	50	20
Rhodes	40	50	20
Sudan grass	40	50	20
Congo signal	40	50	20
Columbus	40	50	20
Love grass	40	50	20
Bermuda grass	40	50	20
Pasture Legumes			
Centro	98	55	
Stylo	97	65	
Desmodium	95	70	
Clover	98	75	
Lucerne	98	75	
Siratro	98	80	
Glycine	97	70	

Source: KEPHIS

Upward pressure on demand comes from increasing farmer awareness of the importance of quality feed for dairy herd production, and Kenya's growth as a recognized hub for dairy production. Demand in the longer term, however, may fall off as more dairy feed producers have established crop bases on their farms, and will then only need to refresh the planting material on a periodic basis. This dynamic is still in the somewhat distant future, and in the near to medium term it is expected that demand will continue to grow strongly.

D. What are the critical constraints in supply of this planting material?

For locally produced seed, solid examples of formal, private sector seed companies that are profitably producing meaningful volumes of seed are very scarce. Most formal sector entities selling certified seed for P&F crops are either parastatals, or private companies importing the seed. From a regulatory perspective, all fodder leys, fodder legumes, and fodder crops belong to Schedule II of the regulations, which means they must undergo compulsory certification. This can be costly for producers, and push potential formal sector production entities into the realm of informal production.

The critical constraints to supply of planting material include:

1. Low private sector investment in the sector, at least partially due to high regulatory costs and subsidized public-sector competition.
2. Lack of adherence to contractual seed production obligations by out growers, driven by large demand/ready market, and possibly unscrupulous behavior by certain market actors.

3. Certification costs for P&F seed, which drive producer interest in informal, rather than formal, production and distribution systems. (Note that seed for P&F crops is legally required to be certified if it is to be sold as seed).
4. Potentially slow variety release by KEPHIS, as there are reports of lengthy delays in getting valid test data from national performance trials, and lack of comparable standards for some varieties against which KEPHIS can measure the proposed variety. (I.e., if a type of variety is new to Kenya – and there are examples of this as the P&F market is expanding and companies are sourcing varieties from countries such as Brazil and Australia – KEPHIS does not have comparable historical data against which to compare the variety).
5. Over-reliance on KALRO for certain planting material. For example, KALRO is the main source for planting material such as napier grass yet has capacity constraints. In addition, many farmers do not have easy access to the relevant KALRO centers. KALRO has 47 subcenters that are not evenly distributed within the 47 counties. Some counties have no KALRO center and must rely on KALRO centers from other counties, particularly for specific crops. For example, farmers from Vihiga, Bungoma and Busia counties must rely on KALRO-Kakamega for P&F materials. Furthermore, many of the KALRO centres do not have the most appropriate varieties available, and may not have the capacity to produce.
6. Overly strict rules for importing seed, as reported by private sector companies. For example, one company manager stated that KEPHIS requires that a letter is provided stating that the source country has never experienced any of the diseases of concern in Kenya. According to this interviewee, other countries simply require a letter stating that: 1) the specific location in which the seed was produced had never experienced the disease, not the entire country; or that 2) the country had not experienced the disease for a specified number of years, versus “ever experienced the disease”.
7. Serious lack of breeder and/or other early generation seed for some varieties, such as Nandi Seteria and Guatemala grass. The few companies that do produce seed locally, such as Kenya Seed, cite lack of adequate amounts of breeder seed as a constraint. This would also serve to discourage new producers from investing in the sector.
8. Recent changes in KEPHIS regulations which make seed more expensive to produce. KEPHIS revised regulations now mandate that P&F seed cannot be certified beyond the second generation (it was previously the fourth generation). This is a challenge generally, but specifically because pasture seed, especially grasses, begins to produce higher yields from the second generation on.
9. Expensive lab fees which impact import costs. According to private sector players, lab test costs for seed importation are very expensive and can run as high as USD \$1,000. In addition, it can be if three weeks before results are released. Importation paperwork can take up to 40 days.
10. Relatively low agro dealer interest, until demand is assured. Many agro dealers are unwilling to carry P&F seed due to its sensitive nature (can be very susceptible to degradation while in storage), large-pack sizes, unstable SHF demand, and the high cost to customers, especially for P&F grasses. Given this, it is likely that the lower quality/less stable seed may end up at agro dealers. Ideally, carryover seed must be returned to the seed company for proper storage at the end of each season. Many large producers can afford to, and do, buy P&F seed directly from the seed company, thus circumventing the agro dealer. SHF generally do not have this option though.
11. High cost and significant logistical challenges of transporting bulky and perishable materials such as splits, vines and seedlings, which particularly impacts affordability for SHF.

12. Low farmer awareness of best suited options, where to source material and how to manage material. SHF are often not aware of various types of P&F planting materials, where to get them, and how to maintain them once established. This may be worse in some counties than others, particularly counties where dairy value chain work has never been undertaken.
13. Lack of appropriate pack sizes of seed for small-holder farmers to access seed to plant on a small portion of their land (e.g. 0.1 acre).

P&F seed also tends to be expensive, and some of it (e.g. Brachiaria) is very expensive. Table 9 provides current prices for various vendors and products.

Table 9: Prices of planting material from selected providers

Seed Company	Price of seed per 1Kg bag		Price of cuttings and Splits
	Crop (Seed)	1 kg	
Kenya Highland Seed	Lucerne	2,500	
Kenya Seed	Boma Rhodes	600	
KALRO Seed Unit	Sweet potato vines		1000 KES per 90Kg bag of vines
Advantage Seed	Brachiaria	4,000	
KALRO Seed Unit	Napier grass		10 KES per cane
Leldet	Fodder sorghum	300 (2Kg)	
Kenya Seed	Desmodium	4,000	
KALRO	Desmodium		KES 2-3 / Vine

Source: Agri Experience interviews and company literature

E. How effective are the distribution channels for the seed?

The main distribution channels, and their pros and cons, are outlined below.

Table 10: Main distribution channels for P&F planting material

Distribution channel	Crops handled	Pros	Cons
KALRO centers and universities	Napier grass and Desmodium,	Lower cost to farmers, generally good quality, some production infrastructure, technically trained staff, knowledge about new varieties, can do large volumes for some crops (e.g. napier grass), can often easily scale production with additional investment as land and expertise are already available	Transport costs for SHF can be high, may crowd out private sector scaling if business model is viable, not clear if KEPHIS certifies or is done internally, many farmers do not know what is available through KALRO/universities, capacity of production location can be limited
Private and public seed companies - direct	Boma Rhodes, Lucerne, desmodium, Brachiaria, and Seteria.	Seed is certified by KEPHIS, have processes for importing, will introduce new varieties, will sell direct to large buyers, may sell through agro dealers, aware of quality control practices, will invest in marketing/online catalogues, may provide extension/farmer training	Contractual obligations by contract growers not always honored which creates unstable supply, best seed may go direct to large buyers, Pack sizes are not appropriate for new-entrant smallholder farmers.
Public and private seed companies through agro-dealers	Boma Rhodes, fodder sorghum, maize for silage and dual-purpose maize	Expands reach to SHF, agro dealers also have potential to provide SHF training/extension, KEPHIS labels provide authentication mechanism, SHF can complain if quality is poor, can introduce new varieties	Seed may deteriorate while held at agro dealer, agro dealers may unknowingly receive low quality seed, package size may be large/too expensive for SHF, demand is unstable so agro dealers do not have incentive to stock, very few varieties available through agro dealers. Pack sizes are not appropriate.
Large and medium sized commercial nurseries	All that are sold as seedlings/splits/vines/cuttings	Have capacity to produce decent volumes, can ramp up production quickly if needed, can establish outreach to farmers if needed via current customer base	Little access to formal sector planting material for propagation, most likely will only produce seedlings upon demand, many not do much marketing or outreach
Roadside commercial nurseries	All that are sold as seedlings/splits/vines/cuttings	Close to farmers, cost effective, can help to spread awareness via word of mouth with current customers	Little quality control, little access to formal sector planting material for propagation
Prisons	Varies by prison	May be a cost-effective production route due to subsidized land and labor	May not be accessible to most SHF. May serve primarily as contract producers; not clear where planting materials go.

Distribution channel	Crops handled	Pros	Cons
Other parastatals such as Agricultural Training Centers (ATCs)	All that are sold as seedlings/splits/vines/cuttings	Low cost to farmers, generally good quality, technically trained staff, can often easily scale production with additional investment as land and expertise are already available	Transport costs for SHF can be high, may crowd out private sector scaling if business model is viable, not clear if KEPHIS certifies or is done internally, many farmers do not know what is available through ATC's, capacity of production location can be limited
Informal trading	All	Very cost effective	May not be legal if sold and sold as seed, no formal quality control (although informal quality control may be good, depending upon expertise of producer)
Farmer recycling	All that can be recycled/propagated	Very cost effective for farmer	May not last through dry cycle, farmer may not know how to maintain crop properly, farmer may maintain crop past useful life but never refresh, crop may become diseased (e.g. sweet potato vines)
County and NGO initiatives	All that are sold as seedlings/splits/vines/cuttings	Lower cost to farmers, may introduce planting material for new crops/varieties. May be paired with extension support. Can help to create demand for varieties.	Not sustainable. undercuts sustainability of established private sector efforts, if any

Source: Agri Experience compilation based on interviews

As can be seen via the complexity of the above chart, it is not possible to generalize about the effectiveness of various channels. However, more planting material needs to be distributed more cost effectively to more farmers. In addition, it is critical that farmers are taught how to maintain and/or multiply healthy planting material on their own farms, as this is undeniably the most efficient “distribution channel.” Sustainable market approaches will offer greater coverage, innovation, and growth potential than government or aid project approaches. Given this, the importance of understanding private sector economics for production and sale of P&F planting material cannot be understated.

F. What needs to be done to solve constraints in the supply chain with respect to availability, distribution, price, affordability, and quality control?

As outlined above, the distribution channels for planting material for P&F crops are:

- Highly fragmented;
- Very dependent upon networking and word of mouth for farmer awareness;
- An historical and opportunistic mix with respect to public versus private participation that may no longer maximize efficiency and scale;
- Frequently not geographically convenient for SHF;
- Frequently supplied in pack-sizes that are too large and too expensive for needs of most SHFs; and
- Often characterized by SHF lack of awareness of planting material options, where to get them, and how to maintain them.

Marrying the above dynamics with the following realities, there are few silver bullet answers to questions about solving constraints with respect to availability, distribution, price and quality control.

- Agroecological suitability for P&F crops will vary by county, and by location within counties.
- Production sources, and types of planting materials, are extremely varied.

- Demand is higher than supply, meaning that producers tend to sell through the easiest and most profitable channels. These channels are not likely to be the best channels for SHF.
- Additional demand could be created through effective promotion and appropriate pack-sizes;
- Formal competition in the sector, which typically drives innovation and quality improvements, is low; parastatal presence is high.
- KEPHIS is most likely not sufficiently well resourced to escalate certification efforts if volume grows significantly. Many inspectors are close to retirement age, and the current KEPHIS efforts to license and authorize non-KEPHIS inspectors do not appear to have impacted pasture and fodder companies, except for Kenya Seed Company.

Despite this, there are some clear paths forward:

1. **Constraint: low private sector investment due to potentially sub-optimal mix of public and private involvement in the sector** Both public and private sector entities are involved in pasture and fodder crops, with public sector entities (KALRO, Kenya Seed Company, KEFRI, ATCs, universities, prisons, etc.) frequently competing with private sector entrants, both current and potential. To some extent, NGOs also often play a similar competitive role. Local formal private sector production of F&P crops is low. To fully understand this dynamic, and the implications of it for Kenya's dairy sector, public and private volumes of locally produced P&F planting material should be estimated and mapped, and a joint public/private strategy developed for significant scaling and expansion of planting material volumes and distribution locations. This exercise should focus on value-adding market actors and long-term sustainability.
2. **Constraint: Lack of profitability deters private sector involvement in supply of certain P&F crops** Work with KALRO and other government institutions to shift focus from direct supply to SHF to supply to small and medium entities (SMEs) involved in production and/or distribution of P&F planting materials. Establish and support pathways for KALRO to sustainably continue and grow this work (e.g. licensed distributors of KALRO material.) Consider use of KALRO production expertise in producing non-KALRO varieties under contract. Work with KEPHIS to identify constraints to profitability for local production and importation of seed.
3. **Constraint: Slow release process for new varieties, many of which can be imported almost immediately** Private sector pipeline efforts to get P&F varieties released, both current and prospective future, should be detailed. Opportunities and bottlenecks should be documented. Once done, a collaborative effort with KEPHIS should be undertaken to look at how to accelerate the release of varieties desired by the private sector without compromising KEPHIS standards regarding safety. Due to the extremely low volumes of F&P seed on the market, KEPHIS assessment of yield gains and other agronomic strengths should be dropped by KEPHIS and left to market forces. If a private sector company sees value for customers, the farmers they serve, they should be allowed to either make or lose money on the product, independent of government assessment of yield in specific test locations. (Note that this may require either legal or regulatory changes, but the possibilities should be explored nonetheless.
4. **Constraint: Poor quality of planting material for P&F** Work with KEPHIS to identify challenges in quality control for certified seed, facilitate solutions and sustainability of solutions. Undertake exploration with KEPHIS to see if standard seed certification levels can be used for seed of P&F crops for local use (not exportable). Identify and support nurseries selling seedlings of P&F crops to improve both scale and quality. Support KEPHIS to train and regulate these nurseries using a tiered system of regulation dependent on size of nursery. Look for other training options as well.
5. **Constraint: High demand driving seed company focus on easiest distribution channels, which are often not SHF friendly** Work with seed companies interested in expanding distribution to target counties to support their efforts to establish sustainable SHF demand, and access, in target counties. Sustainable distribution channels such as VBAs and/or agro dealers should be "lubricated" with product availability to build reliable distribution.
6. **Constraint: Pack sizes are inappropriate for most smallholder farmers.** Work with seed companies to produce smaller and lower cost pack sizes that are more affordable and then test these on the market.

7. **Constraint: Sub-optimal agro dealer role in distribution** Pilot agro dealer distribution programs in specific locations, possibly to include vernacular radio for local farmer awareness.

Other promotional tools should be designed, launched and tracked to gauge future SHF demand and demand growth. Package sizes that are affordable to SHF must be a careful consideration in these pilots.

Complementary, but more specific, proposals are included in the section on Recommendations for Market Systems Development, below.

RECOMMENDATIONS FOR MARKET SYSTEM DEVELOPMENT

Due to the complexity of this sector, we present the recommendations below as a starting point for discussion with the KCDMSD team. These recommendations may need to be tweaked or refocused depending upon county-specific, budget, or partner strength realities. There is, however, great upside and potential for improving SHF access to, and knowledge of, P&F planting material options to improve dairy operations. Critical evaluation of the menu of recommendations is an essential next step.

Private sector profitability and enabling environment

1. Develop and promote viable business models for entrepreneurs producing cuttings and splits (e.g. of Napier grass) – There is a shortage of some key varieties that are propagated via cuttings and splits, yet private sector production of them can be very profitable, particularly as unsold material can be fed to animals or dried for sale as feed. Exploration of how to stimulate SHF participation in bulking this material could result in increased farm income, with less market risk, for SHF.
2. Partner with KEPHIS to look at ways to accelerate the release process without compromising the science – Private sector players feel that the release process for varieties with which KEPHIS is not familiar, or which represent totally new technology for Kenya, take a very long time to move through the evaluation process. Tapping additional expertise/specialists, it would be helpful to review these processes with KEPHIS, as more releases will stimulate greater private sector investment. One possible approach is to encourage KEPHIS to utilize and adopt data from, and possibly even participate in, company trials prior to submission for NPT.
3. Work with KEPHIS, to assess possible role of standard seed in P&F crops – Standard seed is certified seed, but only needs to meet post-harvest standards. Many experts feel that there is no reason why P&F seed cannot be certified as standard seed, which would lower costs for seed producers and farmers
4. Support fodder tree and shrub nurseries as part of the general Seedling Nursery support program, if adopted. This recommendation replicates the parallel recommendations about informal seedling nursery training and support to both improve the quantity and quality of planting material, and enter the formal sector via a ladder approach. (See Seedling Nursery Study recommendations.)

Increased farmer awareness in target counties

5. Improve SHF awareness of P&F options, suitability of options, and sources of planting material – Work through available partners such as county extension agents, FIPS, and dairy value chain players to educate SHF in target counties about the choices available to them for P&F planting material, the pros and cons of their choices, crop management practices, and where to source the planting material. Build on FIPS expertise in SHF adoption of P&F crops and the types of demos that are most respected by SHF.

Scaling availability of planting material

6. Scale existing, and support new, private formal sector players Support existing P&F seed companies and producers of other planting material to enter target counties for distribution of seed/planting material of suitable crop varieties. Research, pilot testing, and farmer education would also be required, e.g. for new crops such as Lucerne. Work to identify potential P&F specialty companies (such as exist in other countries) and initiate dialogue for possible support for entry to sector.

7. Identify and support strategic nurseries in key counties to increase availability of seedlings and other vegetatively propagated material This recommendation replicates the parallel recommendation about strategic nurseries in the Value Chain Planting Material and Seedling Nurseries Scoping Studies.
8. Refocus KALRO on supporting businesses that scale P&F planting material rather than supplying most materials directly to SHF. This recommendation replicates the parallel recommendations in the Value Chain Planting Material and Seedling Nurseries Scoping Study.
9. Link more strongly to agro dealers to increase sale of seed for P&F crops Agro dealers in traditional dairy areas stock seed for P&F crops, but in the target counties this is much less likely. With training, promotion support, and some guarantees about being able to return consigned seed, agro dealers may be much more likely to stock certified seed of P&F crops. Training agro dealers so that they, in turn, can train farmers how to manage the crop will be important. In addition, small pack promotions should be aggressively piloted. Agro dealers stocking the seed piloted should be closely linked to FIPS' work so that farmers will have ongoing access to the seed.

Cross-cutting dialogue and information

10. Catalyze new public private thinking about best practices in the P&F sector through joint learning trips – A strong, well-designed public/private learning trip can catalyze great change and inform both private sector actors, policy makers, and regulators of best practices. Focus of such as trip would include: regulatory practices, farmer access to planting materials, private sector investment and the enabling environment, legal frameworks, control of rogue operators, links to breeding institutions, ICT tools employed, and more. Good options include South Africa and possibly Zambia.
11. Develop industry information platform Information about planting material for P&F crops is notoriously hard to collect, and often outdated when found. However, as the industry grows B2B information will become even more critical. Ideally the platform will be housed sustainably at an industry association or service provider. A key element of this type of platform should be mother block locations for breeder seed.

CONCLUSION

Planting material for P&F crops represents a complex tapestry of varieties and types of planting materials, in addition to suitable SHF options, knowledge, and sources. There is enormous opportunity to benefit SHF by supporting greater capacity, transparency, and outreach in the sector.

Succeeding in doing this will, however, rely greatly upon following genuine market systems approaches; non-market systems approaches have been in place for many years but growth has stagnated. Both political will and donor will be needed to change this.

Agri Experience is extremely grateful for the opportunity to work on this important scoping study, and welcomes the opportunity to provide additional input to KCDMSD as needed.

ANNEXES

ANNEX 1: List of the key people who provided responses during in-depth interview sessions

#	Title	Surname	Name	Organization	Location	Position
1	Mr.	Adala	Alex	AD Association	Vihiga	Chairman
2	Hon	Adhanja	Munyendo Ochieng	Siaya County	Siaya	CEC Agriculture
3	Ms.	Atieno	Phoebe	Hub agro dealer	Homabay	Owner/Director
4	Mr.	Charles	Wesonga	Advantage Crops Ltd	Homabay	Director
5	Mr.	Francombe	Peter	Kenya Highland Seed	Nairobi	Director
6	Mr.	Franzel	Steven	ICRAF	Nairobi	
7	Mr.	Juma	Dorant	Siaya County	Siaya	County Crops Officer
8	Mr.	Kamau	Samuel	Hygrotech E. A	Limuru	Marketing Manager
9	Mr.	Karplus	Omry	Amiran	Nairobi	Marketing Manager
10	Mr.	Khamala	Habakkuk	AD Association	Kakamega	Chairman
11	Mr.	Kibet	Simeon	KEPHIS	Nairobi	GM, Quality Assurance
12	Ms.	Kibui	Rachael	Nation Media	Nairobi	Seeds of Gold writer
13	Mr.	Kiduyu	Philip	KEPHIS	Kisumu	Inspector
14	Mr.	Kiruaye	Humphrey	Pioneer	Nairobi	Managing Director
15	Dr	Kisinga	Julius	Hub Agrodealer	Kitui	Owner/Director
16	Mr.	Kuto	Nick	Boit Kapsuwa Farm	Kitale-Tarbo	General Manager
17	Ms	Leakey	Janey	Leldet	Nakuru	Director
18	Dr	Leley	Philip	KALRO	Katamani	Centre Director
19	Dr	Ludikicus	Mokitoi	KALRO	Kakamega	Centre Director
20	Mr.	Lukuyu	Ben	ILRI	Nairobi	Pasture & Fodder Specialist
21	Dr	Lusike	Wasilwa	KALRO	Nairobi	Director, Crop Systems
22	Ms	Lusweti	Rebecca	Bungoma	Bungoma	Deputy Director of Agriculture
23	Ms	Mageto	Nora	Hub Agrodealer	Kisii	Owner/Director
24	Mr.	Maina	Simon	KEPHIS	Nairobi	Head, Seed Certification
24	Mr.	Malemba	Geoffrey	KEPHIS	Kisumu	Regional Coordinator
26	Ms	Marangu	Doreen	Africa Harvest	Nairobi	Project Manager - Sweet potato
27	Mr.	Masinde	Edward	VI Agroforestry	Kitale	Project Manager

#	Title	Surname	Name	Organization	Location	Position
28	Mr.	Matonya	Ken	EAMDA	Nairobi	Technical Officer
29	Mr.	Mbani	Lameck	Hub Agrodealer	Migori	Owner/Director
30	Mr.	Mboloi		Makueni County	Makueni	Chief Officer, Vet
31	Ms	McEwan	Margaret	CIP	Nairobi	Senior Project Manager
32	Ms	McMullin	Stepha	ICRAF	Nairobi	Associate Scientist / Fruits
33	Dr	Mokitoi	Ludikicus	KALRO	Kakamega	Centre Director
34	Mr.	Mueka	Jonah	Malika Grass Growers Association	Makueni	Chairman
35	Mr.	Mukambani	David	Busia County	Busia	Deputy Director of Livestock
36	Hon	Munyendo	Isaac	Siaya County	Siaya	Acting CEC
37	Mr.	Murray	Roberts	RAE Ltd	Baringo	Director
38	Mr.	Muturi		Ikinyukia CBO	Nyahururu	Director
39	Dr	Muyekho	Francis	KALRO	Kakamega	Centre Director & Pasture Breeder
40	Mr.	Mwaluma	Liverson	Hub Agrodealer	Taita Taveta	Owner/Director
41	Ms	Mwangi	Alice	Hub Agrodealer	Nairobi	Owner/Director
42	Hon	Mwangoma	Davis	Taita Taveta County	Wundanyi	CEC Agriculture
43	Mr.	Mwendia	Solomon	CIAT	Nairobi	P&F specialist
44	Mr.	Mzame	Francis	Hub Agrodealer	Taita Taveta	Vice Chair
45	Mr.	Ndegwa	James	Aberdare Technologies	Thika	Agro Services Manager
46	MS	Ndirangu	Teresia	Bungoma County	Bungoma	Crops Officer
47	Mr.	Ngala	Vincent	Hub Agrodealer	Makueni	Owner/Director
48	Ms	Ngao	Margie	Malika Farm	Makueni	Managing Director
49	Ms	Ngarriere	Charles Omondi	Hub Agrodealer	Homabay	Owner/Director
50	Mr.	Nyongesa	Geoffrey	AD Association	Busia	Vice Chair
51	Hon	Nzunga	Lawrence	Makueni County	Makueni	CEC Agriculture
52	Ms	Odhiambo	Beatrice	KEPHIS	Kisumu	Inspector
53	Ms	Odongo	Beatrice	Hub Agrodealer	Kisumu	Owner/Director
54	Mr.	Ogana	Fred	EAMDA	Nairobi	Managing Partner
55	Mr.	Ohmstedt	Uwe	CIAT	Nairobi	Scaling of Feeds & Forage Technologies
56	Mr.	Okelo	John	Hub Agrodealer	Migori	Owner/Director
57	Mr.	Oketch		Kisumu County	Kisumu	County Director of Agriculture

#	Title	Surname	Name	Organization	Location	Position
58	Mr.	Okongo	Zachary	AD Association	Siaya	Chairman
59	Mr.	Ombuna	Darice	Agriculture Training Centre	Kisii	Principal
60	Ms	Omondi	Immaculate	ILRI	Nairobi	M & E Specialist
61	Dr	Ondabu	Naftali	KALRO	Naivasha	Pasture & Fodder breeder
62	Hon	Onzere	Lincoln	Vihiga County	Vihiga	County Director of Agriculture
63	Dr	Peacock	Christie	Sidai	Kajiado	Managing Director
64	Dr	Priest	David	FIPS	Nairobi	Deputy Director
65	Dr	Rao	E. James	ILRI	Nairobi	Agri. Economist
66	Dr	Sheikh	Amin	AD Association	Bungoma	Treasurer
67	Mr.	Shisya	Maurice	KALRO	Kakamega	P & F Technician
68	Mr.	Shiundu	John	Busia County	Busia	M & E Livestock
69	Mr.	Sirma	Hosea	Kenya Seed	Kitale	P&F Specialist
70	Mr.	Soi	Azariah	Kenya Seed	Kitale	Managing Director
71	Mr.	Wahome	Anthony	AD Association	Busia	Chairman
72	Mr.	Wanjala	Mathews Chirasha	Bungoma County	Bungoma	CEC Agriculture
73	Mr.	Wanjala	Sylvanos	Bungoma County	Bungoma	County Agribusiness Officer
74	Ms	Wanjiru	Mary	Bamato Fodder Tree Nurseries	Limuru	Director
75	Mr.	Wekesa	Boniface	AD Association	Bungoma	Chairman
76	Hon	Weya	Sammy	Weya Nurseries	Siaya	Proprietor

Annex 2: Literature reviewed

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Annex 3: Pasture and fodder varieties released in Kenya

Crop	Variety	Characteristics	Owner (s)	Maintainer	Commercializing Company	Year of Release	Production Altitude (MASL)
Fodder Maize (Dual purpose)	WH605	Good tolerance to MSV, GLS and Blight. Strong green stems at harvest that are used as cattle fodder, and good tolerance to low nitrogen	Western Seed	Western Seed	Western Seed	2008	1500 - 2100
Fodder Maize (Dual purpose)	WH404	Good tolerance to MSV, GLS and blight, strong green stems at harvest us as cattle fodder, and good tolerance to low nitrogen	Western Seed	Western Seed	Western Seed	2008	1200-1800
Fodder Maize (Dual purpose)	WH301	Tolerant to maize streak virus, grey leafspot and blight, tolerant to drought and low nitrogen, suitable for green maize	Western Seed	Western Seed	Western Seed	2008	1200-1800
Fodder Maize (Dual purpose)	WH401	Good tolerance to maize streak virus, grey leafspot and blight strong green stem at harvest us as cattle fodder	Western Seed	Western Seed	Western Seed	2010	1500-2000
Fodder Maize (Silage)	PAN 8M-91	Excellent grey leaf spot and rust tolerance, good for silage, prolific	Pannar	Pannar	Pannar	2008	1400-2000
Fodder Sorghum	BJ28	Dual purpose	KALRO	KALRO	Leldet	1978	1750-2300
Fodder Sorghum	E6518	Dual purpose	KALRO	KALRO	Leldet	2000	1750-2300
Fodder Sorghum	E1291	Dual purpose	KALRO	KALRO	Leldet	1978	1750-2300
Fodder Sorghum	Ikinyaluka	High quality forage	KALRO	KALRO		1996	1750-2300
Fodder Sorghum	Sila	Dual Purpose	KALRO	KALRO	AgriSeed	2006	250-1800
Fodder Sorghum	Kibuyu	Wide adaptability, dual purpose, red seed resistant to bird damage	KALRO	KALRO	Leldet	2011	1500-1800

Crop	Variety	Characteristics	Owner (s)	Maintainer	Commercializing Company	Year of Release	Production Altitude (MASL)
Fodder Rice	Kenya Tae	Resistant to both stem rust and yellow rust. Red hard grain with heavy biomass. May be well adopted by farmers who use straw for livestock feed.	KALRO	KALRO	Kenya Seed	2012	1800-2100
Pigeon Pea	Karai	Firewood, ratoons, drought tolerant, nitrogen fixing, soil improving and can be used as cattle fodder	Leldet	Leldet	Leldet	2011	1000-1800
Dolichos Beans	ELDO-KT Maridadi	Good flavor, short cooking time, late maturity, stay green, high forage, spotted seeds	University of Eldoret	University of Eldoret		2015	Central, North Rift, Western
Setaria Grass	Nandiseteria	Drought tolerant, good forage, good persistence (under grazing)	KALRO/ Kenya Seed	KALRO/ Kenya Seed	Kenya Seed	1956	1000-2500
Setaria Grass	Nasiwa setaria	Good persistence (under grazing), drought tolerant, Good forage.	KALRO/ Kenya Seed	KALRO/ Kenya Seed	Kenya Seed	ND	1000-2501
Panicum Grass	Colored Guinea	Good seed yield	KALRO/ Kenya Seed	KALRO/ Kenya Seed	Kenya Seed	1955	50-2000
Lucerne	WL625HQ	Good resistance to both blight and rust diseases	KALRO	KALRO	KALRO	2015	1800-2400
Lucerne	WL414	Good resistance to both blight and rust diseases	KALRO	KALRO	KALRO	2015	1800-2401
Lucerne	KKS9595	Good resistance to blight and moderate resistance to rust	KALRO	KALRO	KALRO	2015	1800-2402
Lucerne	SA Standard	Good resistance to rust	KALRO	KALRO	KALRO	2015	1800-2403
Lucerne	KKS3864	Good resistance to blight and moderate resistance to rust	KALRO	KALRO	KALRO	2015	1800-2404

Crop	Variety	Characteristics	Owner (s)	Maintainer	Commercializing Company	Year of Release	Production Altitude (MASL)
Brachiaria	Cayman	An apomictic hybrid Brachiaria grass, high tolerance to drought and high persistence and can maintain over 83% soil cover even four years after establishment, high regrowth capacity and good tolerance to waterlogging, highly nutritional quality fodder, has good qualities for preservation in form of hay	Tropical Seed	Tropical Seed	Advantage seeds	2016	Does well in regions experiencing 500 mm rain fall
Brachiaria	Cobra	Apomictic hybrid Brachiaria grass, high tolerance to drought, fast growing/maturing, erect growth habit with well-defined tussocks, which is ideal for cut-and-carry systems, it also has good persistence, has good qualities for preservation in form of hay and silage	Tropical Seed	Tropical Seed	Advantage seeds	2016	Does well in regions experiencing 500 mm rain fall
Brachiaria	Mulato II	It is an apomictic hybrid, high tolerance to drought, good adaptation to acid soils of medium to low fertility, fast growing/maturing, highly palatable and high in nutritional quality for livestock, it is easy to handle as a cut and carry for controlled grazing systems and has good qualities for preservation in form of hay	Tropical Seed	Tropical Seed	Advantage seeds	2016	Does well in regions experiencing 500 mm rain fall
Rhode Grass	Mbarara Rhodes	Drought tolerant Good forage	KALRO/ Kenya Seed	KALRO/ Kenya Seed	KALRO/ Kenya Seed	1960	1000-25000

Crop	Variety	Characteristics	Owner (s)	Maintainer	Commercializing Company	Year of Release	Production Altitude (MASL)
Rhode Grass	Boma Rhodes	High seed and forage yield, wide adaptation, easy to manage	KALRO/ Kenya Seed	KALRO/ Kenya Seed	KALRO/ Kenya Seed	1975	1000-25001
Rhode Grass	Elmba Rhodes	Good seed yield, Good palatability	KALRO/ Kenya Seed	KALRO/ Kenya Seed	KALRO/ Kenya Seed	1976	1000-25002
Sweet Potato	Double	Dual purpose variety: roots for human consumption and vines for livestock. Moderately resistance to SPVD GII	KALRO	KALRO	KALRO	2015	1200-1800

Source: KEPHIS

Annex 4: KEPHIS volumes of certified P&F seed, 2013/14 to 2016/17

Volumes(Kg) of Pasture and Fodder Seed Certified by KEPHIS from 2013 to 2017												
Year	2013/14			2014/15			2015/2016			2016/2017		
Crop Name	Local	Imports	Total	Local	Imports	Total	Local	Imports	Total	Local	Imports	Total
Oats	75,079	0	75,079	277,088	0	277,088	30,732	0	30,732	46,214	0	46,214
Bermuda grass	0	3,578	3,578	0	3,730	3,730	0	3,650	3,650	0	0	0
Clover		80	80			0						0
Crotalaria, Sun hemp	2,025		2,025	248		248				2,948		2,948
Fescue grass	0	0	0	0	450	450	0	3,030	3,030	0	600	600
Festuca	0	1,068	1,068	0	50	50	0	0	0	0	0	0
Ryegrass	0	320	320	0	500	500	0	1,750	1,750	0	2,500	2,500
Lucerne	0	10,250	10,250	0	12,570	12,570	0	20,275	20,275	0	8,300	8,300
Guinea grass	0	0	0	0	20	20	0	0	0	0	0	0
Pasture	97,529	0	97,529	49,482	0	49,482	193,413	0	193,413	121,650	0	121,650
Kikuyu grass	0	3,000	3,000	0	1,725	1,725	0	50	50	0	0	0
Sudan grass	0	2,475	2,475	0	5,000	5,000	0	20,400	20,400	0	0	0
Desmodium	0	5,000	5,000	0	1,025	1,025	0	4,125	4,125	0	1,825	1,825
Lawn grass	0	700	700	0	0	0	0	0	0	0	0	0
Colonia bent grass	0	23	23	0	0	0	0	0	0	0	0	0
Brachiaria		105	105	0	60	60	0	1,600	1,600	0	0	0
Total	174,633	26,599	201,232	326,818	25,130	351,948	224,145	54,880	279,025	170,812	13,225	184,037

Source: Compilation from KEPHIS annual reports

Annex 5: KALRO's input on pasture and fodder crops from the March 21-22 workshop, Naivasha-Kenya

Scoping Activity 3: Planting material/seed for pastures and improved dairy fodder nationally, and in priority counties

1. Pasture and fodder (P&F) crops that are the subject of these answers:
Grasses, Fodder sorghum, Napier grass, Fodder legumes, Fodder trees, Sweet potato vines, Fodder maize, Oats, Lablab, Rice husk, Maize Stover, Sugarcane tops
2. Members of the team providing these answers:
Naftali Ondabu and Ronald Misigo
3. What types of planting material are used for this crop? (seed, seedlings, TC, cuttings, etc.... Be specific)
 - I. **Seed or Splits:** Grasses (Brachiaria) and Fodder legumes
 - II. **Seeds:** Fodder sorghum: Fodder trees, Fodder maize, Oats, Lablab, Rice husks, Maize Stover
 - III. **Cuttings:** Napier grass, Sugarcane
 - IV. **Vines:** Sweet potato vines:
 - V. **Seedlings:** Fodder trees
4. What KALRO varieties have been released and are being produced in Kenya? In what year where they released?

Sorghum: E6518, E1291, Ikinyaruka, BJ30- All released in 2004

Rhodes: ex-tozi (2004), Boma Rhodes (1978)

Can seed be carried over?

Seed for P&F should be sold as fast as possible before the end of one year. Seed cannot be carried over if it is stored under normal room temperature but if it is stored in a cold room with a temperature of -20° c it can be kept for up to 10 years and rejuvenated when needed.

5. Please describe the main production and usage characteristics of your crop(s) of focus. For example: What are the multiplication rates? how often does the planting material need to be refreshed? what are the specific challenges in production? is there an incubation period? or need to shock the seed? etc.

Crop	Variety	Multiplication	Refreshing	challenges	Benefits	Varieties preferred by locals	Preferred for commercial sale	Drought Tolerant
Sorghum	E6518	2kg per acre: 0.5 tons	4 seasons	Inadequate planting materials, Labor intensive, Birds destruction	Increased animal productivity, Conserved as hay and silage to be used during the drought season	yes	Yes	Yes
	BJ30	2kg per acre: 0.5 tons	4 seasons			Yes	Yes	Yes
	E1291	2kg per acre: 0.5 tons	4 seasons			yes	yes	Yes
	Ikinyuruka	2kg per acre: 0.5 tons	4 seasons			yes	yes	Yes
Rhodes	Boma Rhodes	4kg per acre: 300 bales	5 seasons	Lack of breeder seed for multipliers	Conserved as hay, Early maturing and high yielding	yes	Yes	
	Ex-tozi	4kg per acre: 300 bales	5 seasons			Taita Taveta		
Napier Grass	KK1, KK2	5,000 cuttings in an acre: 15 tons of herbage	More than 10 years so long as you add fertilizer	Lack of planting materials, Stunting disease in western Kenya	Grows in a small area using Tumbukiza technology, fast growing	Yes		
Lucerne								

No varieties are exported outside the country because of the low volumes of seed being produced in Kenya. Kenya Seed used to export Boma Rhodes to Uganda but they stopped since they could not meet the demand

6. Which crops and varieties offer the highest potential return for smallholder farmers? Reference specific counties or zones, if needed.

Napier grass: KK1, KK2

Why: High yielding and needs small area to grow

Counties: All target counties

7. Are there high potential opportunities for dairy business growth due to new varieties? If so, what opportunities and which varieties?

There is high potential for dairy business growth due to new varieties of Brachiaria: Xaraes and Piata, and yet to be released drought tolerant varieties- LI, BI, KI

8. When new varieties have entered the system in the last 5 years, where have they come from – local breeding or imports?

- I. *Brachiaria-Imported from Brazil*
- II. *Sorghum-Local breeding*
- III. *Boma Rhodes-Local breeding*

9. How do new varieties enter the system? What are the challenges?

New varieties are Introduced by importation or local breeding and go through mandatory National Performance Trials (NPT) and Distinctiveness, Uniformity and Stability (DUS) testing before being released for commercialization

Challenges:

- KEPHIS is understaffed affecting release programmes
- Climate change,
- Lack of enough testing facilities,
- Expensive fee (1500 dollars per entry) for registration of new varieties for release

10. What new varieties are in the pipeline? Are there good varieties that should be released, but are not?

- I. *Brachiaria: KI, LI, BI undergoing NPT*
- II. *Range Grasses: Entropogon and Maasai love grass undergoing NPT*

11. Could seed/planting material for fodder and pasture crops be produced and sold as standard seed (seed certified to a lower level of quality, most likely only purity and germination)?

- *It should be sold as standard seed certified by KEPHIS*

12. Where do farmers source their planting materials for this crop? (Be specific about varieties if needed)

- **KALRO-Fodder Sorghum, Napier, Sweet potato vines, Desmodium, Caliantra, and Leucaena**
- **Kenya Seed:** Boma Rhodes, Desmodium, and Lucerne
- **Leldet seed Co:** Fodder Sorghum
- **Western Seed Co:** Yellow maize for silage
- **Private entrepreneurs** (KABARNET)

13. Is KALRO selling planting material? If yes, please provide data for at least the last three years on total volume, plus your estimate of the percentage of volume going to smallholder farmers versus larger commercial customers versus NGO projects.

- I. *Boma Rhodes- 3 tons per year totaling to 9 tons in the last three years (this is for KARLO lanet)*
- II. *Sold 3 tons of sorghum seed for the last three years (Approx, one ton/year)*
- III. *70% of the seed is sold to small holder farmers*

NB: this is for KALRO Lanet

14. Where do you hear of agribusinesses sourcing their planting materials for this crop? (Be specific about varieties if needed.)

KALRO and Seed Companies

15. How does availability compare with demand? Please describe the supply/demand equation here: Which is larger? By how much? Why? Is the disparity seasonal?

- I. *Demand: Huge demand for P&F in the target counties.*
- II. *Demand is above 80% and we can only supply 15-20%.*

- III. *Reasons for low supply: Planting materials are produced in smaller quantities due to labor intensive nature of production and high transportation costs.*
 - IV. *Disparity is not seasonal because the production quantity is very low.*
16. What challenges are you aware of related to planting material access (farmer ability to physically find the material)?
- *Poor Infrastructure.*
 - *Distance is long and roads are bad*
17. What challenges are you aware of related to planting material availability (farmer ability to get it every season, when wanted)?
- *Lack of appropriate seed for planting on the onset of the season*
 - *Lack of breeder seed*
 - *Not many people are involved in seed production. They have not seen any potential for business.*
18. What challenges are you aware of related to planting material affordability for farmers?
- *P&F planting materials is expensive to SMH due to poverty level*
19. What are the main quality problems you experience/hear about with planting material for this crop, and how significant do you think these quality problems are for farmers?
- I. *Low germination for Boma Rhodes grass: Processing during harvesting is not properly done by seed producers*
 - II. *Seed companies and agro dealers stock the seed for too long exceeding their shelf life period*
 - III. *Poor post-harvest handling*
 - IV. *Cuttings are affected by soil borne diseases and during dry seasons they don't establish well*
20. What needs to be done to solve constraints in the supply chain with respect to: 1) availability, 2) access (distribution), 3) affordability, and 4) quality of this planting material, as mentioned above?
- I. **Availability:** *More players should avail breeder seed, produce high quantity seed, Improve infrastructure roads,*
 - II. **Distribution:** *informal marketing channels should be improved by training informal multipliers*
 - III. **Affordability:** *Put optimum pricing which is uniform to all farmers and subsidize production of seed*
 - IV. **Quality:** *KEPHIS to supply certification labels promptly, Training of seed/cutting handling and establishing demonstration plots*
21. Of all the potential solutions you have mentioned, what do you think are the most important?
- Availability of breeder seed and more players to be involved in seed production*
22. Is there anything else you want us to know, or that you think is important for the project?
- *There should be a plant policy on P&F cultivation with good agronomic technology to increase the carrying capacity for more cows*
 - *Awareness creation on P&F for farmers to adopt the new varieties*

Annex 6: Selected photographs

Below are several photographs related to the report, selected to provide some visual context for the scoping work.



Photo 1: Brachiaria Xaraes and Basilik nursery at Malika Farm, Makueni



Figure 2: Planted Brachiaria Basilik Splits at Malika Farm, Makueni



Photo 1: Brachiaria Xaraes and Basilik nursery at Malika Farm, Makueni. Photo 2: Calliandra Tree Nursery at Bamato Fodder Tree Nursery, Limuru.
Photo 3: Mary Wanjiru Director of Bamato Fodder Tree Nurseries standing next to Tree Lucerne on her Farm.
Photo 4: Fodder tree seed being sold as informal seed in Limuru

USAID-Kenya Crops and Dairy Market Systems Activity

8th Floor, The Westwood I Vale Close, off Ring Road Parklands

P.O. Box 1181 Village Market

Telephone: +254204241000 | Fax +254203749921

Email: info@kcdmsd.rti.org | Website: www.rti.org

