Integrated & Climate Smart Innovations for Agro-Pastoralist Economies and Landscapes in Kenya's ASAL (ICSIAPL)

Forage Seed Commercialization, Distribution and Adoption by Farmers in Kenya

Authors: J.J.H.M Creemers and F.A Opinya
< ProDairy EA Ltd >

Nairobi, Kenya

Table of Contents

Table of Contents ..... **iii**
List of Figures ..... **iii**
List of Tables ..... **iii**
List of Annexes ..... **iii**
List of Abbreviations and Acronyms ..... **ivv**
SECTION I: INTRODUCTION **1**
1.1 Background 1
1.2 Methodology 1
SECTION II: PRESENTATION OF FINDINGS **3**
2.1 Portfolio of forage seeds 3
2.2 Sales and distribution network 13
2.3 Demand/adoption 17
2.4 Know-how of sales staff, agents/distributors 18
2.5 Regulations 19
2.6 Collaborations and new opportunities 19
SECTION III: RECOMMENDATIONS **23**
REFERENCES **25**
ANNEXES **26**

List of Figures

Figure 1. Forage seed distribution network used by seed companies. 13

List of Tables

Table 1: Forage seed suppliers/stakeholders contacted. 2
Table 2: Inventory of (certified) forage seeds/planting material available in Kenya and suppliers 3
Table 3: Forage seed prices (June 2021), recommended seed rate and estimated yield per acre 6
Table 4. Forage varieties currently in NPT or recently introduced into the market. 9
Table 5. Categorization of forages as viewed important in high potential areas and ASALs. 10
Table 6. Estimated nutritional value for ruminants that can be realised for various forages. 11
Table 7. Proposed interventions to stimulate uptake of certified forage seeds by farmers 20

List of Annexes

Annex 1. Suppliers of vegetatively propagated seed 26

List of Abbreviations and Acronyms

AEZ	Agro Ecological Zone(s)
ASAL	Arid and Semi – Arid Lands
CIAT	Centre for International Tropical Agriculture
CIDP	County Integrated Development Plan
COMESA	Common Market for Eastern and Southern Africa
CP	Crude Protein
CYMMIT	International Maize and Wheat Improvement Centre
DUS	Distinctiveness, Uniformity and Stability
EA	East Africa(n)
ICSIAPL	Climate Smart Innovations for Agro-Pastoralist Economies and Landscapes in Kenya's ASAL
ISTA	International Seed Testing Association
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate
KVDA	Kerio Valley Development Authority
NDF	Neutral Detergent Fibre
NEADAP	Netherlands East Africa Dairy Partnership project
NPT	National Performance Trials
OPV	Open Pollinated Variety
PRA	Pest Risk Analysis
RAE	Rehabilitation of Arid Environments
SNV	Netherlands Development Organization

SECTION I: INTRODUCTION

1.1 Background

The Integrated and Climate Smart Innovations for Agro-Pastoralist Economies and Landscapes in Kenya's ASAL (ICSIAPL) is a project implemented by SNV and KALRO in the Southern rangelands of Kenya, viz. Narok, Kajiado and Taita Taveta Counties. The project is funded by the Netherlands Government (DGIS) and the European Union and runs from 2021 to June 2024.

In 2021, the project conducted forage value chain studies for each County referred to above and a quick scan of forage seed suppliers in Kenya. The latter report gives an inventory of forage seed companies or other suppliers of certified seed, the varieties that are supplied to the market, issues related to regulatory environment (i.e. seed registration and commercialisation), and market development.

In the course of 2023 - and as a follow up to this quick scan - SNV and KALRO in collaboration with CIAT, ILRI and KIT developed a brief with recommendations for policy and operational changes of the regulatory framework for forage seeds, directed to Kenya Plant Health Inspectorate Services (KEPHIS) and the Ministry of Agriculture and Livestock Development. This brief will be published early 2024.

In the same year (2023), ICSIAPL and the Netherlands East Africa Dairy Partnership project (NEADAP) managed by SNV, collaborated to compile a working paper titled: "Getting the Incentives Right": Realising accessibility and affordability of improved and suitable forage seed varieties and a vibrant forage seed sector in East Africa (NEADAP Working Paper, 26th of May 2023). This Working Paper looks at different incentive packages that are - or have been - used across East Africa, to help fast track development of the market for certified seeds (both for food and fodder crops) and enhance vibrancy of the seed-sector. The paper gives an overview of the different support modalities that have been practiced and a tentative assessment of their effectiveness.

Drawing from these different reports, this study interviewed key seed suppliers and other stakeholders in Kenya, on what they consider as best approaches to make (certified) forage seeds available closer to the farmer and spur adoption rate of novel and improved forages at farm level. It also includes the type of support from government, donors and/or development partners that the seed companies consider important and effective. In the next pages the report provides insights in the following aspects of the forage seed sector. Some of the information are derived from earlier reports and updated.

- Forage seed suppliers/research, portfolio, seed costs and seeding rates.
- New forage seed varieties released to the market since 2020 or entered in NPTs.
- Potential for a more vibrant forage seed market.
- Barriers to market growth.
- Market structure (smallholders versus large scale farmers).
- Sales and distribution networks and models.
- Strategies to develop market and increase sales.
- Farmer awareness, adoption rate and demand.
- Know-how of sales staff, agents, distributors.
- Collaboration and areas for support by development partners/donors.

1.2 Methodology

The information in this report was gathered using two interview guides (biased and open-ended) to source relevant information from key experts and stakeholders in the forage sub-sector. The interviews were administered both online and through face-to-face discussions.

The key experts and stakeholders interviewed constituted persons knowledgeable in the forage sector and included forage seed companies and representatives from research organizations as presented in Table 1. below.

This report also borrowed from the earlier reports and studies initiated by ICSIAPL (and partners) as referred to above, and from websites of the seed suppliers interviewed as well as relevant literature. Cross-verification of the data and triangulation of findings from several literature sources was also done with the key informants and compared to previous database of the 2021 study (Creemers *et al.,* 2021), to increase credibility and validity of current results.

Table 1: Forage seed suppliers/stakeholders contacted
(See Annex 1 Vegetatively propagated seed)

	Seed supplier	Head office	Contacts
A.	**SEED COMPANIES**		
1.	Advantage Crops Limited*	Rodi, Homabay County Kenya	0715519922 www.aclseeds.com
2.	Advanta Seeds Africa*	Westlands, Nairobi Kenya	0743478081 www.advantaseeds.com
3.	Amiran Kenya Limited Company	Old North Airport Road, Embakasi Nairobi Kenya	0800720720 www.amirankenya.com
4.	Corteva AgriScience	Riverside Drive, Nairobi Kenya.	+254 0709 142000 www.corteva.co.ke
5.	East African Seed Company / AgriScope / Syova	Dakar Road, Nairobi Kenya	0722207747 / 0734333161 www.easeed.com
6.	Hygrotech East Africa**	Tigoni and Naivasha, Kenya	0202053917 www.hygrotech.co.ke
7.	HyTech Seed Kenya*	Nairobi, Kenya	www.hytechseed.com
8.	Interplant Agriculture EA Limited*	Naivasha, Kenya	+254 729 060 124 www.interplantea.co.ke
9.	JustDiggit**	Nairobi Kenya	www.justdiggit.org
10.	Leldet Seeds**	Rajwera Farm - Nakuru Kenya	0723329393 www.leakeygroups.co.ke
11.	QualiBasic Seed Company*	Nairobi, Kenya	www.qualibasicseed.com
12.	Rehabilitation of Arid Environments Ltd/Trust**	Baringo County Kenya	05351418 / 0721892566 www.raetrust.org
13.	Seedballs Kenya	Nairobi Kenya	0700380009 www.seedballskenya.com
14.	Simlaw Seeds	Nairobi Kenya	020 2215067 www.simlaw.co.ke
15.	U-Farm Holdings Limited*	Westlands, Nairobi Kenya	0719227700 www.ufarm.biz
B.	**RESEARCH INSTITUTES**		
16.	CIAT*	Nairobi Kenya	www@cgiar.org / www.alliancebioversityciat.org
17.	ILRI*	Naivasha Road, Nairobi Kenya	www.ilri.org
18.	KALRO (HQ/Kiboko/Dairy Research Station) *	Nairobi/Kiboko/Naivasha, Kenya	www.kalro.org
C.	**SECTOR ASSOCIATIONS**		
19.	Seed Trade Association of Kenya (STAK)	Nairobi Kenya	+254 020 258 7162 www.stak.or.ke

**List of key informants in the study | **Key informants with additional information on ASAL areas of Kenya*

The discussions focused on the portfolio of forage seeds in Kenya; forage production and underlying dynamics on cost of production; packaging, transport and distribution systems (both forage seeds and the end product, produced forage); pricing of forage in the market, market descriptors including market growth, demand and supply; knowledge of staff and agents; policies and regulation, feed safety, and major constraints and opportunities for commercialization of the forage industry in Kenya.

SECTION II: PRESENTATION OF FINDINGS

This section features responses gathered from the discussion interviews. It is formatted in a question-and-answer manner.

2.1 Portfolio of forage seeds

Q1: What role(s) do you play in the forage seed sector?
[ ] Seed selection [ ] Breeding and/or Multiplication [ ] Seed collection [ ] Importing, repackaging, distribution & marketing [ ] Other: _____

Most forage seed companies in Kenya are involved in importing, repackaging, distribution and marketing. This could be through a partnership arrangement with forage breeders from countries such as Australia, America, Brazil, Egypt, Europe, India, South Africa. There exist seed suppliers that do seed collection and selection, which involves amongst others, buying and collecting forage seeds (as off-takers) from contracted out-growers (like individual farmers, youth and women groups), conducting seed cleaning and germination tests and availing the same in the market for buyers. There are also development partners who initiate projects encouraging farmers to multiply and harvest forage seeds (Rhodes grass, African Foxtail, Desmodium etc) or are involved in landscape restoration in the ASALs encouraging farmers to grow grasses (*C. gayana, C. ciliarias, E. superba, E. macrostachyus*) as pastures and farmer (forage) seed banks (commonly grasses and legumes).

Q2: From your available information materials like website and brochures we learnt that you offer and/or do research on a number of forage seeds and planting materials. Could we once more revisit which ones they are?
The table below is adapted from (Creemers et al., 2021) and updated with information on seed portfolio from the current study but limited to the companies we interviewed.

Table 2: Inventory of (certified) forage seeds/planting material available in Kenya and suppliers

Changes are **bolded and marked ***

Forage Seed Varieties	Seed Supplier
Tropical Grasses	
Cenchrus purpureum (Napier grass)	KALRO DRI/Naivasha/
Cenchrus purpureum variety Juncao (Napier grass)*	**Crevation International***
Hybrid Brachiaria varieties - *Mulato II, Cayman, Cobra, Camello, Sabia*	Advantage Crops, Advanta Seeds, Amiran Kenya Limited, **Simlaw Seeds***, U-Farm, **Interplant Agr. EA**
Cultivar Brachiaria varieties - *Xaeres, Piata, Basilisk, MG4*	KALRO DRI/Naivasha, KALRO Embu, ILRI
Panicum maximum varieties Siambaza/Mombasa,	Advantage Crops, U-Farm, **Interplant Agr. EA***
Panicum maximum variety Gatton (White Buffalo grass)	Hygrotech EA, **Interplant Agr. EA***
Panicum maximum variety Sabanera	**Interplant Agr. EA***
Panicum coloratum (Coloured Guinea Grass)	KALRO Beef/Lanet, KALRO Mariakani
Chloris gayana (Rhodes grass) var. Katambora, Boma, X-Tosi, **Endura***	East African Seeds, Hygrotech EA, Simlaw Seeds, KALRO ARLRI/Kiboko, **Interplant Agr. EA***
Temperate Grasses	
Festuca arundinacea variety Kora, **Paolo, Baroptima, Turf Saver** (Tall Fescue)	Hygrotech EA, **Interplant Agr. EA***
Dactylis glomerata variety Athos, **Adremo** (Cocksfoot)	Hygrotech EA, **Interplant Agr. EA***
Lolium perenne variety Platform, Evens, **Governor*** (Perennial Rye grass)	Advanta Seeds, Hygrotech EA, **Interplant Agr. EA***
Lolium multiflorum variety Impact, Excellent, (Annual Rye grass)	Advanta Seeds, Hygrotech EA

Forage grain crops	
Pennisetum glaucum (Pearl millet) varieties Nutrifeed, **Nutrifast***	Advanta Seeds, East African Seeds, Hygrotech, , **Interplant Agr. EA***
Sorghum drummondii (Forage sorghum) variety Sugar graze variety E6518, E1291	 Advanta Seeds, East African Seeds Leldet Seeds, KALRO/Naivasha, KALRO Lanet
Sorghum vulgare (Sweet sorghum) **Variety Barsweet***	 **Interplant Agr. EA***
Sorghum drummondii (Dual-purpose sorghum) variety Ikinyaruka	KALRO DRI/Naivasha, KALRO Beef/Lanet
Sorghum bicolor variety Sudanese (Sudan grass) variety Kowkandy, **Jumbo, Sweetchoice, Bargrazer***	Advanta Seeds, East African Seeds, Hygrotech EA, Simlaw Seeds, **HyTech Seeds*, Interplant Agr. EA***
Sorghum almum (Columbus grass) *Avena sativa* (Forage Oats)	Simlaw Seeds, Kenya Seed Simlaw Seeds, **Interplant Agr. EA***
Zea mays (Mais) variety ADV 2308 variety Bon bon (Sweet corn) variety H6218 variety PAN14 (Yellow maize) **variety Sweet corn (Yellow maize)***	 Advanta seeds U-Farm Simlaw Seeds Corteva (Pannar Seeds) **HyTech Seeds***
Other forage crops	
Brassica rapa oleifera (Fodder Turnips)	Hygrotech EA, **Interplant Agr. EA***
Raphanus sativus (Fodder Radish)	**Interplant Agr. EA***
Ipomoea batatas variety Mafuta (Sweet potatoes)	KALRO DRI/Naivasha
Beta vulgaris (Fodder/pasture beet)	Simlaw Seeds
Cichorium intybus* variety Commander (Chicory)	**Interplant Agriculture (EA)**
Legumes	
Medicago sativa Lucerne/Alfalfa	Advanta Seeds, **Advantage Crops***, East African Seeds, U-Farm, Hygrotech EA, Simlaw Seeds, Kenya Seed, **Interplant Agr. EA***
Crotalaria juncea (Sunn hemp)	Advantage Crops, U-Farm, Hygrotech EA, **Interplant Agr. EA***
Vicia villosa (Hairy vetch)	U-Farm, **Interplant Agr. EA***
Vicia sativa (Purple Vetch*)*	KALRO DRI/Naivasha, KALRO Ol Joro Orok, Coopers Kenya**, Interplant Agr. EA***
*Desmodium intortum (*Green leaf)	Advantage Crops, East African Seeds, Simlaw Seeds, KALRO Embu, **Interplant Agr. EA***
Trifolium pratense variety Oregon Red, Kenland (Red clover)	Hygrotech EA, KALRO Lanet & Ol Joro Orok, **Interplant Agr. EA***
Trifolium repens variety Klondike, S184 (White clover)	Hygrotech EA, **Interplant Agr. EA***
Trifolium incarnatum variety Kardinal, (Crimson clover)	**Interplant Agr. EA***
Vicia Faba (Faba bean)	**Interplant Agr. EA***
Vigna unguiculata variety M66 (Forage cow pea)	KALRO Katumani
Vigna unguiculata variety Betswit (Forage cow pea)*	**Interplant Agr. EA***
Stizolobium spp (Mucuna/Velvet bean)	KALRO DRI/Naivasha, KALRO Ol Joro Orok
Desmanthus virgatus (Desmanthus)	KALRO DRI/Naivasha
Lablab purpureus variety Rongai (Dolichos bean)	Simlaw Seeds, KALRO Katumani, **Interplant Agr. EA***
Lablab purpureus* variety Highworth (Dolichos bean)	**Interplant Agr. EA***
Lupinus albus	KALRO DRI/Naivasha, Lanet & Ol Joro Orok, **Interplant Agr. EA***
Rangeland grasses	
Cenchrus ciliaris variety Baringo (Buffel grass/African Foxtail)	Rehabilitation of Arid Environments (RAE Trust), Seedballs
Cenchrus ciliaris variety Gayndah (Buffel grass/African Foxtail)	Hygrotech EA

Cenchrus ciliaris var MGD1, TVT3 (Buffel grass/African Foxtail)	KALRO ARLRI/Kiboko
Cenchrus ciliaris variety Molopo, Gayana (Buffel grass/African Foxtail)	**Interplant Agriculture EA***
*Digitaria eriantha v*ariety Irene (Pangola/Smutsfinger grass)	Hygrotech EA**, Interplant Agriculture EA***
Eragrostis superba (Maasai Love grass)	RAE Trust, Seedballs, U-Farm, KALRO Kiboko
Eragrostis curvula variety Ermelo (Weeping Love grass)	**Interplant Agriculture EA***
Eragrostis teff variety Tiffany (Teff)	**Interplant Agriculture EA***
Enteropogon macrostachyus (Bush Rye)	RAE Trust, Seedballs, KALRO ARLRI/Kiboko
Chloris roxburghiana (Horse Tail grass)	KALRO ARLRI/Kiboko
*Sehima nervosum (*Sehima Needle grass)	RAE Trust
Cymbopogon pospischilli (Narrow-leaved Turpentine grass)	RAE Trust
Antephora pubescens variety Wollie (Bottle brush grass)	Hygrotech EA, **Interplant Agriculture EA***
Agro Forestry Trees	
Calliandra calothyrsus (Calliandra)	KALRO Beef/Lanet, KALRO Ol Joro Orok & Embu
Leucaena leucocephala (Leucaena)	KALRO Beef/Lanet, KALRO Ol Joro Orok & Embu
Sesbania sesban (Sesbania)	Seedballs, KALRO Lanet, KALRO Ol Joro Orok
Chamaecytisus palmensis (Tree lucerne)	KALRO Beef/Lanet, KALRO Ol Joro Orok
Rangeland Trees	
Acacia nilotica Acacia Senegal, Acacia tortilis, Acacia xanthopholea, Acacia kirkii.	Seedballs

Q3: Can you give us for these forages the recommended seeding rate per acre or per hectare and the current price per kilogram including Value Added Tax?

The table below shows the forage seeds and recommended seed rate and potential yield per acre. It is adapted and updated from ICSIAPL forage value chain study in 2021 (Creemers et al., 2021). Because of the continuous price changes due to the exchange rate of the Kenyan shilling with the US dollar, the prices are not indicated as this may be misleading

Table 3: Forage seed prices (June 2021), recommended seed rate and estimated yield per acre

Forage seed varieties	Seed rate/plant population per acre*	Estimated yield per acre*****
Tropical Grasses		
Cenchrus purpureum (Napier grass)	1,800-2,000 cuttings	3-5 tonnes per acre/cut
Hybrid Brachiaria		
variety Mulato II	2 kg	
variety Cayman	2 kg	
variety Cobra	2 kg	-
variety Sabia (coated)	4-6 kg	
Panicum maximum varieties Siambaza/Mombasa	2 kg	2.5-3 tonnes per acre/cut
Panicum maximum varieties Sabanera (coated)	2-4 kg	
Panicum coloratum (Coloured Guinea / Small buffalo grass)	2-3 kg	
Chloris gayana (Rhodes grass)		
variety Boma	4 kg	8 tonnes (irrigated)
variety Katambora (uncoated)	2-4 kg	-
variety Katambora (coated)	6-8 kg	
Temperate Grasses (C3 grass, only suitable in high altitude areas with temperate climate)		
Dactylis glomerata variety Athos, Adremo (Cocksfoot**)**	6 kg	
Lolium perenne variety Governor	10 kg	
Lolium multiflorum variety Impact, Excellent (Annual Rye grass)	10-12 kg	6 tonnes (irrigated)
Festuca arundinaceae (Tall Fescue)	10 kg	
Forage grain crops		
Pennisetum glaucum (Pearl millet)	6-10 kg**	30 tonnes
Sorghum drummondii (Forage sorghum)		
variety Sugar graze	5-6 kg	50 tonnes

variety E6518	3- 4 kg	-
Sorghum drummondii (Dual-purpose sorghum) variety Ikinyaruka		
Sorghum vulgare variety Barsweet (Sweet sorghum)	2-10 kg**	
Sorghum bicolor x sudan hybrid (Sudan grass)	4-10 kg **	
variety Kowkandy	10 kg	6 tonnes (irrigated)
Other forage crops		
Brassica rapa oleifera (Fodder Turnips)	1-2 kg	
*Cichorium intybus (*Chicory)	2-4 kg**** / 0.5-1 kg***	
Ipomoea batatas variety Mafuta (Sweet potatoes)	4,500-5,000 vines	-
Raphanus sativus (Fodder Radish)	0.5-1 kg*** /2-3 kg****	
Beta vulgaris (Fodder/pasture beet)	32,000 seeds/acre	8 tonnes (dry matter)
Legumes		
Medicago sativa Lucerne/Alfalfa	6-10 kg	4-8 tonnes (green)
Crotalaria juncea (Sunn hemp)	16-20 kg	3-3.5 tonnes
Vicia villosa (Hairy vetch)	3-5 kg*** /10-12 kg****	2.5 tonnes (pure stand)
Vicia sativa (Purple Vetch*)*	3-5 kg***/10-12 kg****	
*Desmodium intortum (*Green leaf)	4-6 kg***	
Lablab purpureus (Dolichos bean)	6-12 kg	
Lupinus albus	40-50 kg	3-5 tonnes
Trifolium pratense variety Oregon Red, Kenland (Red clover)	1-3kg***	
Trifolium repens variety Klondike, S184 (White clover)	1-3kg***	
Trifolium incarnatum variety Kardinal, (Crimson clover)	1-3kg***	
Vicia Faba (Faba bean)	50-60 kg****	
Vigna unguiculata variety M66 (Forage cow pea)	6-12 kg**	
Rangeland grasses		
Cenchrus ciliaris variety Baringo (Buffel grass/African Foxtail)	10 kg	-
Cenchrus ciliaris variety MGD1, TVT3 (Buffel grass/African Foxtail)	5 kg	-
Cenchrus ciliaris variety Molopo, Gayanda (Buffel grass/African Foxtai*l)*	2-4 kg	
Digitaria eriantha variety Irene (Pangola/Smutsfinger grass)	1.5-3 kg	
Eragrostis superba (Maasai Love grass)	5-10 kg	-
Eragrostis curvula (Weeping Love grass)	2-3 kg	

Eragrostis teff (Teff)	3-10 kg**	
Enteropogon macrostachyus (Needle /Bush Rye grass)	3 kg	-
Chloris roxburghiana (Horse Tail grass)	5 kg	-

* Seed rate in this table are indicative and need to be verified with seed distributor at the time of purchase.

** Seed rate depends on or climatic conditions / irrigation.

*** Seed rate in grass mixtures.

**** Pure stand.

***** Yield per acre is indicative and depends mostly on agronomic practices applied.

Q4: Which forage seed varieties did you introduce to the market in Kenya since 2020?

Majority of the forage seed suppliers have not introduced new forages into the market since 2020. On the one hand they attributed this to the forage market being nascent and uptake/adoption is still increasing. Other companies also attributed this to the bureaucratic processes and high costs incurred in forage seed importation, testing and registration (PRA, DUS and NPT). On the other hand, new varieties have been introduced in the market as summarised in Table 4 below.

Table 4. Forage varieties currently in NPT or recently introduced into the market

Name of seed supplier	Varieties introduced into the market since 2020	(Other) remarks
Advantage Crops Limited	-	Planning to introduce *Medicago sativa* Lucerne/Alfalfa variety ALFAC and *Zea mays* (Mais) – white maize with germplasms from CIMMYT
Hygrotech	*Lolium multiflorum* variety Impact, Excellent, Lolan (Annual Rye grass) *Medicago sativa* Lucerne/Alfalfa variety Supersonic, Iconic and American HL10.	Planning to enter the following forages in the NPT in the next 2 years. Clovers, Vetches, Brachiaria and forage Oats.
HyTech Seeds	*Sorghum bicolor* variety Sudanese (Sudan grass) *Zea mays* (Mais) variety Sweet corn (Yellow maize)	New company incorporated in Kenya in 2020 and began importing forage seeds in 2023.
Interplant Agriculture EA	Rhodes grass (var. Endura) Brachiaria grass hybrids (var Sabia) Forage millet hybrid (var. Nutrifast) Lucerne (var. Bar7) Chicory (var. Commander)	Planning to enter the following forages in the NPT in the next 2 years; Forage sorghum (var. Bar grazer) Sweet sorghum *Panicum maximum* (cv. Sabanera) Dolichos (var. Rongai and Highworth) Cowpeas
QualiBasic Seeds	*Zea mays* (Mais) dual-purpose White maize / Yellow maize)	New company. Their maize seeds are mostly from CYMMIT germplasms.

Q5: Which forage seed varieties are currently in the National Performance Trials and are waiting for registration?

Other than the forage varieties listed in table 4 above, the seed suppliers interviewed have no new forage seed varieties planned to NPT tested. This, they attributed to the high costs involved.
One company has Brachiaria hybrid Camello pending for approval by the Variety Release Committee, the approval which is said to be delayed possibly on grounds that it is not better than existing hybrids, despite having attributes e.g. disease/drought tolerance which make it an interesting choice for areas with less rainfall or longer dry spells.

Q6: Which forage seed varieties are you planning to enter in the National Performance Trials in the next 2 years?

See (other) remarks column in Table 4 above.

Q7: Do you stock any seeds that are in the actual sense food crops but are widely used by farmers as forage crops (maize, sorghum, beans or peas)? If yes, please list the varieties.

The seed companies interviewed also have seeds that in actual sense are food crops but are also used by farmers as forage crops. These include beans and maize (white maize) that are grown for silage making, which have attributes such as high sugar and/or starch content, energy and digestibility, and biomass yield.

Q8: Do you have food crop seeds in the market which were bred as a dual-purpose crop with focus on improved digestibility of the crop residues by livestock? If yes, please name them.

There are those bred and registered on the NCVL as a food crop (Cow peas var. M66, Sweet potato var Mafuta) but promoted as a forage crop. Only one crop was mentioned as a dual-purpose variety as referred to in the question being Sorghum var E1291.

Q9: Give a ranking in importance in terms of uptake, interest and use of the seed varieties used for forage that you are marketing in Kenya, both in high potential dairy areas and in ASALs.

The respondents categorised the following forage varieties as important in the respective agro-ecological zones.

Table 5. Categorization of forages as viewed important in high potential areas and ASALs.

High potential areas	ASALs
Brachiaria hybrids	Brachiaria hybrid var Camello
Panicum maximum var Siambaza, Sabanera	*Panicum maximum* var Siambaza, Sabanera
Cenchrus purpureum (Napier grass)	*Chloris gayana* (Rhodes grass)
Medicago sativa (Lucerne/Alfalfa)	*Cenchrus ciliarias* (African foxtail) *
Chloris gayana (Rhodes grass)	*Eragrostis superba* (Maasai love grass) *
Lolium multiflorum (Annual Rye grass)	*Enteropogon macrostachyus* (Needle grass)
Cenchrus ciliarias (African foxtail) *	Forage Sorghum var. E6518 and E1291
Eragrostis superba (Maasai love grass) *	*Vigna unguiculata* (Cow peas var M66)
Enteropogon macrostachyus (Needle grass)	*Dolichos lablab* (Lab lab bean var Rongai)
Forage Sorghum var. E6518 and E1291	
Vigna unguiculata (Cow peas var M66)	
Dolichos lablab (Lab lab bean var Rongai)	

Q10: What are your main end consumers/target group for these forage seeds? [Smallholder farmers/agro-pastoralists, medium-large scale farmers, ranches, commercial forage producers]?

It was categorical that most seed companies distributing forage seeds for high potential areas are targeting smallholder dairy farmers, often through cooperatives. Medium to large scale farms, ranches and commercial forage producers make direct orders of forage seeds too, but these are few in numbers. Large scale farms have easier access to towns such as Kajiado, Taveta, Voi, Narok in the ASAL areas and Nairobi, Naivasha, Nakuru, Eldoret, Kitale, Njeri, Nanyuki, Meru in the high potential areas. In these urban centres seed distributers and agrovets have a wider range of forage seeds available.

On the same note, companies with forage seeds targeting both high potential and ASALs, mainly sell based on direct orders that meet the company's minimum order threshold (e.g. smallholder, medium and large-scale farmers (in high potential areas), agro pastoralists (dryland farming areas), and through agrovets. Some seed companies have a policy not sell to agrovets due to challenges discussed later in this report.

Q11: In which forms can the listed forages be used and fed? [ ] Hay [ ] Silage [ ] Fresh (includes grazing)/Cut and carry.

The forages discussed within the scope of this study can either be fed directly, i.e. cut and carry or grazed (pastures). Silage and hay are other forms of utilization. When silage is made from grasses and legumes pre-wilting is recommended.

Q12: Which are the most promising forage varieties according to you and why are they promising?

The responses were as follows:

i. Sorghum E6518 –the variety ratoons, yields high biomass and makes good quality silage if harvested and ensiled properly.
ii. Clovers – they improves protein in rations. It needs to be noted clovers can only be cultivated in high potential areas and may require correction of the soil fertility.
iii. Vetches – can adapt better to hotter conditions as compared to clovers but are not suited for ASAL areas.
iv. Grasses namely *Brachiaria grass* hybrids*, Chloris gayana, Panicum maximum and Cenchrus purpureum*. *Cenchrus ciliaris*, *Eragrostis superba*, *Enteropogon macrostachyus* have been in existence but are still considered promising because they are suited to dry areas/period.

Q13: High nutrient density of forage crops is becoming more and more important as farm size (land) is increasingly becoming smaller. Which species in your portfolio, do you consider as being a high nutrient dense forage crop.

Medicago sativa (Lucerne) was mainly mentioned. It is a perennial crop therefore it can be utilised and harvested for several years with several cuttings per year, has high protein content, lower fibre content and high digestibility. In addition, it fixes nitrogen into the soil hence less N-fertilizer is required.

Most interviewees refer to biomass yield or multiple cuts to increase yield per acre. The forage seeds sold are tropical grasses and crude protein is the most referred to nutrient. Nutrient density of protein in tropical grasses depends mostly of stage of harvesting (early- versus late- vegetative).

*Zea mays a*nd forage sorghum can also be considered nutrient-dense; Zea Mays in energy (ME) and Forage sorghum, depending on stage of harvesting in energy and protein (ME, CP). Though we approached different distributors of hybrid seed maize, none of the seed companies accepted the invitation.

Q14: What is the estimated nutritional value for ruminants that can be realised for each forage variety? [CP, Digestibility, Starch, NDF]. If harvested at the optimum stage (balance between yield nutritive value and when harvested at the highest biomass yield per cutting.

The table below presents the nutritional values of forages missing in the ICSIAPL forage study in 2021.

Table 6. Estimated nutritional value for ruminants that can be realised for various forages

Forage seed varieties	CP*	Digestibility*	NDF*
Improved forage grasses			
Lolium multiflorum variety Wester old, Excellent (Annual Rye grass)	18-21%	55-60%	40-50%
Forage grain crops			
Sorghum X S**udan** grass variety Bargrazer	10.8%	52%	34%
Legumes			
Medicago sativa Lucerne/Alfalfa variety Supersonic, Iconic	22%	57%	25-30%

* Data form factsheets shared by forage seed companies. CP, NDF and Digestibility can be influenced by stage of harvesting (incl. grazing) and residual height and are therefore only indicative

Q15: In Kenya cost of feeding is frequently mentioned by farmers as a constraint to improve profitability of the farm. How will the forages which you mentioned as promising, contribute to reduction of feed cost and increased milk or meat production?

Majority of the respondents felt that the cost of feeding livestock greatly depends on how farmers handle forage production costs; amid the ever-increasing inputs and production services costs as well as preservation costs, and the agronomic practices that are used resulting in a successful harvest. These disregard how promising in terms of potential nutrient supply to livestock the forage seed is. Other forage attributes mentioned that can result in reduction of forage production costs are number of cuts. For example, in regard to fodder sorghum (which has deep roots hence adapted to dry areas), and one can get 2-3 cuts, which saves costs on recurring land preparation and one can efficiently plan on silage making. Lucerne too is harvested after every 4-6 weeks, which can cut costs on buying commercial protein-based concentrates.

Q16: Can you share an example calculation for "your" forage crop which shows cost of production from seed to feed?

This information was only provided by Advanta for Forage Sorghum. The other forage seed companies interviewed did not provide an example of cost of forage production.

Q17: What kind of developments do you see and where is according to you the biggest potential for growth in sales and uptake of forage seeds in Kenya?

The following were identified as developments/areas of biggest potential for growth in sales and uptake of forage seeds in Kenya:

- **Variety release process**: forage crops species need to be valued as a feed ingredient in cattle diets. Next to biomass yield and nutritive value biotic and abiotic attributes play a role for the cattle farmer new forage variety to be registered should therefore be valued on the own merit and not, as until now is the norm for example with maize as maize varieties for commercial grain maize production. In addition, efforts need to be made to make the registration process to be faster. Checking into these issues would result in potential milestone market growth for the forage sub-sector.
- **Further on variety release**: the costs of NPTs to be reduced or new avenues to be explored. These avenues include (i) faster implementation of the harmonization process of seed regulations in EA and (ii) direct registration of COMESA registered varieties thus reducing the requirements to register the same variety in each individual country (iii) recognize and appreciate standard seeds particularly for tropical grasses.
- **Hybrid forage crops**: crops such as sorghum, pearl millet and select varieties of Brachiaria grass give options for farmers as they, being more water efficient compared to forage maize, can be grown in some lowland areas with potential for these forage crops; Lucerne provides protein in the diet of ruminants has lower fibre content and is more digestible than the tropical grasses. It requires irrigation, deep rooted soils and may require some soil fertility correction depending on location.
- **Divers number of varieties**: introduction of new varieties for example those that can perform well in acidic soils. An expansive pool of forage varieties can help farmers to choose the best forage crop(s) or their location and farm. It increases the possibilities for crop rotation and intercropping resulting in more biodiversity on the farms and offers ruminant nutritionists to substitute diet ingredients when making rations.
- **Expanding market for forage crops**: the awareness and demand for forage crops is growing especially in the dry zones/ASALs. This awareness is normally more pronounced during periods of drought. This is an opportunity for the sector to expand and thrive**.**
- **Urbanization**: in Kenya and in semi-arid/pastoral zones means increased demand for food partly from animal sources (meat and milk), this will result in increased demand of forage for livestock.

Q18: What are the main barriers for growth of the forage seed market in Kenya?

The following were outlined as barriers:

- **Limited choice:** lack expansive pool of varieties especially tropical grasses, to reduce the over-dependence on Napier and Rhodes grass.
- **Regulatory environment**: In terms of registration of forage varieties with KEPHIS the cost a high vis a vis the extent of the market. This in the end adds to the cost of forage seeds for the farmers. The registration process (PRA, DUS, NPT) – protocols and processes are time consuming further adding to the cost.
- **Insufficient knowledge**: farmers don't always understand the nutritional aspects of the forage crops and choose the forage crop based on higher yield/acre.
- **Affordability:** farmers find cuttings shared from farmer to farmer or bought a cheaper option which in their view reduces cost of forages. This at the expense of purchasing seeds of improved forage varieties.
- **Population growth:** there is increasing conversion of pastoral lands into commercial and residential buildings.

2.2 Sales and distribution network

Q19: What channels do you use for distribution for sales/target beneficiaries? Do you distribute directly to individual farmers, groups or cooperatives?

The figure below represents distribution pathways for forage seeds by forage seed companies. Broken lines indicate distribution channels used, but not necessarily by all companies interviewed in this study. For instance, some companies are not interested in working with distributors, such as agrovets because of payment issues. Consequently, these companies prefer to sell forage seeds directly to farmers, usually from their stores. Only one of these suppliers goes directly to market and sell to farmers and other buyers and has smaller affordable packet sizes e.g. 400g.

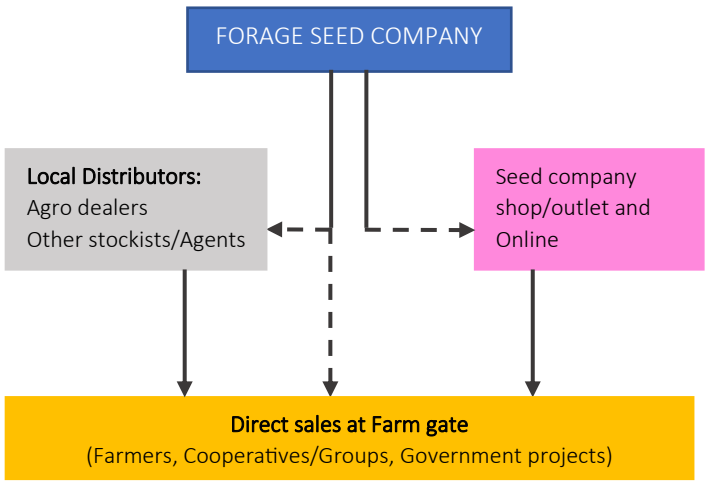

Figure 1. Forage seed distribution network used by seed companies

Q20: Do you make specific arrangement with resellers or stockists for different crops in terms of credit sales, margin, stocks, handling out of date seeds, any other?

Majority of the forage seed companies sell through agrovets (and directly to registered farmers too) – where there are special business arrangements such as credit periods (quite often 60 days) and profit margins given – companies have a list of recommend distributor/wholesale and retail prices. Some companies do not work with agrovets at all (see above).

Q21: In case you also distribute through stockists like agrovets, what main issues and challenges do you experience with them?

- Agrovets, in any cases, do not pay within stipulated credit periods.
- They do not play a significant role in farmer sensitization on forage seeds e.g. participating in or organizing field days, demonstrations, technical training or sharing credible information about best practices (agronomy and feeding). Most agrovets only stock and sell to "walk-in" clients. This possibly leads to slow turn-over, hence difficulty in paying credit.
- A few companies pointed out that storage of forage seeds could also be a challenge for the agro dealers. Poor storage, particularly with tropical grasses, leads to loss of seed viability over time.

Q22: Do you experience any issue with "fake seeds" or seed multiplication in the informal sector? If yes for which species/ forage crop seeds - in relation to what you sell/research on?

The following are some of the responses:

"Yes, especially in Kitale region with one of our bean varieties."

"Farmers keep true seeds or vegetatively propagated seed (farmer-saved seeds), from the forage crops (grasses, legumes) most companies are aware and consider this practice of farm saved seeds or splitting grass or using cuttings to multiply the pasture on the farm as part of the pasture seed business in East Africa. With hybrid seeds the vegetatively propagated plant material will lose vigour after some time and farmers will return at some point to keep plant vigour in their pastures. No one has encountered problem with fake seeds.

"In regard to the introduction of new Napier grass varieties such as Pakchong (Super King Napier grass) and Giant Napier (Jumbo or Juncao) it was questioned by some of the interviewees that it is difficult, if not impossible for farmers to determine, if they purchased the original planting material from the cuttings.

"Quite a few, although the knowledge on seed handling, establishment and agronomic practices in cases of seed multiplication is limited."

Q23: Have you had experiences with nearly expired or expired seeds? Do you have a recall policy for the same and how do you handle the returned seeds?

None of the companies interviewed have had experiences with expired seeds. A few of the companies attribute this to growing market demand for their quality seeds. There are however instances where farmers have complained of poor germination rates. Investigations by some of these companies revealed improper storage (which was traced to the shops of agrovet) and agronomic practices which were in some cases insufficient or in effective (e.g. insufficient land preparation – (over) seeding hard topsoil after drought, broadcasting tropical grass seed, and not covering this with light soil and compacting the seed with a "Cambridge roller" by the farmers). Nearly all the companies, however, do have a recall policy and/or investigation protocol.

Q24: Do you think farmers are aware of the presence of improved forage seeds and how to use them?

Responses point out that there is slow but progressive awareness of presence of improved forage seeds in the market by farmers and their benefits. However, wider access to these forage seeds is the biggest bottleneck as outlets or access points are not close enough to farmers (yet). Furthermore, there exists a disconnect between sensitization, which now seems to go faster (hence the increasing awareness) and availability of the forage seeds at easily accessible sales points. Whereas most companies express satisfaction with performance of the forage crops they market, the level of knowledge, regarding agronomic and feeding practices among farmers is low. This affects productivity and ruminant livestock farmers do not reap the full benefits of the improved forages. This may cause farmers to perceive that the improved forage varieties are not benefiting them as expected and the costs are too high.

Q25: Please tick the method(s) you use to increase awareness/disseminate information on your forage seed products to customers and rank on a scale of 1 to 5 the most effective. [Printed information materials (leaflets, brochures, fact sheets etc), Extension service providers, Demo plots, Field days, Radio, TV, social media, Apps]. What works best – also in terms of easy access by farmers?

Responses here agree with ICSIAPL findings in 2021 that companies employ a mix of all possible awareness avenues to disseminate information to the market. The notable difference is companies point out that they now employ technical staff and extension agents to guide and advise farmers on best agronomic practices, conservation techniques and feeding practices. Sometimes the technical staff go out with salespersons for *ad hoc* meetings with farmers.

Out of all the avenues, what works best also in terms of easy access by farmers are (i) agricultural shows, demonstration plots with field days for farmers to visit these plots (most), (ii) simplified technical brochures and (iii) direct practical training in the field on good agronomic/agricultural practices (GAPs) particularly for youth and women groups. These trainings are embedded with cross-sectoral aspects such as business e.g. production cost vs income – basically profit/loss, to encourage farmers to value and view growing forage crops as a business.

Q26: Do you have specific current activities targeting market development? If not, what are the plans for the future regarding this?

All the companies interviewed make efforts to develop or expand their markets. Activities include participating in trade fairs, agricultural shows and investing in demonstration plots. One company has direct partnership with a development partner who works directly with farmers on supply of farm inputs. This has been a boost in pushing their brands in the market, that said, quite often they do not satisfy market demand with their seeds.

Q27: What are the most pressing challenges/problems you face when trying to increase your market share for forage seeds?

The following challenges were highlighted:

- New varieties, tried and tested elsewhere in the world that would excite farmers. For example, varieties adapted to different AEZs, including the ASALs. A few companies pointed out that technically, bringing in new varieties from elsewhere in the world is not a limitation in Kenya. However, they expressed concerns that introducing these new varieties and developing the market, in a market which is currently relatively small, is costly and time consuming due to the protocols and processes for registration of novel forage varieties.
- Some commercial companies pointed out that Government or semi-government organizations (KALRO, KVDA) and NGOs compete with private sector while multiplying, distributing, and selling forage seed and/or planting materials. There should be public-private partnership arrangement such that KALRO only focuses on research and development of new planting materials and the private sector acts as distributors and merchants to farmers and farmer organisations.

- Slow rate of purchase of forage seeds: perennial crops such as tropical grasses and perennial legumes like Desmodium and Lucerne once established, farmers take too long to return to buy more seed.
- Market competition directly affects pricing whereas quality is guaranteed.
- Market economic forces directly impacts on the price of forage seeds (e.g. the dollar-shilling exchange rate). Sometimes farmers view forage seeds as very expensive hence shying away from purchasing the seed.

Q28: Cognisant of the challenges you face in the business and competition, what strategies have you put in place to ensure steady supply and stay afloat for the long-term?

- Diversification: embracing different products from other companies vertically and horizontally in the value chain. This is best explained with some examples. One seed producer, next to having a seed portfolio, grows hay with pasture seeds bought from Kenya Seed Company and sells the hay as a separate commercial activity. Another seed producer opted to add maize to its seed portfolio to retain and expand its client base, because maize is on higher demand and attracts more customers. The maize is sourced from CIMMYT germplasms. Other companies sell grass seed, originally introduced by Alliance Biodiversity-CIAT (e.g. Brachiaria hybrids, Guinea grass variety Siambaza) but now marketed by U-Farm Holdings and Advantage Seed Limited.
- High quality products with unique packaging.
- Mechanization: where forage seed production (incl. tropical grass seed) is depending on manual labour this is time consuming and sometimes may affect the quality of the final product. For example, accidental mistakes can be made during the field period when manually weeding or hand picking the seeds).
- Only few companies are keen on trying to produce tropical grass seeds locally because this requires heavy investments.

Q29: Looking at the forage seed sector as a whole, what are, according to you the main challenges? What suggestions do you have to circumvent these challenges?

Findings here are like those in 2021. Additionally, with the growing population and urbanization agricultural land continuously shrinks. This can only be addressed by growing higher yielding, quality forage crops.

Q30: Specifically, for the seed companies that work with ICSIAPL: have you increased sales of forage seed in Kajiado, Narok and Taita Taveta and your distributors network. Please specify.

The companies recognize and acknowledge efforts made by the ICSIAPL project in market sales in the southern rangelands as well as bringing together stakeholders in the forage sector space in Kenya. As a result, some of them have increased market sales in the counties in the Southern Rangelands. Only new company not interviewed in 2021 responded that it did not increase sales in the ICSIAPL project area (Narok, Kajiado and Taita Taveta Counties).

“Yes, but not with smallholder farmers but with medium/large scale farms such as (community) ranches, conservancies and medium to large scale farms.”

“Yes: With ranches and large-scale farms/ranches in Taita Taveta while in Kajiado and Narok we have increased orders with agro dealers who sell to medium and lager scale farms.”

The JustDiggit organization implements a project called TWENDE – Towards Ending Drought Emergencies in 11 counties including Samburu, Isiolo, Nanyuki, Kajiado, Taita Taveta. They are keen on identifying areas of synergy with ICSIAPL to help farmers as the end beneficiaries of the forage seeds.

2.3 Demand/adoption

Q31: What is the targeted category of livestock for your forage crops? [Beef, Dairy, Dual purpose, small ruminants]

The forage seeds sold target dairy farmers pre-dominantly. Other targeted ruminant livestock categories include beef and dual purpose mainly kept by agro pastoralists. Lucerne and sorghum are also utilized by beef cattle farmers in feedlots.

Q32: Interest vs Adoption: How do you rate farmers interest? Adoption? Is return on investment – from cost of production, yields and livestock productivity, enough trigger to increasing adoption?

Majority of companies agreed there is a high level of interest for novel forage seeds among farmers, triggered by higher yield per acre. The ever-increasing demand for feed and food (milk and meat) was noted as a trigger for the commercial market-oriented and knowledgeable farmers. Overall, the companies concur that adoption rates are slow and low.

Q33: What is your understanding on their perceived challenges to interest and adoption?

The challenges to interest and adoption were perceived as:

- The demand for certified seed varieties is still small and so are availability/stocks
- Forage market is still immature – demand is still developing, compared to the market demand for food crops.
- True seed of forages, particularly tropical grasses are perceived as expensive. A significant number of farmers, being used to vegetatively propagated seed of Napier grass give preference to new Napier grass varieties as the reason it is economically more attractive.
- Whereas there is perception of high interest but low adoption rates, there are no data yet to quantify this and help seed companies make better informed decisions.

Q34: Demand: In your view is the market for improved forage seeds at the moment demand driven or more supply driven? Is the demand by farmers growing?

In equal measures, the companies expressed that the market for improved forage seeds is supply driven as well as demand driven. The latter is propelled by the increasing number of livestock that needs to be fed. In the ASALs, pastoralism is shifting from herding and regularly relocating livestock to growing forage due to land pressure (less land to graze). This means if livestock keepers want to retain the same number of cattle or small ruminants, they need to adopt cultivation of higher yielding and better-quality forage crops in smaller areas. This is one of the reasons which increases uptake of forage seeds.

Q35: Price: Is there willingness to pay for good quality seeds. Are current prices and packaging sizes an issue to farmers affording improved forage seeds? Please explain.

Overall, respondents agreed that they see an increased willingness to pay for forage seeds.

- Farmers and agro pastoralists for example make decisions based on what they see. Good quality grasses have better yields (quantity in this context) thereby fuelling interest and purchase.
- Smallholder farmers are willing but do not have the purchasing power due to the high price of some of the forage seeds (e.g. hybrid tropical grasses). Repackaging into smaller size packets make it more attractive for smallholder farmers.
- Commercial more market-oriented farmers have expressed interest and willingness to pay for larger quantities (e.g. > 1 kg).
- According to some companies, County governments and NGOs at times source from outgrowers or brokers non-certified or non-quality-controlled seed and are possibly less aware of seed quality aspects. Seed companies and some farmers pointed out that these seeds are of low quality (germination rate, purity, etc). More farmers, therefore, are willing to pay for certified seeds.

Q36: Supply: Do you think there is difficulty for farmers to acquire/access improved forage seeds in or near their locality? If yes, could you suggest (business) models to get seeds closer to the farmer?

Yes, there is difficulty to access forage seeds especially for farmers far-off/remote in the rural areas. Farmers do not cooperate easily to pool resources to buy forage seeds in larger quantities and divide amongst themselves. It is pointed out that farmers coming together as forage interest groups and distributors (e.g. agrovets), will ease seed marketing efforts bringing points of sale closer to farmers.

Q37: Which forage varieties in your portfolio have the most interest those promising a high yield (biomass) or those promising a high nutritive value for ruminant livestock.

Most of the forage seeds that were mentioned in the portfolio of the seed companies had attributes that interested farmers. For example, Lucerne was mentioned as a crop that can be cut frequently and having a high CP while forage sorghum was appreciated for its ratooning ability. The respondents however voiced that high yield in terms of biomass and nutritive values are best realized when applying good agronomic practices from seed to feed (planting to utilization). Exploring ways to improve knowhow amongst farmers cannot be overlooked in this context.

Q38: Grasses that perform well or have farmer preference for other reasons are likely to be locally multiplied either through true seeds or vegetatively propagated seed. Do you see this as a serious threat for sound business development or is this an accepted practice? How does yields from true seed versus vegetatively propagated seed compare? How does this affect your research or sales turnover where you work with the same or similar forages?

Respondents expressed little or no threat posed by seed multiplication by farmers themselves be it as true seed or as vegetatively propagated seed. If the variety is a hybrid, productivity reduces in subsequent generations and farmers will return for new seeds.

2.4 Know-how of sales staff, agents/distributors

Q39: Are you, satisfied with the results in the field, after farmers have planted some of your forage varieties? If yes, can you quantify these results? If no, what do you think needs to be addressed for farmers to be more successful when making use of your forage seeds?

All companies were satisfied with the end-result (performance in the field and yield per acre) of the forage crops planted by their clients (farmers). They however acknowledge there is room for improvement as sometimes farmers do not observe best agronomic practices. Nonetheless quite often at the time of harvest, forages are left to over-grow (flowering or even seeding) for higher yield, but this reduces quality or desired nutritive values for tropical grasses and legumes. This practice is only justified with forage maize where 2/3 of the energy (starch) of the dry matter yield originates from the cobs in the total biomass. This implies that technical extension staff play an important role to coach farmers in adopting best agronomic practices.

Q40: Do you have information about the actual realized yield by farmers (e.g. 25%, 50% 75% of potential)? Explain.

The satisfaction level in terms of realized yield was estimated between 60-70%, observing the need to improve on good agronomic/agricultural practices as explained above.

Q41: Which agronomic practices, should farmers adopt because they are important for your forage crops to realize their full potential?

These include practices from establishment in the nursery to planting full field, i.e. management through to harvesting and post-harvest handling (seed-feed). Where seeds are targeted, the chain should be from establishment to storage (seed- seed). Practices mentioned are listed below:

- Soil sampling for testing and implementing recommendations of soil analysis report. This is mentioned by all as one of the biggest problems in Kenya to get higher yields per acre.
- Proper land preparation.
- Weed control using herbicides depending on the type of forage crop.
- Pest control, use of insecticides and fungicides to control damage caused by these pests.
- Fertilizer application as per soil analysis report, in addition to manure.
- Irrigation to kick start the crops before the rains arrive or when the rains subside.
- Timely harvesting.
- Avoid losses during conservation and storage.

Q42: Do you think the knowledge of your staff can be improved as regards to forage production and animal nutrition (from seed to feed)? If yes, how will you do this or what support is needed and from who?

Yes. Staff have technical knowledge but sometimes not enough field experience. Results in the field depict that farmers do their best to realize better yields, but there still exist knowledge gaps relating to how to effectively apply or upscale good agricultural practices in ways that are both inclusive (environmentally sustainable and climate-smart) and effective. This can be enhanced while supporting the technical staff with practical skills trainings in farms and by setting up demonstration sites. Sponsoring staff for online short courses to avoid interfering with official work duties was also proposed.

2.5 Regulations

Q43: Earlier (in 2021) regarding a different study for SNV, we had a discussion on the most pressing challenges that seed producers, seed companies and research institutes face regarding government regulations and policies and how they relate to forage sector or seed business? In your view what has improved since then? Any more suggestions as solutions to these challenges?

Majority of the seed companies feel not much has changed, as regards operation procedures and processes at KEPHIS. For example, the registration process for forage crop varieties is still long and costly in relation to the size of the forage seed market currently.

One company, despite the hurdles, recognized some changes. The open pollinated varieties (OPVs) this company produced were recognized as standard seeds.

Q44: There are cases where forage seeds that have undergone performance trials in other countries in Africa, and have been imported, but with certificate from country of origin; for example, maize seeds. Is this the case for pastures/forage seed? If yes, which forage seeds have undergone performance trials in other African countries?

No, this has not been the case with forage seeds except for Sugar graze (Forage sorghum). One possible intervention mentioned is to fast-track sharing information with COMESA and encourage forage seed distributors to make use of the option to register varieties in the COMESA variety list.

2.6 Collaborations and new opportunities

Q45: In your view, does the forage seed sector development receive enough support from the National and County governments – for instance improving productivity and access by farmers, giving subsidies, creating awareness platforms. Do you have existing collaborations with the government?

From the interviews, there does not seems to be much focus on forage sector development by the government, neither at county nor national level. Some companies feel that there may be some support in the higher potential zones but not in the low potential areas, the ASAL areas. A respondent pointed

out that in the past, when seed companies had collaborations with the government, payments have been slow for forage seeds supplied which is not good for company business and farmers in the end.

Another seed distributor pointed out that there is competition, which he deemed as unfair, between KEPHIS registered seed merchants and government authorities and NGOs, who are not registered as seed merchants, but buy forage seeds from farmers or brokers and sell or distribute the seeds free of charge. They compete with seed merchants, but do not follow the KEPHIS protocols and regulations.

Q46: Suppose there are opportunities with the government, research or development partners to support improving uptake for farmers of forage seeds. What measures would you propose?

The interventions proposed in Table 7 below were recognised as effective, with comments alongside.

Table 7. Proposed interventions to stimulate uptake of certified forage seeds by farmers

Intervention	Comment
Support forage demonstrations/field days	This activity (intervention) is proven to work, and is the general comment of the respondents. Some respondents point out however that the downside of it is that the conversation ends on the event day. Partnerships between the organisers can help to take the interaction with the farmers to the next level (repeated visits or field days) and thus increase the impact past the event day.
Support forage demonstrations plus training (lead) farmers in their farms.	Sensitize farmers on new forage seeds through field trials, demonstrations plots and field days followed by training session on best practices.
Support 50% voucher for farmers.	Best effected by engaging agrovets. Normally government /development organizations' projects acquire seeds directly from companies and give to farmers (most often for free). So, this cuts out agrovets. And although, as earlier pointed out, their knowledge on forage seed varieties may be limited and needs to be updated. The staff of the agrovets know the location (agro ecological zones) and understand the needs of the farmers better. Handing out seeds to farmers directly, without further guidance and follow up carries the danger in it that the forage seeds, when planted does not lead to the expected results.
Support 50% voucher for starter kit-seed and fertilizer.	Explore ways to assist farmers with improved forage seeds, instead of financial subsidies. The seeds are preferably in a starter kit with other inputs that are required to grow and conserve a good fodder crop. (e.g. fertilizer, crop protection, some molasses and a silage bag)
Support grant for agrovets to keep/improve stocks of forage seeds.	Strengthen access to finance for agro dealers to further scale and penetrate the market with the result increased accessibility of forage seeds to farmers.
Facilitate memoranda of understanding (MoUs) between seed company and dairy cooperative unions, ranches and other commercial farms in combination with support for forage production (demos/ trainings).	

Other interventions proposed: **i. KEPHIS** ▪ Explore ways, other than NPT/DUS, to make new seed varieties availability quicker. For example, KEPHIS to explore if the class "standard seed" can be used for tropical grasses having in place less strict conditions (e.g. germination rate and purity), but clearly labelled to inform the farmer. ▪ Work with KEPHIS to fast-track PRA, NPT and DUS issues for forage species that have not yet been "officially" introduced in Kenya or originate from countries that have had, so far, no record of seed importation into Kenya. This will facilitate, faster, more diverse variety of tropical grasses/forage crop seeds being imported into the country for the benefit of farmers and livestock keepers. **ii. Policy gaps** ▪ Push for policies or policy changes by the government to (i) always have a budget allocation to stimulate the supply of forage seeds (incl. tropical grasses for different AEZ) to farmers and (ii) stimulate investments exposing farmers to the forage seeds through demonstration plots or centres for farmers and organize field days and practical skills training, learn, increase interest and adoption rates of new and more diverse forage crop varieties. ▪ Push for specific policy frameworks for counties in the ASAL areas to integrate fodder production (incl. re-seeding and overseeding) in their budgets and CIDPs. ▪ Amend the law(s) in respect to the importation and multiplication of seeds of tropical grasses to be more in line with the technical rules and regulations for tropical grasses in countries that are a potential source for these seeds. **iii. Seed companies** ▪ Allow a window of 3-5 years with favourable fees for seed companies on the importation and registration of forage seed variety in Kenya. ▪ Support and encourage local seed companies with financial incentives to invest in forage seed technology, register, multiply and scale locally to regain the globally recognised status Kenya used to have in the late 1960-70's with various Rhodes grass varieties. ▪ Create incentives for seed companies to acquire new equipment e.g. seed cleaning equipment at competitive prices to enhance the process of forage seed 'processing'. This will help upscale and produce seeds more efficiently and meet the demand of the farmers and capacitate the farmers to use the seeds for rangeland rehabilitation and pasture improvement. Such incentives can create decent jobs at the same time. ▪ Exchange visits: Facilitate benchmarking interactions with other farmers and seed companies e.g. from South Africa, Australia, USA, Brazil, Colombia, India and Thailand. **iv. Forage producers/farmers** ▪ Forage interest groups: establish farmer groups to enhance individual and collective grassland and forage production, marketing of forage seeds and forages as a feed, increase bargaining power of farmers in the market for certified forage seed. ▪ Organize open markets: to create awareness about the benefits of improved and diversified forage production among livestock farmers and awareness of the commercial value of forages, facilitate direct linkages between forage producers (clients of forage seed companies) and buyers (livestock farmers) to develop trust, ready and consistent markets with pricing based on the quality of the forages.	

Q47: Who should organize demos and trainings (seed company, agrovet, cooperatives, government extension staff?

Seed companies would be best placed to organize demonstrations and establish demonstration plots followed by skills training because they know which forage crops they have in their portfolio e.g. the forage seed varieties, their performance potential, special attributes and agronomic practices needed to show best results, and what the farmers may want or expect form the forages they plant. Other

respondents expressed confidence in combined efforts from all stakeholders e.g. development partners working in collaboration with, or supporting seed companies, inviting farmers (and groups). An important aspect which did not come out clearly in the interviews is that during the demonstration, next to expertise in forage production and conservation technology also expertise in ruminant nutrition (e.g. feed intake and utilization) needs to be available (present).

Q48: What other measures would you recommend if forage seed suppliers were to be supported to increase market share and for farmers to increase adoption rate of improved forage seeds?

The response of the respondents can be summarized as follows:

- Support establishing of centres of excellence or knowledge centres in different regions as reference points for access to and availing credible technical knowledge about forage seeds and feeding.
- Support local production and multiplication of forage seeds, although this is expensive it would create opportunities such as diversification of forage crops on farms, decent employment, export opportunities to COMESA member states and even beyond (like Kenya Seed Company was well known for internationally in the past).
- Locate, list and organize farmer to farmer exchange visits to farms who successfully grow forage crops and willing to share information of cost of production, how to incorporate the forage in diets for dairy and beef cattle and the margin above feed cost (milk income – feed cost) that is realized on the farms.

Q49: Of the options above, what do you think would work best?

The answers of the respondents can be summarized as follows: what works best for forage seed companies are marketing arrangement with organizations and/or institutions which intervene at the level of input supplies (e.g. agrovets) or supporting the local seed distributor while participating in field days, agricultural shows, trade fairs, establishing demonstration plots (e.g. showcasing new forage crops) and demonstration farms (e.g. showcasing conservation practices and feeding of the forage crops) .

SECTION III: RECOMMENDATIONS

To enhance the forage sub-sector from seed to feed, a concerted effort or system approach is needed where choice (diversity), availability, affordability, access, awareness and adoption by farmers of improved certified forage seed are key. It is important that certification is not perceived as a hurdle and an extra cost by forage seed producers or farmers, but as a way of "branding" that raises trust among stakeholders in the forage seed sector. To achieve faster adoption of novel seed varieties, awareness creation through (skills) training is needed up. This should go hand-in-hand by guiding (coaching) farmers to apply good agronomic and forage conservation practices, to realise optimum yields, and nutritive value, and to preserve the excess biomass produced by the forage crops during the wet season, for utilisation in the dry season.

Laborde et al (2020) conclude in their study that smallholders are more likely to adopt new seed varieties and practices when planting climate-resilient crops. Specifically when they are supported with technical advice and inputs.

Coaching of farmers how best to apply and implement new technologies is key. Membership of cooperatives, self-help groups and other organizations can help farmers with market connections and economies of scale to reduce costs, e.g. shared seed procurement, transport or storage (derived from Bizikova et all, 2020).

The respondents to this study mentioned many concrete actions to support the forage sector to become more vibrant. These can be categorised in short, medium and long term.

Short term actions

- Forage seed companies agree they are best served by dairy development partners when provided with support in the establishment of demonstration plots and identifying demonstration farms in a wide range of agro-ecological zones and in various parts of the country.
- Farmers and forage seed companies will benefit widely if technical staff can coach farmers to cultivate forage crops successfully achieving 85-100% of optimum yield/nutritive value potential. This will assist the farmers to keep cost of production (price per kg feed) at a minimum.
- Once farmers are aware of the availability and potential benefits of improved and new varieties of cultivated forages it is crucial to coach farmers how to include the forage in a balanced, formulated diet. In the value chain forages are valued when turned into animal protein (milk, meat) or draught power commercial forage production. Therefore, this needs to be validated by improved animal performance (optimised production, more consistent production, reduction of no-productive periods during the lifetime of cattle).
- Best conservation techniques and technologies need to be introduced at the same time with the introduction of the new forage crops as otherwise chances are, the farmers are not aware how to feed or utilize the excess biomass which may result in (over) mature forage crops, sometimes wasted in the fields or during feed out (moulded hay, spoiled silage).
- Experience of the consultants is that there needs to be support from a team of technical staff from the forage seed producing or distributing companies who can guide and, where possible, coach farmers how to best use the improved forage crop from seed to feed. This includes and starts with advice on correction of soil fertility if needed, land preparation, planting, crop maintenance, grazing, stage of harvesting, conservation and how to use the forage in a formulated balanced diet.
- The seeds of tropical grasses are small and light and the newly emerged seedling is generally weak. Practices such as soil analysis before planting, climatic conditions when broadcasting (wind), seed depth, rolling (e.g. Cambridge roller, tyre to tyre, use of oil drum with added weight) after planting, awareness of insects' damage on the young seedlings, timely use of herbicides in early stage to control weeds effectively, all play an important role in successful establishment of pastures. Successful establishment is the beginning of reducing feed cost in diets for dairy and beef cattle.

Medium term actions

- The potential for a more vibrant forage market is present but is implicitly linked to a better understanding of the role and potential of forages in dairy and beef cattle diets.
- Increase of laboratory capacity, linked to tropical forages and other diet ingredients under local conditions like this has happened for soil sample analysis over the past 15-20 years.
- Training, but eventually continuous coaching of rural communities how to reap the benefits of forage crops and, for most small holder farmers, how these can be integrated in a food crop system.
- Encourage and support (local) forage seed companies to establish and start up the process of seed selection, multiplication, introduction, distribution, and scaling in the market.
- Create knowledge pool, analytic and technical capabilities within the regulatory authority to assess forage crops on their own merit e.g. biomass yield/acre, nutritive value, biotic and abiotic factors, and other forage crops specific attributes.

Long term actions

- Forage seed companies agree that policy influencing is a slow and long process of which the results may only be felt to the companies after several years and likely, even longer for the farmers to benefit from.
- Forage seed companies agree that a continuous debate between forage seed stakeholders and the regulatory authority is needed and needs to take place regularly and frequently where seed companies can be represented by STAK to manage the effort in time and finances seed companies need to invest in the debate.
- Review of the various laws affecting forage seed and update of these laws based on the most up to date regional and global views and technologies regarding improved forage production is needed to facilitate an enabling environment for domestic and international forage seed producers.
- Capacity building (manpower) of the regulatory authority (KEPHIS) is needed. The expansion of registered seed merchants and certified forage seed crops will claim more time and manpower from the regulator to guide the seed merchants follow the rules and regulations in regard to seed production, multiplication, registration and marketing.

REFERENCES

"Getting the Incentives Right": Realising accessibility and affordability of improved and suitable forage seed varieties and a vibrant forage seed sector in East Africa; NEADAP Working Paper, May 2023.

Bizikova, L. et al. Nature Food https://doi.org/10.1038/s43016-020-00164-xX (2020).

Creemers J., Maina D., Opinya F., and Maosa S. (2021). SNV/ICSIAPL Report of a Scan of Forage Seed Suppliers in Kenya as part of Forage Value Chain analysis for the Counties of Taita Taveta, Kajiado and Narok." August 2021. https://cowsoko.com/programs/kmdp/publications/131/item

https://cgspace.cgiar.org/bitstream/handle/10568/111370/%5B60%5D%203.4.1.7.2%20Forage%20seed%20Systems%20In%20Kenya%20Report%20%28002%29-SM.pdf?sequence=1

https://www.kit.nl/project/improving-access-to-quality-feed-forage-seed-for-the-dairy-sector-in-kenya-and-uganda/

https://www.nfpconnects.com/conversations/forage-seed-policy-brief-2023-improved-farmers-access-to-improved-forage-seed-in-kenya

https://www.nfpconnects.com/insights/more-and-better-forage-all-year-round-enhancing-forage-production-in-east-africa

Laborde, D., Porciello, J. & Smaller, C. Ceres2030 (2020): Sustainable Solutions to End Hunger (Ceres 2030, 2020).

Liverpool-Tasie, L. S. O. et al. Nature Sustain. (2020). https://doi.org/10.1038/s41893-020-00621-2

ANNEXES

Annex 1. Suppliers of vegetatively propagated seed

(Not contacted)

	Seed supplier		Head office	Contacts
1.	Crevation International Ltd	Juncao/Giant	Athi River – Namanga Road Kitengela	0731169169 jambofarm1116@gmail.com
2.	Christie's Farm Gate	Pakchong/ Super King	Juja farm, Juja, Kenya	0715 342986 simon.mbugua55@yahoo.com
3.	KALRO (HQ/ Dairy Research Station) *	Kakamega I Kakamega II	Nairobi/Kakamega/Naivasha, Kenya	www.kalro.org
4.	Shomoro Farm Supplies Ltd	Various tropical grasses	Narok – Bomet Road Narok	0706825555 peter.francombe@shomore.co.ke