PROGRESS REPORT

ON

Fodder Production and Preservation Demos in the Dairy Value Chain

SUBMITTED TO

SNV

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PERFOMETER
DAILY GROWING DAIRY

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ACRONYMS

SNV	Netherlands Development Organization
KMDP	Kenya Market-Led Dairy Program
ASAL	Arid and Semi-arid Lands
SPEN	Service Providers Enterprise Network
LCB	Local Capacity Builder
JC	Junior Consultant
CBE	Collecting and Bulking Enterprises
PDTC	Practical Dairy Training College
MASL	Meters above Sea level
NR	North Rift
KGS	Kilograms
CBA	Cost Benefit Analysis
AEZ	Agro Ecological Zone
SPE	Service providers Enterprise
CFP	Commercial Fodder Producer

1. Introduction

The dairy sub-sector in Kenya is vibrant and dynamic and is largely private sector driven. It is characterized by high productions costs mainly caused by inefficiencies at farm level, largely contributed by poor quality feeds and fodder including inconsistent supply. It is evident that more than anything else, year round access to quality feeds & fodder determines the competitiveness of the dairy sector. Depending on the intensity of dairy production, dairy feeds account for between 60-70 percent of the production costs in dairy farming. Improved feed availability and quality will be a key strategy to realizing the largest proportion of the needed dairy productivity levels and supporting dairy population increases. Feeding is the major constraint to achieving the targeted milk production because of heavy dependency on rain-fed forage and unimproved pastures, while there is limited adoption of preservation of fodder to smoothen seasonal fluctuations in milk production. Various studies carried out in Kenya have highlighted the fodder challenge in the Kenya dairy sector, pointing to low volumes and low quality, this has often been attributed partly to skill or information gaps and inadequate extension support. As a result most smallholders continue to use traditional feeding systems for example Napier grass which is lower in nutritional value as compared to maize or other more energy or protein rich fodder crops such as desmodium and Kikuyu grass. Evidently protein fodder is largely unavailable and also expensive to buy in the market and most farmers rely on hay, which is generally of poor quality.

About KMDP

SNV's work in the Kenyan dairy sector is through the Kenya Market-led Dairy Program (KMDP). KMDP is a 4.5 year programme funded by the Royal Embassy of the Kingdom of the Netherlands in Nairobi and started at the 1st of July 2012. It has two main intervention strategies or pillars:

I. To increase efficiency and competitiveness of the smallholder dairy value chain
II. To promote and facilitate innovation and address systemic issues in the sector

In the systemic issues agenda, fodder is one of the key systemic issue being addressed at the farm level (targeting small, medium and large scale farmers), as well as through agricultural contracting services (maize and grass train) and commercial fodder producers (CFPs).

2. KMDP fodder development strategy (DVC)

Largely informed by the feed and fodder study carried out by SNV/KMDP in 2012, KMDP strategy in promoting fodder development in the dairy sector as part of T&E mainly emphasized on farmer training and provision of Technical Assistance (TA) revolving around on-farm fodder production and management, feeding, feed rationing and fodder supply. Besides KMDP helped in linking farmers and CBEs to Commercial Fodder Producers (CFPs) and SPEN.
To promote on-farm fodder production, it is imperative that the various fodder types (energy or protein) performance in the various agro-ecological zones are determined to optimize their production and utilization. It is as a result of this that SNV through KMDP undertook the initiative to pilot fodder demos in 18 CBEs which are supported under the program in three milk shed regions namely:

1. North Rift region - New Ngorika, Kiplombe, Mumberes, Ainabkoi & Olenguruone (added in 2015) CBEs
2. Central region – Slopes, Ndumberi, Kiambaa, Muki, Kitiri & Tulaga CBEs
3. Meru Region - Githongo, Nkuene, Kithurune, Mbwinjeru,Nkuene, Uruku & Naari CBEs

The fodder demo pilots were implemented in selected farms who were ready to provide land and also host other farmers for trainings. The crops piloted included both energy and protein rich fodders and were as follows: Maize, Fodder sorghum, Oats, Boma Rhodes, Rye grass, Kikuyu grass, Lucerne, Desmodium, Lupines, Columbus grass & Vetch.

In addition to the setting up of the fodder pilots, a series of farmer trainings were conducted in each CBE demo plots to train farmers on all aspects of fodder establishment, management, preservation and utilization. This were geared towards promoting on-farm fodder production which is a key contributor to reducing the costs of milk production.
The program strategy also included efforts to link CBEs to Commercial Fodder Producers (CFPs) for supply of hay especially during the dry seasons and to SPEN being groups of local youth that do silage making for farmers at a fee.
An attempt was made to establish the economics of the above fodder crops. Information was obtained from the participating farmers as well as some information/data was obtained from Kenya Agricultural Research and Livestock Organization (KARLO).

Hence the fodder development strategy has the following objectives:

1. To determine the suitability of the various fodder types across the different ecological zones where the CBEs are located
2. Use the fodder demo pilots to train farmers on good fodder establishment, management, preservation and utilization practices
3. Establish the economics of the various fodder production pilots at farm level.
4. Promote CBEs to move towards fodder commercialization
5. Determine the viability of both energy and protein fodder production under the smallholder dairy farmer context
6. Strengthen linkages between CBEs and CFPs for increased fodder supply

3. Fodder production and preservation demos assessment methodology

The assessment team used both quantitative and quality assessment methods to establish the progress, lessons learned, challenges and impact of the fodder development strategy. Secondary data was obtained from existing KMDP and CBE reports. Primary data was collected in 11 CBEs through CBE site visits to fodder demo plots and holding Focussed Group Discussions (FGDs) with participating farmers, T&E staff including KMDP Local Capacity Builders (LCBs) and Junior Consultants (JCs) and CBE managements. A semi-structured questionnaire was prepared to collect the data that targeted the farmers who did the fodder pilots. The data was mostly collected through face-to-face interviews, while others were filled in directly by the informants. KARLO also provided some information that aided the economic calculation of the various fodder.
The assessment team was not able to establish reliable quantitative economic data for the various fodders piloted at the farms. They had to rely on LCBs and farmers qualitative judgement as regards the success of the demos and impact on milk production and farm profitability of the piloted fodders. Hence this was left for further validation in subsequent pilots/demos.

4. Fodders pilots per CBE over the period 2013 - 2015

Fodder plots and types piloted in 2013 per CBE

A total of 150 demo plots were established in 2013. The breakdown of how the seeds were distributed in each CBE and the number of demo plots established in each CBE is shown below.

Table 1. Fodder crops piloted in 2013

CBE Name	Number of fodder plots	Fodder type (Kgs)						
		Energy					Protein	
		Fodder Maize	Oats	Forage Sorghum	Columbus grass	Rhodes grass	Lupin	Tree Lucerne
Nkuene	13	17	3	6	8	1.8	6	0.1
Naari	15	22	4	8	10	2.4	8	0.1
Uruku	8	14	3	5	7	1.6	5	0.1
Kithirune	10	15	3	6	7	1.7	6	0.1
Githongo	10	15	3	6	7	1.7	6	0.1
Meru C. Models	18	30	20	4		25	50	0.2
Mbwinjeru Arithi	10	15	3	6	7	1.7	6	0.2
Muthiru	11	21	4	8	10	2.3	8	0.2
Meru C.2 Models	8	12	1	2		10	11	0.3
Ndumberi	13	24	8	24	7	6	5	0.2
Kiambaa	12	23	8	24	7	6	4	0.2
MIK	21	30	14	8	10	6	15	0.2
Total	**150**	**238**	**74**	**107**	**80**	**66.2**	**130**	**2**

Fodder plots and types piloted in 2014 per CBE

A total of 188 demo plots were established in 2014. The breakdown of how the seeds were distributed in each CBE and the number of demo plots established is shown below.

Table 2. Fodder crops piloted in 2014

CBE NAME	Number of Demo plots	Fodder type (Kgs)									
		Energy						Protein			
		Yellow Maize	Pannar Seeds-PAN691/PAN683	Nandi Seteria	Oats	Forage Sorghum	Columbus grass	Lucerne	Desmodium	Lupin	Vetch
Mumberes	18	115	16	16	16	49	8	0	1	16	12
Kiplombe	12	70	10	10	10	30	5	0	1	10	7
Ainabkoi	8	50	7	7	7	22	4	0	0	7	5
New Ngorika	7	44	6	6	6	19	3	0	0	6	4
Nkuene	7	28	6	1	6	17	3	0	0	0	4
Naari	3	11	2	0	2	7	1	0	0	0	2
Uruku	4	14	3	0	3	9	1	0	0	0	2
Kithirune	5	24	5	0	5	14	2	0	0	0	3
Githongo	5	20	4	0	4	12	2	0	0	0	3
Mbwinjeru	2	10	2	0	2	6	1	0	0	0	1
Muthiru	27	122	24	2	24	73	12	0	1	0	17
MIK	15	63	13	1	13	38	6	0	1	0	9
Kiambaa	7	35	7	1	7	21	3	0	0	0	5
Ndumberi	9	47	9	1	9	28	5	0	0	0	7
Kitiri	10	41	8	1	8	24	4	1	2	8	6
Tulaga	17	75	15	2	15	45	8	2	3	15	11
Muki	32	160	32	3	32	96	16	3	6	32	22
TOTAL	**188**	**930**	**170**	**53**	**170**	**510**	**85**	**6**	**17**	**95**	**119**

Fodder plots and types piloted in 2015 per CBE

A total of 60 protein demo plots were established in 2015 with an average of three demo plots per CBE. The size of the demo plots in this phase were relatively big as compared to the ones established in 2013 and 2014 as it ranged from a quarter to an acre. This was basically an upscale of the previously established demo plots, only that this time, the focus was on protein rich fodder. A breakdown of how the seeds were distributed in each CBE is shown below.

Table 3. Protein rich Fodder crops piloted in 2015

CBE	Number of demo plots	LUCERNE	DESMODIUM	LUPINS	VETCH
Kiambaa	3	15	0	0	0
Ndumberi	3	3.25	2.5	0	0
MIK	3	15	0	0	0
Kitiri	3	5	0	30	0
Tulaga	3	15	0	0	0
MUKI	3	10	0	0	6
Mumberes	3	10	0	15	0
New Ngorika	3	10	2.5	0	0
Kiplombe	3	10	0	15	0
Olenguruone	6	20	5	0	0
Ainabkoi	3	10	2.5	0	0
Naari	3	5	5	0	0
Muthiru	3	5	5	0	0
Kithirune	3	10	0	0	0
Mbwinjeru	3	15	0	0	0
Githongo	3	15	0	0	0
Kithirune	3	15	0	0	0
Nkuene	3	15	0	0	0
Uruku	3	10	0	15	0
Total	**60**	**213.25**	**22.5**	**75**	**6**

NB: All the above fodder demo plots besides determining their agro-ecological suitability, also provided an opportunity for farmers to be trained practically on all aspects of fodder production, management, harvesting and utilization. The trainings were being organized by KMDP LCBs and JCs in the respective CBEs in close collaboration and partnership with CBE T&E staff.

5. Fodders piloted

5.1. Maize

Maize was one of the major energy rich fodder crops to be piloted, it is also true that it was one of the most successful fodder crop to be adopted by farmers. Before KMDP intervention farmers were not used to preserving fodder and more so maize silage. This was mainly attributed by cultural barriers which farmers believed that maize was only meant to be human food and not for animals.

> Maize (*Zea mays*)
>
> It grows to a height of between 1.5 m and 3 m. From the stalk grows the conical cob on which the grains are found and is usually used for cereals and also as a forage crop. It requires a well prepared seedbed and can grow in a wide range of agro-ecological zones in Kenya ranging from 0-2200 M.A.S.L and 600-900mm of rainfall. Common varieties include: DKC 90-89, DKC 80-31, H6213, H628, H515, H511, PAN 63, PAN 67 etc.

While previously almost all farmers grew maize for their own food or to sell as grain, there are now more and more farmers growing maize specifically for silage. There are such farmers in every CBE though still a minority. The demos piloted observed proper agronomic practices including proper land preparation, recommended spacing, proper fertilization and the right harvesting stage. From this farmers were able to see and learn the best practices regarding maize production and management. The notion of 'seeing is believing' applies for most farmers as they learnt agronomic practices from each other. This activities were overseen by LCB's and JC's in collaboration with the CBE extension staff. Behavior change from just preserving fodder, to preserving the right fodder in the right way took time and a series of training activities. In the beginning, farmers preserved Napier for silage which was more understood as 'cattle feed' and progressed slowly to maize silage which was more understood as 'human food'. From the maize demos established, KMDP through the LCB'S and JC's organized farmer group's trainings where farmers were trained on how to make maize silage through the support of Service Provider Entrepreneurs (SPEs) - rural-based silage making contractors/service providers.

Maize fodder demo plot, Ainabkoi Dairy Society, Uasin Gishu County

5.2 Sorghum

Fodder sorghum is an energy rich fodder crop. It was mainly piloted and adopted in the low altitude and the ASAL areas. This is mainly because sorghum has been known to be resilient in drought conditions and this attributes have been enhanced through breeding to tolerate and even do better in the harsh climatic conditions where maize cannot thrive. Sorghum was piloted and adopted in a number of CBE's which includes Kiplombe, Naari and the dry parts of Muki CBE. Recommended agronomic practices were applied including but not limited to proper land preparation, seed rate, spacing and harvesting stage. This also involved the production potential in terms of yield and feed value composition. The sorghum hybrids (Sudan grass & Columbus grass) were also piloted and were adopted in the CBE's with a higher elevation where the ordinary sorghum could have taken longer to mature for example Mumberes. A case in point is Kiplombe CBE where Sorghum was highly adopted.

Fodder Sorghum

(*Sorghum Vulgare* Pers)

It grows 6 to 12 feet tall, produces more dry matter tonnage than grain sorghum, and is coarse stemmed and used for silage. Grows well in altitudes below 1500, rainfall between 420 -630 mm per annum. Common varieties include; E-6518, E-1291 & BJ28.

Sorghum fodder demo plot, Kiplombe Dairy Society, Baringo County

5.3 Oats

Fodder Oats (*Avena sativa*)

It is an annual forage crop particularly suited to the cold highlands. It resembles wheat in most growth aspects but is taller, growing up to 100-120 cm tall. Grows well at an altitude of 2,000-3,000 and minimum rainfall of 1000 mm per year.

Oats was piloted and adopted mostly in the areas with high altitudes. It was adopted in such areas because it matures in a much shorter time (3-4 months) as compared to other fodders i.e. maize which takes almost a whole year to mature (especially in colder areas) hence a better and viable option. The Oats demos piloted observed proper agronomic practices which included proper land preparation, proper spacing, proper fertilization and right harvesting stage. From this farmers were able to see and learn the best practices regarding Oats. Due to the wet conditions experienced in this regions, the LCB's and JC's and the extension officers advised farmers to make silage and mostly tube silage as in most cases the conditions did not favour hay making. Also other fodders such as Maize are affected by frost unlike Oats which were not affected. A case in point was Muki CBE oat fodder demo where with the support of SNV via KMDP they were able to lease 22 acres of land and established the crop. With the advice and supervision received from various KMDP advisors in collaboration with the CBE extension staff and CBE management they were able to grow and manage it well. The crop was later harvested as seed which was sold to the farmers for their own on-farm fodder production.

Oat fodder demo plot, MUKI Dairy Society, Kinangop, Nyandarua County

5.4 Boma Rhodes

Boma Rhodes was piloted in almost all the CBE's. Due to its wide ecological adaptability, Rhodes did well in most of the CBE's in which it was piloted. The only limiting factor being the size of land as hay requires a relatively bigger piece of land say at least an acre for it to be economically viable. The Rhodes demos were piloted observing the best recommended agronomic practices namely; land preparation, seed rate, spacing and harvesting stage. A case in point was Kiplombe CBE where Rhodes grass was established demo. Located in a region which receives relatively low rainfall as compared to the other CBE's. KMDP bought certified seeds, they leased 10 acres of land where they established the grass. Farmers were sensitized to visit the demo plot and learn from it. The case was also the same for other CBE's such as Mbwinjeru, Naari and Slopes. From the demo plots trainings, some other farmers have started similar fodder farms where they bail the grass for farm use and excess for sale. As a result, other businesses such as hay bailers and tractors entrepreneurs have gotten new business opportunities due to increased fodder uptake by farmers and CBEs.

Rhodes grass (*Chloris Gayana*)

It is a perennial with erect, spreading stems with sword-like leaves, grows up to 0.5-1.2 m. It is native to East and South Africa and widely introduced throughout the tropics and subtropics. Grows well at altitudes of between 600-2000 with an annual rainfall of 700-1200 mm. Varieties include Boma, Elmba, Masaba, Mbarara, Rongai and Pokot.

Boma Rhodes fodder demo plot, Kiplombe Dairy Society, Baringo County

5.5 Kikuyu grass

Kikuyu grass is a good protein rich fodder if well managed and fertilized. It was piloted mainly by Meru CBE's. The planted Kikuyu grasss did poorly in the demo plots. The naturally occurring kikuyu has performed very well under good management practices (fertilization).

About Kikuyu Grass
(*Pennisetum clandestinum*)

It is a long growing perennial with strong, thick and long rhizomes. Also has stolons with short internodes which roots at the nodes. It is a member of the graminae family. Grows best at an altitude of 1,500-2,500 and a minimum of 1000 mm of rainfall annually.

The considerable high protein levels in the grass as compared to other grasses and the ease in management as compared to Lucerne led to it being adopted by farmers. Some of the CBE's where the crop has been observed to be doing very well are Olenguruone, MUKI, Ainabkoi, Mbwinjeru & Mumberes. One of the farm where the crop was piloted was Itiri dairy in Mbwinjeru, Meru County. The farm owner acknowledges that compared to Lucerne the management of kikuyu grass is far much better in terms of management. The farm is also a model farm hence other farmers from different regions were able to learn on the same through exchange visits.

Kikuyu grass demo plot, Cheptiret Dairy Society, Uasin Gishu County

5.6 Lucerne/Alfalfa

Lucerne is a protein rich crop was first piloted in 2014 in small demo plots and Up-scaled (much bigger demo plots of 0.25 – 1 acre) in 2015 in most of the CBE's. This was mainly to create awareness of the best agronomy practices and utilization of the crop. The nutritional value of Lucerne is estimated as follows; Crude Protein 19-22% in the dry matter. Fresh lucerne has a dry matter of approx. 20-25%.

Lucerne (*Medicago sativa*)

Lucerne is a deep rooted perennial legume. It grows up to 50 cm tall. However, it has the tendency of lodging under excessive moisture and soil fertility. Grows well in altitudes of below 2,700 and rainfall amounting to 1200 mm annually. Common varieties: Hunter River, Cuf 101, Hairy Peruvian, Siriva and Trifecta. Hairy Peruvian does well in high altitudes while Hunter River and Cuf 101 are suited to lower altitudes.

Through SNV/KMDP, farmers were supported with soil analysis but most demo plots did not comply with the optimum PH for lucerne which is 6.0 and above. Most plots had PH 4.5 - 5.0 and hence agricultural lime was supplied and manure was applied to begin reducing the acidity of their soils. The low soil PH in Kenyan soils negatively affected the Lucerne demo plots as Lucerne does not do well in acidic PH. LCB's/JC's and CBE extension officers were tasked with mobilizing farmers to visit this demo plots and train them on the best Lucerne crop husbandry practices throughout its establishment and growth stages to harvesting. Lucerne management proved a costly and involving process and its adoption by smallholder farmers and viability is doubtful. Well managed desmodium and Kikuyu grass are a better choice in acidic soils.

Lucerne fodder demo plot, Mbwinjeru Dairy Society, Meru County

Lucerne fodder demo plot, Githongo Dairy Society, Meru County

5.7 Desmodium

The same approach which was used in piloting and up-scaling Lucerne was also applied in Desmodium which is protein rich. The aim of the demo plots was mainly to create awareness of the existence of the fodder crop and to promote the best practices and also inform farmers of its nutritive composition as a protein fodder crop. The feed value for Desmodium is crude protein 15-20 %, dry Matter 20-26% and a crude fiber of 25-30%.

About Desmodium
(*Desmodium intortum & Desmodium uncinatum*)

A trailing and climbing perennial legume that roots at the nodules. It has deep tap roots and stems that branch freely. Leaves are dark green with purple or brown speck on the upper surface for Greenleaf desmodium and Irregular silvery spots along the mid-rib on the upper surface of all three leaflets are the characteristic marks for silver leaf desmodium. Grows well at altitudes above 1200 M.A.S.L and rainfall above 800 mm annually.

Desmodium demo plot, Githongo Dairy Society, Meru County

5.8 Lupins

The feed value for Lupin is as follows; Crude Protein 29-32%, dry matter 95% and a crude fibre of 10%. A case in point is Joseph Muikia Mwangi, lead farmer Kitiri CBE; Nyandarua. With the support of SNV/KMDP through its consultants, the farmers established an acre of Lupins managed it well and the crop was able to yield him 1000 Kgs of Lupin seed. The farmer informed the assessment team that he mixes the seeds with maize in the ratio of 1:3, mills and feeds them to the animals as concentrate. The use of the feed to dairy cows improved milk production as well as their body condition score.

About Sweet lupins
(Lupinus angustifolius)

Lupins (*Lupinus* L.) are members of the legume family (subfamily Papilioniodeae) containing both herbaceous annual and shrubby perennial types with attractive long racemes of flowers. Being a legume, lupins fix atmospheric nitrogen via a rhizobium-root nodule symbiosis, which together with a deep root system, explains their tolerance of infertile soils. .Grows well at altitudes above 1200 M.A.S.L and rainfall above 1000 mm annually.
Sweet lupins can be grown anywhere in the highlands where rainfall is over 900mm in a year.

The farmer was planning on making an arrangement with the CBE to see how some of the seeds can be given to farmers so that they can also benefit from them.

Lupins fodder demo plot, Kitiri Dairy Society, Kinangop, Nyandarua County

5.9 Vetch

Purple Vetch were piloted in the CBEs. It was reported that the demos piloted observed proper agronomic practices from land preparation all the way right harvesting stage. There was also practical lessons held around the demo as part of sharing knowledge with other farmers on vetch production. The nutritional value for vetch is as follows; Crude Protein 17- 22 %, Dry matter (DM) 89% and Crude Fibre (CF) of 30%.

Purple Vetch (*Vicia Sativa*)

Vetch is a leguminous plant with horizontal growth habit but may climb on any support if provided. Flowers are blue to purple in colour and appear singly or in pairs at the base of the leaves. Grows well at altitudes above 1500 M.A.S.L and rainfall above 100 mm annually.

A case in point was MUKI CBE who intercropped 22 acres of Oats with Vetch.

Purple Vetch demo plot, Ainabkoi Dairy Society, Uasin Gishu County

6. Fodder adaptability to per CBE

The table below shows where the different fodder crops piloted adapted to the various CBE agro-ecological zones.

CBE name	Fully adapted	Moderately adapted	Marginally adapted
Ndumberi	Maize, Desmodium, Sunflower, Columbus Grass	Lucerne, Kikuyu grass	
Kiambaa	Maize, Desmodium, Sunflower, Oats	Lucerne, Kikuyu grass	
Muthiru	Maize, Oats, Columbus Grass	Lucerne	
Kithirune	Maize, Sorghum, Oats, Rhodes Grass ,Vetch, Columbus Grass	Lucerne	
Uruku	Maize, Sorghum, Oats, Columbus Grass, Lupins	Vetch ,Lucerne, Rhodes grass,	Kikuyu grass
Mbwinjeru	Maize, Sunflower, Columbus Grass, Sorghum, Lupins	Lucerne, Kikuyu grass	
Naari	Maize ,Desmodium, Lupins, Vetch, Columbus Grass, Rhodes Grass, Oats	Lucerne, sorghum	Kikuyu grass
Githongo	Maize, Sorghum, Vetch, Oats, Lupins, Rhodes Grass	Columbus, Lucerne,	Kikuyu grass
Nkuene	Maize, Sorghum, Vetch ,Oats, Rhodes Grass	Lupins	Lucerne, kikuyu grass
Mik/Slopes	Maize, Kikuyu Grass, Desmodium, Lupins, Oats	Lucerne, sorghum, Columbus grass	
Muki	Oats, Purple Vetch, Lupins, Kikuyu Grass, Sorghum (The Lower Parts)	Lucerne, Desmodium	Maize, sorghum
Kitiri	Kikuyu Grass, Oats, Lupins, Purple Vetch	Desmodium, Lucerne	Maize, sorghum
Tulaga	Oats, Kikuyu Grass ,Purple Vetch, Lupins,	Lucerne,Desmodium	Maize, sorghum
New Ngorika	Boma Rhodes, Nandi Setaria, Kikuyu Grass, Oats, Lupins	Lucerne, sorghum, Columbus grass, desmodium	
Kiplombe	Boma Rhodes, Sorghum	Maize, Oats, Lupins	Lucerne, Desmodium
Mumberes	Kikuyu Grass, Oats, Lupins, Nandi Setaria, Purple Vetch	Maize, Lucerne, Columbus grass	Sorghum
Ainabkoi	Oats, Kikuyu Grass, Lupins, Nandi Setaria, Sunflower, Purple Vetch	Maize, Columbus grass,Desmodium	sorghum
Olenguruone	Kikuyu Grass, Puple Vetch, Oats, Nandi Setaria, Lupins	Maize, Lucerne, Desmodium, Columbus grass	sorghum

7. Linkages between CBEs and CFPs

This output did not materialize as some factors largely attributed to CBE bureaucracies. At some point during the project cycle, it became evident that encouraging SH dairy farmers to buy expensive poor quality hay is not cost effective and sustainable in the long run. SH dairy farmers were instead encouraged to produce their own fodder own their farms, with the help of SPEN youth groups.

Some CBEs such as Kiplombe and Mumberes in the North Rift region and MUKI in Central region were supported by KMDP to establish their own commercial fodder fields for harvesting and sale to their members at much discounted prices. This is expected to spur the CBEs towards thinking commercially in fodder production and providing leadership in fodder production and availability for their membership hence being assured for an all year round supply of milk.

8. Experiences from various actors

8.1 Farmers

Successes:

- Most of the farmers interviewed acknowledged that their knowledge has increased regarding awareness of which fodder exist, how they are grown, harvested, preserved and how they are utilized in dairy.
- They also are able to establish most of the fodder crops taking into consideration the best fodder practices.
- Maize, sorghum, lupins, vetch and oats recorded very good results where they were piloted. The adoption levels have therefore improved in those areas

Challenges/Issues:

- Certified fodder seeds availability in the market when it is required is still a challenge to most farmers.
- Seeds for certain fodders were very expensive i.e. Kikuyu grass (Ksh 7,000/kg). This price remains prohibitive to the farmers who would be willing to grow Kikuyu grass in the place of other protein forages. Managing existing natural Kikuyu grass may be the best option in the meantime.
- Managing Lucerne turned out to be very expensive due to the high management cost involved especially in weeding the crop. This was more-so in places where PH was low and therefore unsuitable, farmers used manure which also came along with a variety of weeds.

8.2 Junior consultants (JCs)/Local capacity builders (LCBs)

Successes:

- The selection of the demo sites/farmers, the establishment and management of the demo plots in accordance with the best agronomical practices improved with each year of demo plots
- The demo plots provided the best avenues for training many farmers in a more practical way from land preparation to harvesting and utilization.

Challenges/Issues:

- Training and Extension on fodder management by agronomists were not adequate making some fodder to fail as farmers could not know how to handle certain diseases or emerging new challenges. This is a critical activity that needs to be addressed in any serious fodder production.
- Emerging diseases associated with climate change, sudden change of weather and heavy rains had a toll on some fodder affecting the various stages of growth including germination.

8.3 CBE level

Successes:

- Some CBEs were able to stock and sell seeds as demanded by the farmers, for example MUKI dairy society but at times they could also be let down by the suppliers. Mumberes became an agent for Kenya Seed.
- The fodder demos provided a good avenue to infuse technical knowledge of the CBE extension staff. The extension teams from different CBEs are now equipped and knowledgeable with the best husbandry practices for different fodders and this is useful even beyond the KMDP supported initiatives.

Challenges/Issues:

- Some CBEs have vast catchment areas making it very hard to reach all the farmers in equal measures due to logistical challenges. I.e. for example Olenguruone and MUKI. It would therefore require a wider selection of farmers to facilitate and increase peer-learning.

8.4 Role of KMDP LCBs and SPEN

KMDP LCBs played a crucial role in mobilization, creating linkages and farmer and in some cases co-financing their business investments. The farmer training was on good agricultural practices (GAP), animal health and nutrition. Linkages were created between input suppliers and the farmers, commercial fodder producers (CFP's) with small holders (SH) through their CBEs. Before the start of KMDP, fodder preservation especially maize silage was almost non-existent. Most of the farmers believed that maize would only be used as human food as opposed to animal feed or are usually tempted to convert maize meant for silage to human food (especially if they do well). This required a shift in the mindset which needed some time before it was achieved. Service Provider Entrepreneurs (SPEs) youths working together with LCB's/JC's and the CBE extension team started by ensiling Napier grass as they slowly progressed to ensiling whole maize (stalk + cob). SPEN played a key role in fodder preservation (silage making) and nurturing the upcoming SPE's (local chapters). SPEN in collaboration with the LCB's/JC's and the CBE extension team were involved in organizing trainings where farmers were trained on how to make silage, utilization and simple cost benefit analysis computations aimed at reducing the cost of production. The demos played a crucial role as they were used by SPEs to demonstrate the practice of ensiling whole maize crop and its utilization as dairy feed. The benefits were also clear as there was an increased milk production reported by the farmers who fed their cows on the silage translating to more returns. This motivated the rest of the farmers to adopt maize silage. Economics of using maize silage compared to other fodder has also boosted the adoption rates as compared to use of expensive low quality hay. This is one of the most visible outcome of the KMDP program.

8.5 Introduction of scythe

A scythe is an agricultural implement consisting of a long, curved blade fastened at an angle to a handle, for cutting grass, grain, etc., by hand. The implement was introduced to small holder farmers (SH) as it was more convenient for them to use it compared to a sickle in harvesting grass. Equally true, the implement was introduced to the small holder farmers due to the small sizes of their grass fields which rendered it uneconomical to use tractor mounted mowers. Trainings were organized and held in Nyandarua and Meru CBE's where farmers were trained on how to use and

Scythe in action in Tulaga Dairy Society, Kinangop, Nyandarua County

maintain the implement. The process was spearheaded by Eric De Jong an independent consultant from Dejirene Enterprises Ltd in collaboration with LCB's, junior consultants and & extension team of the respective CBE.

8.6 PUM and Kenya Agricultural Livestock Research Organization (KALRO)

Jaap de Vrij a senior expert from PUM also played a pivotal role in ensuring that the fodder demos met the standards in good agricultural practices (GAPs), especially in terms of land preparation and seeding. This was achieved through knowledge sharing in workshops and field trainings. He was also involved in coaching the LCBs.

KALRO also played an important role, Dr. John Kangara from KALRO Embu and Dr. Robert Irungu from KALRO Naivasha helped in sharing knowledge through trainings and farm visits. Some of the seeds bought for the demo plots were sourced from KALRO i.e. Lupins and Purple vetch. They also provided some of the information that led to the calculation of costs of production and grass margins of the various fodders piloted.

8.7 Creation and success rate of new SPE's (local chapters)

Due to the awareness on the importance of fodder preservation and more so silage, there was a demand for SPE services. It was clear that the few SPEs could not meet the rising demand from farmers, it became necessary to support the development of new SPE's in each CBE who would then fill this gap in extension. The SPE's would offer their services in nearly the same model as the older SPEN team and as a result earn some income which they could support themselves and their families. A case in point is Bidii SPE from Mbwinjeru CBE who are now actively providing silage making services to farmers in the CBE amongst other services. The SPE's local chapters were created in 12 CBE's out of the 18 which are supported under KMDP. The remaining 6 are Kiambaa, Ndumberi, MIK/Slopes, MUKI, Tulaga and Kitiri who were to be supported by the older SPEN group. Most of the SPE's created are active and doing well in spite of many challenges, of the second generation SPE's, Bidii SPE of the Mbwinjeru CBE comes across as the most vibrant. The other SPE's will be evaluated at a later date to determine their level of growth, cohesion, and business portfolio.

8.8 Evaluation of what worked well and what did not

The analysis of what worked or what did not work is based on the extent to which the objectives of each were achieved, particularly so in terms of visible outcomes.

- The selection of the host farmers and the subsequent coordination of soil analysis, allocation of seeds and lime went well.
- Agronomic support to the demo farmers through the T&E staff of the various CBEs and the JC's on the ground was fairly well carried out, while some of the demos did not succeed, such failures were attributed to other external challenges such as heavy rains and drought
- Coordination of farmer learning around the demo was well coordinated, the internal farmers' exchanges were resourceful in sensitizing the farmers about the fodder varieties available, and how they are grown and utilized as dairy feed.
- The development of local SPE chapters and the subsequent connection of SPEs with the Demo farmers both for support in establishment and conversation was well coordinated and it worked.
- The knowledge of maize cultivation for fodder purposes and later silage making has been going on and the impact is visible. More farmers are leaving a portion of their fodder farms for maize silage alongside the maize grown for human food.

Among the processes that did not work well include:

- The documentation of costs at the farmer stage was not very accurate, it could have been sophisticated in nature, but a good attempt to take into account the financial costs would have helped greatly to determine viability of the various fodder more accurately.
- While the seeds were well supplied in the beginning for two consecutive years with the support of KMDP, the anticipated linkages between the CBEs and the seed companies did not materialize I continued partnership and cooperation that would lead to timely delivery of fodder seeds whenever required at the CBE level as well as the farmers.
- The technical back up for the fodder farmers was a challenge as the fodder agronomist at Perfometer was not readily available to provide back up support to the LCBs/JCs as well as CBE T&E staff. This needs to be addressed in future should more pilots be implemented.
- Piloting of lucerne was adversely affected because of insufficient consideration in selection of demo plots as regards to PH of the soil.

8.9 Changes brought about /associated with fodder demos

Some of the major changes associated with the fodder demos include:

- Knowledge development on GAP i.e. fertilization, establishment, management, harvesting stage etc. was enhanced.
- Adoption of new fodder types i.e. Lupins, purple vetch and sorghum was largely successful
- Development and uptake of SPE local chapters. This is critical as part of fodder adoption and preventing post-harvest losses

9.0 Lessons learnt and recommendations

- As long as an intervention returns visible and direct value to farmers, the adoption is faster. Demand does not have to come from producers, it can be 'an initiative that begins as supply driven' but as long as producers see value, demand is activated.
- Seed availability in the seed supply chain is still a challenge. When seed is needed, shortages are experienced. As long as the supply of seeds remains inconsistent, adoption will not be optimal.
- Managing lucerne for most small holders is a challenge, the limitations range from soil characteristics (pH), water availability, weed control and generally viability in small holdings as compared to a protein rich grass like Kikuyu grass or desmodium.
- The fodder crops did not do well with too much rain, but did better with lighter rains. Apart from Lupins and Vetch, Lucerne and Desmodium did not cope well in heavier rains and cold seasons.
- For optimal adoption and best practices and addressing of challenges along the growth stages of fodder crops, it is imperative that farmers have an all-time access to an expert agronomist to help farmers address issues related to fertilization, emerging diseases due to weather changes, appropriate harvesting stage etc.
- There is no doubt that the fodder demo practices ranging from seed sourcing, establishment, management, harvesting, preservation ad utilization practices significantly improved the farmer's level of awareness and adoption in the CBEs. There is also no doubt the farmers used the information obtained from the demo plots to produce their own fodder hence reducing the costs of production and by extension evening seasonality of milk production challenges. Evidently the demand for fodder seeds (both energy and protein) increased as evident in farmers demanding for the seeds in the CBEs.
- In spite of these indications of reduced cost price of milk and enhanced profitability of the dairy farm enterprise, there is need for economic analysis to quantify this and to advise farmers better on choice of crop and acreage.

- The SPEs have been able to fill a gap in fodder preservation (silage) which would have dampened the adoption levels amongst farmers.
- There is need to continuously conduct fodder demos as training avenues for practical training of farmers due to emerging new fodder varieties and new farmers venturing into dairy farming.
- There is need to share the findings from the demo plots to farmers via workshops and trainings especially on the fodder crops which did well and the ones which didn't on the different CBE agro-ecological zones. Also, equally important is to disseminate the knowledge on the GAP, production potential, gross margins and the feed values for this fodder crops. Definitely this information is rich enough to inform the dairy sector.

Annexes

Annex 1: Schedule used in data collection

No	CBE Name	Day	Date
1.	MIK/Slopes	Tuesday-Wednesday	9-02-16 to 10-02-16
2.	Ndumberi	Thursday	11-02-16
3.	Muthiru	Monday	15-02-16
4.	Kithirune	Tuesday	16-02-16
5.	Uruku	Wednesday	17-02-16
6.	Mbwinjeru	Thursday	18-02-16
7.	Naari	Friday	19-02-16
8.	Olenguruone	Tuesday-Thursday	01-03-16 to 03-03-2016
9.	Muki	Monday- Tuesday	07-03-16 to 08-03-16
10.	Kitiri	Wednesday	09-03-16
11.	Tulaga	Thursday	10-03-16
12.	New Ngorika	Friday	11-03-16

Annex 2 : Fodder Demos - Picture Speak!




Meru **SPE** ensiling maize silage for a farmer-Mbwinjeru CBE


Farmers applying agricultural lime provided by SNV to their farm-Naari CBE




a) Proper land preparation, b) Farmer being trained on proper Lucerne husbandry by a fodder expert, c) Farmer trained above share the knowledge with more farmers-Mbwinjeru CBE.


Well established Desmodium crop in Muthiru CBE

Farmers being trained on proper Lupin crop husbandry-Mbwinjeru CBE

PUM Senior fodder crop expert **Jaap De Vrij** sharing knowledge with farmers on proper fodder crop husbandry.

Fodder Oats intercropped with Vetch piloted in MUKI CBE

Sorghum crop at one of the lead farmer farm in Kiplombe CBE