

Forage production and on farm feeding of the produced forages

Abstract

Proper feeding is identified as one of the most limiting factors in dairy production, several reports describe the feeding situation on many farms in Kenya as insufficient in quantity and quality resulting in underfed dairy cows, which such reach out only to a limited percentage of their production potential.

Cows require 50-60 kg of high quality of fresh feed/day to be healthy and productive. Most of the cows do not get this quantity, nor is the quality of the feed provided, meeting their nutritional requirements. Dried maize stokes, overaged Napier or low quality hay are frequent feeds and the productivity of the cows is consequently low. Production of forages can change the situation towards the better. Farmers planting forages and feeding them to their cows report on significant increased milk productivity.

Consultants of the Dutch Senior expert service recommend to feed dairy cows ideally on fresh high quality forage as this is ideal for the intake, digestibility and productivity of the cows.

On farm produced forage is also a way to bring down costs, which is important as feeding accounts for 60 – 70 % of the costs in dairy production. If the dairy farmer finds a way to bring down this cost factor, the production of milk will becomes more economic and the profitability of the farm will increase.

In conclusion:

- on farm forage production is increasing the quantity and quality of the available feed.
- feeding forages to the cows is increasing their milk production
- producing own forage brings down feeding costs

Production of forages and land size needed to feed one cow

If a dairy cow is exclusively fed on fresh forage:

Need of forage /cow / year: $50-60 \text{ kg / cow / day} \times 365 = 18.250 - 21,900 \text{ kg /cow /year}$

Average $55 \text{ kg /cow/day} \times 365 = 20,075 \text{ kg /cow / year}$

Need of land:

Table 1: Example1; production data from Magut and Leketeton farms (Eldoret) for fresh forage

Forage (fresh)	Prod kg FM /ha/year	Prod/year : 20 t = numbers of cows fed /ha	Need of land to feed 1 cow exclusively on fresh forage
Brachiaria Mulato2	40 t	40t : 20 t/cow=2	0.5 ha
Brachiaria Cayman	51 t	51t : 20 t/cow=2,5	0.4 ha
Panicum Mombasa	50 t	50t : 20 t/cow=2,5	0.4 ha

If a dairy cow is exclusively fed on dry matter (hay)

Need of kg DM / cow / day: 12 -15 kg depending on the body weight of the cow

Need of kg DM / cow / year: Average 13.5 kg / cow / day x 365 = 4927 kg

Table 2: Example2; production data from Kagura ATC and Chure dairy from trials on cutting regime for dry matter. In brackets production range

Forage	Prod kg DM/ha/year (range)	Prod / year : 4,92t/year/cow= number of cows fed/ha	Need of land to feed 1 cow exclusively on
Brachiaria Basilisk	17.84 (15,24 – 20.46)	17,84 : 4,92 = 3.62	0.276 ha
Brachiaria Cayman	23.52 (18.62 – 28.42)	23.52 : 4.92 = 4.78	0.209 ha
Panicum Mombasa	16.54 (10.61 – 22.46)	16.54 : 4.92 = 3.36	0.298 ha

Remark: Many farmers in the Meru area favour Panicum Mombasa and Panicum Tanzania due to the high biomass production. This is not reflected in the above productivity numbers and leaves some questions open and has to be further assessed.

Increase of productivity per cow after change of feeding to a stronger forage based diet

Table 3: Four examples of increasement of milk production based on interviews with farmers in the Meru area. All the farmers interviewed have high potential exotic breeds, mainly Frisian and Holstein

Farmer	Cows total (milking cows)	Average prod of cows before	Average prod of cows after	Increase average per cow in l (%)	Increase in income / cow /year (KES)*	Total income from milk sales/year (KES)
Bernard Gitobu	11 (4)	(8-9 l)	20 l (T: 80 l)	11 l (122 %)	3305 l / cow 114.070 (T: 456.000)	829.600
Joseph Gatobu	29 (12)	18 l (total 212 l)	24 l (T: 300 l)	6 l (33 %)	1830 l / cow 62.220 (T: 746.640)	3.111.000
Geoffrey Muuru	5 (2)	15 l	18 l	3 l (20 %)	915 l / cow 31.110 (T: 62.220)	373.320
Rachel Kinyua	15 (6)	13 l (T: 40 l – from 3 cows)	26 l (T: 160 l – from 6 cows)	13 l (100 %)	3965 l / cow 134.810 (T: 808.860)	1.659.200

*Lactation period: 305 days/year, price per l of milk 34 KES

Establishment cost for one ha of forages based on 20 farms from our Cost-Benefit Analysis (Virginia Mwangi, 2019) and info received from Climate smart Brachiaria Project.

Establishment cost for one ha of forages is about 110.000 KES. Based on experiences from South and Latin America forage plots can be harvested for at least 10 years without decrease of yield.

Colleagues from CIAT's Tropical Forages have even seen forages plots used for more than 20 years without reestablishment.

Calculating a time of use of 10 years the cost per year are 11.000 KES/ha for establishment.

Yearly maintenance costs for the plots are calculated on a basis of 20 farmers interviewed for the cost benefit analysis. The average costs for maintenance / ha / year was calculated with 149.000 KES. This number is highly doubtful even that it is based on farmer interviews. Maintenance costs cannot be higher as the establishment costs; as costs for land preparation, seeds, planting and more intensive weeding do only account in the first year, while manure application and harvesting costs are the main cost factors from year two on.

The origin forms show that e.g.

- Magut (Eldoret) applied 36.000 kg wet manure on 2 acres, which translates to about 4.4 kg / m², doubts are justified, if that is realistic. In addition, the value of 10 KES / kg of wet manure seems to be overestimated. A value of 3 KES / kg of dry manure seems to be the more realistic price (info from CIAT's long term trial responsible, 2019)
- Joseph Kimati applied 360 kg of dry manure on ¼ acre, which translates to 0.360 kg / m². The involved labour costs are 6 hours, which seems to be realistic, while 30 days each for harvesting 1000 m² is not possible.

- Another farmer claimed having applied a quantity of manure, which would represent an amount of 40 kg of dry manure / m², which is far from being realistic.
- There are more such examples, though we have to estimate the costs for maintenance; taking harvest costs and manure application as the main cost factors, the yearly maintenance cost can be estimated at maximum 50.000 KES/ ha / year. That gives a realistic cost of 61.000 KES / ha forage / year.

Table 4: Profit per cow / year calculated for four commercial oriented farmers in the Meru area based on the productivity data for forages from Table 1 and 2 and the increase in milk productivity by a stronger forage oriented feeding

Farmer	Forage necessary to feed 1 cow / year	Prod cost forage / year / cow	Additional income from higher milk production / year / cow	Profit per cow / year
Bernard Gitobu	Br. Basilisk 0.34 ha	61,000 x 0.34 20,740 KES	114,000	93,260 KES
	Br. Cayman 0.30 ha	61,000 x 0.30 18,300 KES	114,000	95,700 KES
	Br. Mulato 2 0.5 ha	61,000 x 0.5 30,500 KES	114,000	84,000 KES
	P. Mombasa 0.30 ha	61,000 x 0.30 18,300 KES	114,000	95,700 KES

Farmer	Forage necessary to feed 1 cow / year	Prod cost forage / year / cow	Additional income from higher milk production / year / cow	Profit per cow / year
Joseph Gatobu	Br. Basilisk 0.34 ha	20,740 KES	62,200	41,460 KES
	Br. Cayman 0.30 ha	18,300 KES	62,200	43,900 KES
	Br. Mulato 2 0.5 ha	30,500 KES	62,200	31,700 KES
	P. Mombasa 0.30 ha	18,300 KES	62,200	43,900 KES

Farmer	Forage necessary to feed 1 cow / year	Prod cost forage / year / cow	Additional income from higher milk production / year / cow	Profit per cow / year
Geoffrey Muuru	Br. Basilisk 0.34 ha	20,740 KES	31,100 KES	10,360 KES
	Br. Cayman			

	0.30 ha	18,300 KES	31,100 KES	12,800 KES
	Br. Mulato 2 0.50 ha	30,500 KES	31,100 KES	600 KES
	P. Mombasa 0.30 ha	18,300 KES	31,100 KES	12,800 KES

Farmer	Forage necessary to feed 1 cow / year	Prod costs forage / year / cow	Additional income from higher milk production / year / cow	Profit per cow / year
Rachael Kinyua	Br. Basilisk 0.34 ha	20.740 KES	134,810 KES	114,070 KES
	Br. Cayman 0.30 ha	18.300 KES	134,810 KES	116,510 KES
	Br. Mulato 2 0.50 ha	30.500 KES	134,810 KES	104,310 KES
	P. Mombasa 0.30 ha	18.300 KES	143,810 KES	116,510 KES

This description of a business case is not claiming to be scientific; it is based on forage production measurement from four different sites in Meru and Eldoret undertaken over six respective 12 months. As productivity of forages depends on many factors like soil quality, natural rainfall patterns, altitude but also on forage management like fertilizer / manure application, cutting regime or additional irrigation, it is impossible to give exact predictions about harvests for a specific site.

The quantity of forage production is highly dependent on the environment and the management of the plots and the potential is high and profitable.

In the described business case, the forage is fed on farm to the dairy cows and increased in all cases the productivity of the dairy cows. It is known that the productivity of cows depends on many factors. Genetic potential, health, cow comfort are important, but the most important influence is given by the feeding. The above calculations are made under the estimation that all other influencing factors were kept stable and that the cows are entirely fed on forages. In reality the diet is composed of different origins (Napier, sweet potato vines, Rhodes grass hay, silage) but all interviewed farmers reported the above noted productivity increases since the improved forages are more dominant in the feeding of their cows. It can be estimated that also local breads fed on forages will increase their productivity, but if it will be profitable will depend on the increase of the milk yield versus forage production costs, but all feeding is expensive and it would be interesting to compare other feeding costs to self-produced forage.

Conclusion

Even without referring to concrete numbers, all the farmers increased their profit per cow. The increase however differs, but the greater picture is that producing and feeding fresh forage to dairy cows has in general a positive effect and can be recommended to farmers.