Dry season forages for improving dairy cattle production in smallholder dairy systems

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Abstract: Economically feasible strategies for year-round feed supply to dairy cattle are needed to improve feed resource availability, milk yield and household income for the smallholder dairy farming systems that dominate in the rural Eastern and Central African region. Currently, napier grass (*Pennisetum purpureum*) is the major forage in zero-grazing production systems, but production is often constrained. While forage legumes, including *Centrosema pubescens* and *Clitoria ternatea* are used to complement napier grass, *Brachiaria* spp, a new drought tolerant grass, is being introduced. Our results showed that the introduction of drought tolerant forage technologies improved milk yield and household income. Supplementing napier grass and forage legume mixture with *Brachiaria* and forage legume mixtures by 0.5 ha on farm, elevated household production levels and lead to economic returns of US$677/cow/year.

Key words: Napier grass, *Brachiaria*, milk yield, income

Introduction

Smallholder dairy farming systems dominate in the rural Eastern and Central African (ECA) region, employ over 70% of the region's population and contribute 70-90% of the total meat and milk output in the region (Njarui *et al.* 2012). Small-scale dairy production plays a crucial role in food security, human health and overall household livelihoods, particularly among climate change prone resource poor households in the region. Zero grazing dairy systems are increasingly promoted owing to grazing land shortages and intensive dairy production requirements. Women are immense contributors to and beneficiaries from smallholder dairy production systems (Njarui *et. al.* 2012), which unfortunately, are progressively being devastated by rapid climate change and its attendant extreme weather conditions. The availability of rural household livestock feeds is being affected by climate change. The lack of effective adaptation to the adverse effects of climate change is likely to jeopardise the achievement of Millennium Development Goals 1 (eradicating extreme poverty and hunger), 7 (ensuring environmental sustainability) and 3 (promoting gender equality and empowering women) (United Nations 2010).

Napier grass (*Pennisetum purpureum*) is the major forage in zero-grazing production systems in Masaka district (Kabirizi 2006). However, the grass is constrained by long droughts, poor agronomic practices, pests and diseases such as Napier stunt disease resulting into a reduction in fodder yield of up to 100% during the dry season. *Brachiaria* Hybrid cv. Mulato 1 (*Brachiaria*) has high biomass yield and tolerates long drought and poor soils (CIAT, 2001) and could be used to complement Napier grass. *Brachiaria* is recommended to be grown at a different time to complement napier grass. The commonest forage legumes include *Centrosema pubescens* (Centro) and *Clitoria ternatea* (Clitoria). It is generally recommended, however, that forages are grown in grass-legume mixtures in order not only to ensure calorie-protein balance for livestock, but also harness atmospheric nitrogen (N) for the production systems by the legume component (Kabirizi 2006; Thomas 1995).

A study was thus designed to develop economically feasible strategies for year-round feed supply to dairy cattle in order to improve feed resource availability, milk yield and household income.

Methods

Masaka lies between 00^{o}15' and 00^{o}43' South of the equator and between 31^{o} and 32^{o} East longitude, having an average altitude of 1,150m above sea level. The annual average rainfall is 800-1,000 mm with 100-120 rainy days, in two seasons. Mean temperature ranges between 16^{o}C and 30^{o}C, while relative humidity is 62%. The district is typically dependent on crop-livestock systems, with vegetable production as a key income earner.

The study targeted dairy zero-grazing farmers with 1-2 cows and having at least 2 ha of land. The treatments involved mixtures of grass species (*Brachiaria* spp. or Napier) with legumes (*Clitoria ternatea* or *Centrosema pubescens*). The forages were established on 24 farms using methods described in Humphreys (1995) and CIAT (2001). The forage banks were compared with the farmer's practice of growing Napier grass alone. Farmers participated in all stages of project implementation to enhance rapid uptake of emerging knowledge and practices. The study was laid out in a randomised complete block design with household farms as

Table 1. Fodder availability and feeding period of different forage banks

Parameter	Forage banks			SEM
	Napier grass and Centro mixture	Brachiaria and Clitoria mixture	Napier grass monocrop	
Mean DM yield (kg/ha)	15,790	12,119	10,354	307
Feeding period (days) from 0.5 ha	254.6	195.5	167.0	20.9
Crude protein content (%)	8.4	12.1	7.0	0.14

SEM: Standard error of mean

Table 2. Socio-economic benefits of drought tolerant forages

Household characteristics	Beneficiaries (n=24)		Non-beneficiaries (n=24)		F-test	IA
	Mean	SD	Mean	SD		
Land size (ha)	1.7	1.2	1.6	0.9	0.12 NS	
Cattle (number)	1.5	0.5	1.3	0.7	0.03 NS	
Fodder area (ha)	1.1	0.3	0.5	0.3	14.4 **	134.1
Feed offered/cow/day (fresh)	55.4	12.3	31.4	7.2	5.7 *	76.4
Milk yield (L/day)	10.6	7.2	5.9	3.1	4.3*	79.7
Revenue (US $) from milk yield/cow/year	676.9	48.2	444	64.1	1.66 NS	52.4

***=significant at 1%, ** = significant at 5 %; NS = not significant SD: Standard deviation; IA: Intervention advantage

replications. Data were collected on fodder and milk yield from 24 randomly selected household farms. Dry matter yield and associated feeding period were estimated using methods described by Humphreys (1995). Data were analysed using analysis of with costs of inputs and returns from milk (including home consumed) were recorded for profitability evaluation using partial budgeting.

Results and Discussion

Intercropping forage legumes with Napier grass increased fodder availability by 50%, crude protein (CP) content by about 16.7% and feeding period (number of days a cow was able to feed on fodder from a given area of land) by approximately 30% (Table 1).

Higher total fodder yields and CP content in intercrops (Table 1) could be attributed to the presence of forage legumes that improved growth of the grass. The legume acted as a cover crop to control weeds and conserve soil moisture during the dry periods, apart from the possibility of augmenting Nitrogen (N) supplies to the grass component through symbiotic N fixation (Kabirizi, 2006). The study results revealed that the currently recommended acreage of 0.5 ha of a mixture of Napier grass and forage legumes (Samanya, 1996) cannot sustain an economically producing dairy cow and its calf for a full year. Additional establishment of 0.5 ha of a mixture of *Brachiaria* spp. and forage legumes is recommended during the dry season when production of Napier grass monocrop is disadvantaged due to drought and poor agronomic practices.

There were no significant (P>0.05) differences in land size and number of cattle kept between the beneficiaries and non-beneficiaries of the interventions (Table 2).

Introduction of drought tolerant forage technologies improved milk yield and household income by 80 and 52%, respectively. The beneficiaries fed 76% more feed which resulted in 80% more milk – *i.e.* the milk yield response was largely due to simply feeding more. But beneficiaries has 120% more land sown to fodder, implying they were not harvesting as much/ha (if all fed to cows) or were able to sell fodder to others. The area under forage production and feed offered to the animals was greater for beneficiaries. Farmers were able to harvest about 56 kg/cow/day of fresh fodder.

Conclusion

Supplementing the Napier grass and forage legume mixture with *Brachiaria* and forage legume mixtures by 0.5 ha on farm elevated household production levels and lead to economic returns of US$677/cow/year (Table 2).

Acknowledgements

This publication is a product of a regional project funded by ASARECA. We appreciate farmers, local leaders, implementing institutions and district staff for their commitment.

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