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**Integrating Livestock into Agricultural Systems for Increased Livestock Productivity:  
Evidence from Smallholder Dairy Farmers in Babati District, Tanzania**

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**Abstract**

Smallholder farming systems are characterized sub-optimal production and use available feed resources. Smallholder farmers in Babati District keep an average of 3-4 heads of cattle per household. A feed assessment (FEAST) survey conducted in 2015 identified limited access to high quality fodder in adequate quantities as a constraining factor in dairy production. The current study was therefore geared towards evaluating the impact of introducing crop residues (maize stover, bean haulms, and pigeon pea haulms) into basal rations on milk yield under smallholder farmer conditions. The study tested the impact of feeding improved Napier grass and maize stover supplemented with bean haulms at different levels on milk yield under smallholder conditions. The study designed involved use of field trial experimentation considering 2 genotypes (local and improved cattle) and 2 basal rations of Napier grass and maize stover supplemented with bean haulms at different levels (100, 80, 70 & 60%). However, the study considered only improved cattle as local cattle could not be confined for the experiment as such there was no data collected. Farms were used as experimental units and lactating cows as replicates. A total of 24 cows in early lactation were selected from six villages. Data was collected for 45 days with a 7-day adjustment. A regression analysis was applied to assess the incremental changes. Results indicate that Napier grass can yield significantly higher milk yield when supplemented with bean haulms at the rate of 20-40%. The higher the inclusion rate the more milk is realized: 0.5-2.7 litres per day. Supplementing maize stover with bean haulms on the other hand yielded marginal milk increased per day. Therefore, there is an opportunity to promote improved forages and integration of crop residues in dairy production. There is a need for upscale technology and promote good dairy/livestock production practices for improved livestock productivity.

**Key Words:** Crop residues, Feed supplementation, livestock productivity, Sustainability

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## Introduction

Smallholder farming system is characterized by production of forage and fodder in sub-optimal levels integrated with other aspects of agricultural production. By growing and utilizing greater quantities of locally produced high quality forages, livestock production costs can be reduced without compromising productivity, thus increasing on-farm sustainability (Thornton, 2010). Integration of improved forages in smallholder mixed systems results in a sustainable utilization of land for both forage and food crop production (Lugusa et al., 2016). Moreover, this would result in sustainable dairy production systems by availing adequate high quality forages (Nangole et al., 2011). A feeds assessment (FEAST) survey conducted in Babati in 2015 identified that farmers have limited access to adequate quantities of high quality forages (Lukuyu et al., 2015). It is on foregoing that this study was aimed at evaluating the impact of introducing crop residues (maize stover, bean haulms and pigeon pea haulms) into basal rations on milk yield under smallholder farmer conditions. Specifically, the current study tested the impact of feeding improved Napier grass and maize stover supplemented with bean haulms at different levels on milk yield under smallholder conditions.

## Material and Methods

The study used field trial experimentation in Babati, considering 2 genotypes (local and improved cattle) and 2 basal rations of Napier grass and maize stover supplemented with bean haulms at different levels (100, 80, 70, & 60%). Using farms as experimental units and lactating cows as replicates, a total of 24 cows in early lactation were selected from six villages namely; Hysum, Bermi, Long, Bashnet, Masabed & Gabadaw). Data was collected for 45 days with a 7-day adjustment before trial. A regression analysis was then applied to assess the incremental changes in milk production by the level of supplementation. The experimental diets are as shown in table 1:

Table 1: Dairy experimental diets

Feed ingredients	Napier grass-based diets				Maize stover - based diets			
	T1	T2	T3	T4	T5	T6	T7	T8
Treatments	T1	T2	T3	T4	T5	T6	T7	T8
Napier grass	100	80	70	60				
Bean haulms	-	20	30	40	-	20	30	40
Maize stover					100	80	70	60
Total	100	100	100	100	100	100	100	100

## Results and Discussion

### *Effects of feed supplementation on milk production*

Results from the regression analysis showed that Napier grass supplemented at 70:30 & 60:40 levels yielded significantly higher milk output compared to other levels (100, 80:20). Therefore, Napier grass can yield significantly higher milk yield when supplemented with bean haulms at the rate of 20-40%. The higher the inclusion rate the more milk is realized. This translates to about 0.5-2.7 litres of milk per day.

Similarly, the average increase in milk production from maize stover ration was significant only at 80:20 and 60:40 levels of supplementation. Therefore, supplementing maize stover with bean haulms translates to marginal increase in milk between 0.5-1 litres per day. This can be attributed to the low DMI implying low palatability of the diets due to high fibre.

Table 2: Average milk production and feed intake (DM) at different levels of feed supplementation

Fodder type	Feed intake (kg DM)	s.e.d and sig Feed intake	Milk yield (Litres)	sig Milk yield	Rate of change in milk yield (Litres)
NG100	5.99	0.694	9.47	ns	(reference feed)
NG80_BH20	3.96	0.078	9.76	ns	0.4
NG70_BH30	3.98	0.088	9.88	***	1.7
NG60_BH40	3.35	0.058	9.898	***	2.7
MS100	1.6	0.062	6.81	ns	(reference feed)
MS80_BH20	1.71	0.094	7.25	***	0.97
MS70_BH30	1.71	0.087	7.48	ns	0.47
MS60_BH40	1.69	0.015	7.64	***	0.98

s.e.d: standard deviations; sig: level of significance  
 \*\*\* and \*\* represent significance at 1% and 5% probability levels, respectively

## Conclusions and Outlook

This study showed that feed supplementation with protein-rich on-farm feeds can result in increased milk production. Napier grass supplemented with bean haulms resulted in milk yields similar to those of the Napier grass and concentrate feed supplements. Thus, indicating that using legume crop residues has the potential to replace the use of commercial feeds and consequently reduce dairy production costs. The low palatability in maize stover-based rations results in lower milk output. Therefore, the study recommends reduction on maize stover proportions in animal diets. There is therefore, an opportunity to promote improved forages and integration of utilization of legume crop residues in dairy production. There is a need to also upscale and promote good dairy production practices among farmers for improved livestock productivity.

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