

## THE EFFECT OF *MUCUNA* (*Mucuna pruriens*) FORAGE ON THE PERFORMANCE OF LACTATING COWS

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### SUMMARY

A study was carried out at the Kenya Agricultural Research Institute's Regional Research Centre in coastal Kenya to evaluate the long-term effect of *Mucuna* on milk production. *Mucuna* (*Mucuna pruriens*) was compared to *Gliricidia* (*Gliricidia sepium*), a recommended legume for supplementation of the grass-based diet in dairy feeding. Twelve Jersey cows were divided into two groups balanced for initial milk yield and live weight. The cows were fed Napier grass *ad libitum* and three kilograms of maize bran daily. They were supplemented with eight kilograms of either fresh *Mucuna* forage or *Gliricidia* to form two treatment diets for 24 weeks. Each cow was housed in a well-ventilated stall with individual feeding facility. The two legumes had similar nitrogen (N) concentration but the tannin tended to be higher in *Mucuna* (2.9 vs. 2.1%). The total dry matter intake and milk yield were similar for the two groups. *Mucuna* and *Gliricidia* forages gave similar daily milk yield (5.2 and 5.5 kg cow<sup>-1</sup>, respectively) when used to supplement a grass basal diet.

**Key words:** legume forage, velvet bean, *Mucuna*, *Gliricidia*, milk yield.

### INTRODUCTION

Forages provide the main part and in some cases the only feed for dairy cows in the tropics. Most of the farmers in coastal Kenya rely on natural pastures, which have been shown to be of low quality and require protein supplementation (Muinga *et al.*, 1998). Most farmers supplement their milking cows with small quantities of maize bran (100 g CP kg<sup>-1</sup> DM) and earlier studies in the region recommended legume supplementation for increased milk production (Muinga, 1992). Twenty-three herbaceous legume species were evaluated in 1995 and 1996 for their adaptability to coastal Kenya (Saha *et al.*, 1997). The legume species were evaluated for their biomass production, nodulation and nitrogen fixation characteristics. *Mucuna* was found to be among the best legumes for the region. It produced the highest amount of biomass and over 90% of its nodules were

active. This legume was therefore recommended for soil fertility improvement.

A wild species of *Mucuna* grows in abundance in many parts of the coastal region. This species produces black grains and has long prickly hairs on the pods. The cultivated species produces grains that are creamy-white or mottled and has silky non-stinging hairs on the pods. Farmers in some parts of coastal Kenya have used grains from the black-seeded *Mucuna* to make a beverage. Under the coastal climate, *Mucuna* spreads on the ground to quickly form a carpet of green material slightly over 50 cm high.

To enhance the acceptability of *Mucuna* by farmers for soil fertility improvement in the region, the legume was evaluated in 1999 among other legumes for livestock feeding (Muinga *et al.*, 2000). The study showed that cows supplemented with fresh forage of *Gliricidia*, *Clitoria*, *Lablab* or *Mucuna* over a period of 12 weeks had no significant difference in their mean daily milk yield (7.1, 7.1, 6.8 and 6.3 kg, respectively). However, the milk yield of cows fed on *Mucuna* tended to be different from that of cows fed the other legume forages (5.3 vs. 6.3 kg) during the 12<sup>th</sup> week of the experiment. The current study was carried out to determine whether over a longer time frame, *Mucuna* may negatively impact milk production. The objective of the study was therefore to assess the long-term effect of feeding *Mucuna* forage on milk production.

### MATERIALS AND METHODS

The study was carried out at the Kenya Agricultural Research Institute, Regional Research Centre Mtwapa in coastal Kenya (3°50'S, 39°44'E and 15 m.a.s.l.). The Centre is in agro-ecological coastal lowland zone 3 (CL3) as described by Jaetzold and Schmidt (1983). The mean annual rainfall is 1200 mm and the mean monthly minimum and maximum temperatures are 22 and 30°C, respectively. The relative humidity is high (>80%). The site has well drained sandy soils, which are prone to leaching and have low levels of organic matter and N.

## Forages

The forages used in the experiment were established in 1989 at the Research Centre. These were established in an alley system of Napier grass in either *Gliricidia* or *Leucaena* alley. The Napier grass was rehabilitated by cutting back in May 2002. Calcium ammonium nitrate (CAN) was applied to the Napier grass after weeding, at the rate of 50 g per hill (equivalent to 75 kg N ha<sup>-1</sup>). The *Gliricidia* was cut back and the four-weeks re-growth fed to dairy animals. *Mucuna* was planted in April-June 2001 on two hectares of land. This legume was established at two-week intervals over the three-month period to ensure a continuous supply of good quality fodder. The legume was harvested two months after planting at about 50 to 70% flowering.

## Animals

Twelve Jersey cows in their second or third month of lactation were selected from a Jersey herd grazing natural pastures in the Research Centre. The cows calved within a period of two months (31 March-29 May 2002). The cows were divided into two groups balanced for milk yield and live weight. The average daily milk yield for both groups at the start of the experiment was 5.8 kg and the live weight was 270 kg (range 260 to 280). The cows were housed in well-ventilated stalls with individual feeding facilities. They were sprayed with an acaricide every fortnight to control ticks.

## Procedures

Two weeks prior to the start of the experiment, all cows were offered Napier grass *ad libitum* and 8 kg fresh *Gliricidia* forage together with 3 kg maize bran in two equal parts daily. Napier grass (1-1.5 m re-growth) was harvested daily and chopped with a motorized cutter to pieces of about 20 mm to avoid selection of leaves by the animal. Fresh Napier grass was offered in the morning and added as required during the day to ensure availability of feed at all times. Refusals were removed and weighed the following day before fresh feed was offered. The quantity offered was 5 kg more than the previous day's intake to ensure *ad libitum* feeding.

During the experimental period, all the cows were fed with Napier grass *ad libitum* and three kilograms of maize bran together with 60 g of a mineral lick (Maclick super). One group of cows was supplemented with 8 kg fresh (equivalent to 2 kg DM) *Mucuna* forage daily while the control group was supplemented with 8 kg fresh *Gliricidia* forage daily. The *Mucuna* forage was harvested at 10 cm from ground level and chopped into pieces of about 20 cm length. *Gliricidia* leaves and twigs less than 5 mm diameter were separated from the branches and fed to

cows. The supplements were offered in two equal amounts in the morning and afternoon immediately after milking. The treatment diets were offered for 24 weeks.

Water was provided at all times. The cows were hand milked twice per day and milk weight recorded. The cows were weighed every two weeks to monitor weight changes. Blood samples were taken from the jugular vein every fortnight to screen for trypanosomes.

## Sampling and analyses

Napier grass, *Mucuna* and *Gliricidia* were sampled weekly throughout the experimental period. The samples were divided into two groups; one was dried at 105°C to a constant weight for DM determination while the other sample was dried at 85°C and preserved for nutritive value analysis. Fresh *Mucuna* was also collected and preserved in the freezer for L-Dopa analysis. The weekly forage samples were later bulked per month, ground and packed for L-Dopa analysis.

Ash and nitrogen were determined according to the official methods of AOAC (1984). Neutral detergent fibre (NDF) and acid detergent lignin (ADL) were determined by using the method of Goering and van Soest (1970). The total tannins were determined using the procedure described by the Tropical Soil Biology and Fertility Programme (TSBF, 1989). L-Dopa analysis was done in Judson College, USA.

## Statistical analysis

Data was stored in MS Excel files and subjected to Analysis of Variance using the SAS GLM procedure (SAS, 1987). A complete randomized design was used and means were separated using least significant difference.

## RESULTS AND DISCUSSION

The composition of the feeds used in the experiment is shown in Table 1. Five monthly samples were analyzed, but since there were no significant differences between the months, the reported figures are means across months. The N concentration in *Gliricidia* was significantly higher ( $P<0.05$ ) than in *Mucuna*. The N concentration in both legumes was, however, lower than that reported earlier at the same site (Muinga *et al.*, 2000). The NDF and tannin concentration was significantly higher ( $P<0.05$ ) in *Mucuna* than in *Gliricidia*. There were no significant differences between the concentrations of lignin and ash in both legumes. From the chemical composition, *Gliricidia* forage would be expected to be of higher quality than *Mucuna*. The L-Dopa concentration in the

forage was 0.19% and was relatively low compared to the mature pods which had 3%. It is unlikely that the low levels of L-Dopa in the forage could affect the lactation performance. However, future studies should evaluate cumulative effects in long term feeding.

Total DM and Napier grass intake were not significantly different between the treatments (Table 2). Cows fed *Gliricidia* consumed more legume ( $P<0.05$ ) than those fed *Mucuna*. Although the mean Napier grass consumption of cows fed *Gliricidia* appeared to be less than that of cows fed *Mucuna*, the difference was not significant. The two treatment groups did not differ significantly in their total feed intake per animal (Table 2). The cows consumed all the 3 kg maize bran offered (equivalent to 2.6 kg DM). Cows fed *Mucuna* maintained live weight while those fed *Gliricidia* tended to lose weight. The two treatment groups did not differ in their milk yield although cows

fed *Mucuna* tended to produce more milk than those fed *Gliricidia*. This was in agreement with the earlier study that showed no difference in milk yield in cows fed *Mucuna* compared to those fed other legumes which included *Gliricidia*, *Clitoria* and *Lablab* (Muinga *et al.*, 2000). In contrast to the earlier study where cows fed on *Mucuna* produced significantly less milk than cows fed other legumes during week 12, this study showed an increase in milk production throughout the experimental period (Figure 1). However, this difference was not significant. During the fifth week of the study, there was an outbreak of Foot and Mouth disease that affected the experimental animals. This decreased the milk yield of both experimental groups. None of the experimental animals died. However, three cows from the group of cows fed *Gliricidia* and two from the group fed *Mucuna* were not included in the data analyses since their milk yields were severely affected by the disease.

Table 1. Chemical composition (% w/w DM) of the forages and maize bran used in the experiment.

Feed	DM	Ash	N	NDF	ADL	Tannin	L-Dopa
Maize bran	87.6	2.7	1.6	63.5		0.99	
Napier	23.8	8.0	1.03	73.5	4.6	1.9	
<i>Mucuna</i>	23.3	7.4	2.6	53.0	10.9	2.9	0.19
<i>Gliricidia</i>	23.4	7.7	3.1	41.1	11.4	2.1	
LSD*		1.70	0.44	5.40	2.25	0.45	

\* Comparison between *Mucuna* and *Gliricidia* ( $P<0.05$ ).

Table 2. Daily DM intake ( $\text{kg cow}^{-1}$ ) and milk yield ( $\text{kg cow}^{-1}$ ) of dairy cows fed daily 3 kg maize bran, Napier grass *ad libitum* and supplemented with either 2 kg DM *Gliricidia* or *Mucuna* for 24 weeks.

	Treatment		LSD
	<i>Gliricidia</i>	<i>Mucuna</i>	
DM intake			
Total	7.7	8.0	2.42
Napier grass	3.3	3.9	2.29
Legume	1.8	1.5	0.13
Maize bran	2.6	2.6	-
Milk yield	5.2	5.5	2.31

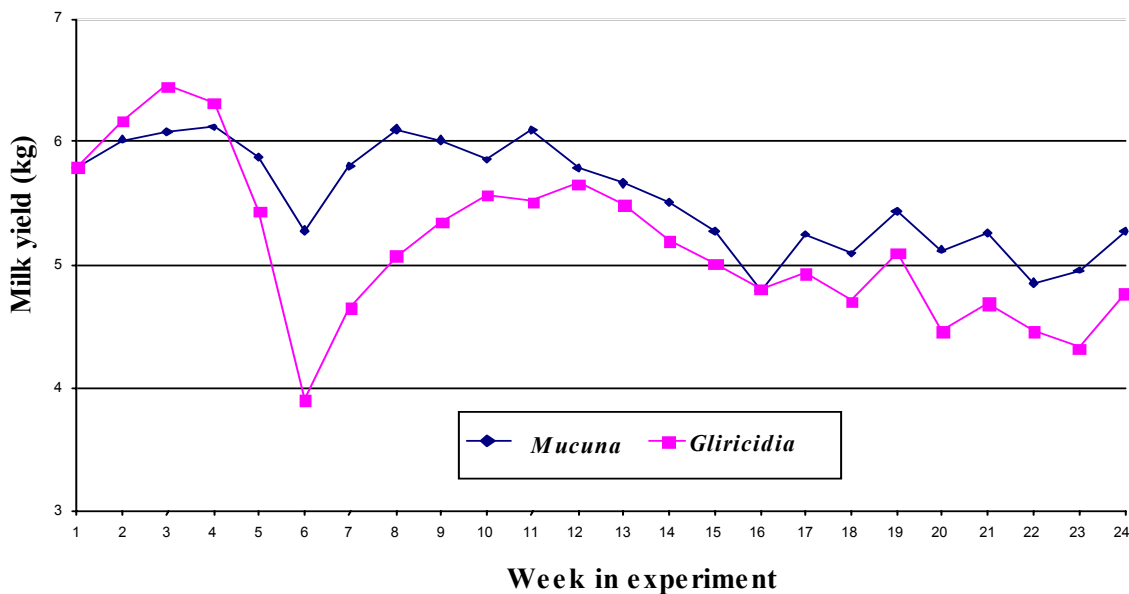


Figure 1. Daily milk yield (kg cow<sup>-1</sup>) of cows fed *ad libitum* Napier grass and 3 kg maize bran based diet supplemented with 2 kg DM of either *Mucuna* or *Gliricidia* forage

### CONCLUSION

From the experiment, it is concluded that *Mucuna* forage at the daily rate of 2 kg DM can be used to supplement dairy cows fed a grass-based diet. Farmers have the option of either using *Mucuna* for soil fertility improvement or for livestock feeding and use the manure for crop production.

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