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Preliminary assessment of rearing male buffalo calves on *Leucaena leucocephala*-buffel grass pasture in Maharashtra State, India

Valoración preliminar de cría de terneros bubalinos en una pastura de Leucaena leucocephala-Cenchrus ciliaris *en el estado de Maharashtra, India*

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Introduction

India's US$4 billion buffalo meat export industry relies mainly on the slaughter and processing of females that have stopped lactating. The potential for fattening of male buffalo calves (MBCs) for quality meat production was identified in 1995 in a report of the National Dairy Research Institute (Sharma et al. 1995): "Underfed MBCs after weaning are either starved to death or pushed to the slaughterhouse. Such malnourished calves, weighing 60 to 80 kg, yield only 30 to 35 kg carcasses of inferior quality. These calves, if reared on high energy diets up to a live body weight of 350 kg, may yield 180 kg carcasses of good quality". The rearing of MBCs could augment meat exports and provide raw material for the domestic leather industry, thereby developing a new avenue for rural employment.

Leucaena leucocephala is high quality forage, which is highly regarded in seasonally dry environments in eastern Indonesia, due to its excellent ability to produce year-round fodder if properly managed and regularly pruned (Panjaitan et al. 2014; Nulik and Kana Hau 2015). In previous research in India, no ill-effects on the general health of MBCs fed 70% of their dry matter requirements as *L. leucocephala* were observed, although daily bodyweight gains were less than 50% of those of the control group given 3.5 kg concentrates and 3.5 kg wheat straw daily (Gupta et al. 1986). This may have been due to reduced dry matter intake, lower levels of serum triiodothyronine (T3) and thyroxin (T4) and increased aspartate transaminase (AST) and alanine transaminase (ALT) activities in plasma as reported by Gupta (1995). ALT and AST are serum biochemical variables whose activities are considered as biomarkers for liver function, and synthesis of protein, albumin and globulin largely depends on the liver function status. T4 and T3 levels are considered valuable indicators of thyroid function in animals.

Given the contrasting results from previous experiments in India, the objective of this study was to conduct a preliminary assessment of rearing MBCs on leucaena-buffel grass pasture in a semi-arid part of the state of Maharashtra in India.

Materials and Methods

The study consisted of 2 experiments:

- Experiment 1: 1 December 2015–27 February 2016 (2 MBCs)
- Experiment 2: 5 January 2017–1 August 2018 (4 MBCs)

A pasture of *L. leucocephala* cv. Wondergraze + *Cenchrus ciliaris* cv. Laredo (buffel grass) was established on a 4,000 m^2 area at 'Tambmal' farm of the Nimbkar Agricultural Research Institute (NARI) by sowing 1 kg leucaena seed on 13 July 2015. Twin rows of leucaena were planted with inter-row spacing of 4.5 m. This was followed by sowing of 1 kg buffel grass seed on 13 August 2015 in the inter-row space (between the leucaena twin rows).

Another pasture was established on 8,000 m^2 at 'Madhura' farm at Jadhavwadi village near Phaltan,

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where buffel grass cv. Laredo was planted with slips in 2013. About 1,300 seedlings of leucaena cv. Tarramba were planted in this pasture at a spacing of 4 × 1 m in October 2016. Both pastures were located near Phaltan town (17.98° N, 74.43° E; 568 masl) on medium black basaltic soils. Growth of the leucaena seedlings was slow, presumably due to the competition from the buffel grass. *Gliricidia sepium* trees (gliricidia) were planted around the boundary of the experiment, and we planned to feed their foliage to the MBCs. However, even after repeated attempts, the calves refused to consume fresh, wilted or dried foliage of gliricidia.

In the first experiment, the 2 MBCs (about 7–8 months old and weighing 79 and 89 kg) were allowed to graze in the leucaena-buffel grass pasture for 3 months. The MBCs were removed from the pasture every Saturday evening and returned to it on Monday morning. This was a precaution against them being stolen over the weekend. During these 40 hours away from the pasture they were fed with sweet sorghum leaves and fresh leucaena forage from 3–5 trees (not weighed). The sorghum leaves were fully consumed, but some leucaena leaves were always left over.

The 2 MBCs were weighed weekly. After they showed satisfactory growth, they were sold and 4 additional MBCs (about 3–4 months old and 37–51 kg) were acquired on 5 January 2017 for Experiment 2. No measures were undertaken for internal or external parasite control in these 4 MBCs. They were shifted between the 2 farms (buffel or leucaena + buffel pastures at Madhura and Tambmal farms, respectively), depending on the availability of fodder, and were housed at night. It was decided to feed fresh leucaena fodder to them as much as possible, but sometimes due to its shortage, other fodders such as chopped sweet sorghum stalks (dried or fresh) or stripped sweet sorghum leaves were fed. For about half of this experiment the MBCs grazed buffel grass pasture and the other half leucaena-buffel grass pasture. The different feeds and the periods during which they were supplied to the MBCs are presented in Table 1.

The animals were difficult to handle despite being castrated (13 December 2017), making it difficult to weigh or measure them once they exceeded about 100 kg live weight, and there was no facility for weighing at Madhura farm.

The feed supplied was measured where possible (Table 1). Fresh leucaena forage (300 kg per week) was sent to Madhura farm for about 15 weeks during the second period of grazing. This was fed to the MBCs throughout the week either during the morning before they were taken to the buffel grass pasture or after bringing them back in the

Table 1. Feed offered to the 4 male buffalo calves (Experiment 2).

Dates	No. days	Grazing	Fresh leucaena leaves	Sorghum leaves	Other
5.1.17 to 5.2.17	32	-	Weight not recorded		
6.2.17 to 31.3.17	54	Buffel grass pasture	-	-	-
1.4.17 to 10.4.17	10	Leucaena-buffel grass pasture (day)	Buffel grass + leucaena leaves + sorghum leaves (all fresh) + fresh or dry chopped sorghum (total 100 kg)		
11.4.17 to 22.4.17	12	Leucaena-buffel grass pasture	-	-	-
23.4.17	1	Leucaena-buffel grass pasture	-	4 kg (at night)	-
24.4.17 to 8.5.17	15	Leucaena-buffel grass pasture	-	-	-
9.5.17 to 18.5.17	10	Leucaena-buffel grass pasture	12–15 trees per day (at night)	-	-
19.5.17 to 19.9.17	124	Leucaena-buffel grass pasture	-	-	-
20.9.17 to 25.4.18	218	Buffel grass pasture	300 kg once a week from 2.12.17 to 20.3.18 (15 weeks)	-	Solution of 200 g urea sprinkled on 5–10 kg buffel grass and fed 5 times from 29.12.17 to 27.1.18
26.4.18 to 7.6.18	43	Leucaena-buffel grass pasture	3,098 kg	-	-
8.6.18 to 1.8.18	55	Leucaena-buffel grass pasture	733 kg from 30.6.18 to 31.7.18 (4.5 weeks)	100 kg from 2.7.18 to 30.7.18	-
Total	574				

evening. Rainfall was measured at the Tambmal farm over the course of the experiments. Both farms have irrigation facilities and flood irrigation was provided on a weekly basis to the buffel grass pasture, while leucaena-buffel grass pasture received 3 flood irrigations in total during February and May 2017 and February 2018.

Figure 1. Four MBCs grazing in buffel grass-leucaena pasture.

Results and Discussion

Rainfall was variable over the 2 growing seasons. In 2017, 733 mm was received, which is about 200 mm above average, with 70% falling in September–October, while no rain fell in January, February, April, November and December. In 2018, 145 mm rainfall was received from January 1 to July 31, which is below average with no rain in January–March.

In Experiment 1, weights of the 2 MBCs increased to 125 and 137 kg, respectively, after 88 days in the leucaena-buffel grass pasture, giving growth rates of 466 and 716 g/d, respectively.

For Experiment 2, average daily gains for different pasture types are given in Table 2 with final weights of the 4 MBCs after 574 days ranging from 218 to 305 kg. Average daily gains ranged from 304 to 452 g/d, with the highest daily gains (582–970 g/d) during the trial occurring in the last 98 days when leucaena was fed.

Overall, growth rates were much higher when animals grazed leucaena-buffel grass pasture than on buffel grass alone (Table 2). Feeding leucaena forage on the buffel pasture increased weight gains but daily weight gains on leucaena-buffel grass pasture were 2.8 times greater than on buffel grass pasture.

No overt signs of mimosine toxicity were observed but hair was lost from the bodies of the MBCs by the end of the first year and there was no need to shave them as is the normal practice.

Table 2. Average daily gain (kg/hd/d) as affected by pasture type (February 2017–August 2018).

Sr. No.	Pasture type	No. days	Calf 1	Calf 2	Calf 3	Calf 4	Mean
1	Buffel grass	54	0.14	0.10	0.0	0.0	0.06
2	Leucaena-buffel grass	161	0.43	0.33	0.36	0.35	0.37
3	Buffel grass	229	0.36	0.30	0.26	0.44	0.34
4	Leucaena-buffel grass	98	0.97	0.76	0.58	0.75	0.76
Total	Buffel grass	283	0.25	0.20	0.13	0.22	0.20
	Leucaena-buffel grass	259	0.70	0.54	0.47	0.55	0.57

The cost of establishing the buffel grass-leucaena pasture on the 4,000 m^2 area was about INR 25,000 with 50% being spent on manual weed control. The cost of putting up a barbed wire fence around this pasture was INR 40,000. The 3–4 month old MBCs cost about INR 5,000 each. This makes the total cost of the operation INR 85,000. The price realized for 250–300 kg MBCs is INR 25,000–40,000 each. Even with the lower figure of INR 100,000 for 4 MBCs, about INR 15,000 net income can be expected from them in 1.5–2 years. This is expected to increase to about INR 75,000 from the next 4 MBCs kept on this pasture.

Conclusions

The study has demonstrated that the use of leucaena as a source of high quality protein feed can result in high levels of liveweight gain in MBCs compared with being fed grass alone and this can be highly profitable. Local farmers should be encouraged to take up the planting of leucaena to feed their buffalo male calves and possibly other ruminants as well.

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