

Agroforestry for livestock rearing and improving livelihood of small holder farmers

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Introduction

In intensive cropping systems livestock rearing in Bangladesh is constrained by availability of forages which accounted for up to 80% of the total cost of their farming. Cultivation of multipurpose fodder trees in agroforestry system is considered a potential source of quality feed for ruminants. This study was conducted at farmers' sites and considered utilization of forage trees for improving livestock rearing, forage yield, soil fertility and socioeconomics of the farmers.

Materials and Methods

The trees of Ipilipil (*Leucaena leucocephala*), Gliricidia (*Gliricidia sepium*) and Calliandra (*Calliandra calothyrsus*) were planted at 1 meter spacing around homesteads and cultivable lands of 80 research farmers, while a similar number of farmers remained as control farmers. The trees were lopped at 1 meter height 4 times a year after 3 years of plantation for use as forage, firewood, and as a contribution to soil fertility, live fencing. Socioeconomics were investigated over 4 years for the adoption of a tree forage-based livestock rearing system. Freshly cut foliages was supplemented at the rate of 25% and 50% DM requirement/d to 20 lactating cows and 20 growing goats, respectively for 60 days. Similar numbers of cows and goats belonging to control farmers were included as a control group to compare the effect of foliage supplementation on milk yield and growth. Phenolic compounds in foliages and microbial-N yield in goats were determined according to Makkar (2003) and Chen *et al.* (1990), respectively.

Results

The trees produced on average 6.7 and 3.1 MT/ha/yr of foliage and firewood, respectively. The soil in the plantation sites over 4 years maintained pH of 6.8 and C:N ratio of 15.1; improved organic matter (OM), nitrogen (N), phosphorus (P) and sulphur (S) contents by 22, 42, 7 and 12%, respectively. On average these leaves contained 86, 21.9, 35.8, 25.9, 8.4 and 1.29% of OM, crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF), Total Tannins (TT) and Condensed Tannin (CT), respectively. Supplementation of fresh foliages to lactating cows increased milk yield of cows and live weight gain of calves by 32% and 48%, respectively ($P < 0.01$). On average goats digested 66% of Ipilipil, Gliricidia, Calliandra which was 22% higher than naturally grown grass. Feeding of these leaves to goats yielded 75% higher microbial N (on average 5.6 g/d) than grass diet ($P < 0.01$), estimated from purine derivative. Goats supplemented with these leaves

Table 1 Yield of foliages, soil composition and production performance of cattle and goats

Foliage	Yield			Soil Composition (8%)					
	Fresh	Firewood		pH	C:N	OM*	N*	P*	S*
Ipilipil	7.34	3.7	Initial	6.7	14.9	0.9	0.065	44.3	17.6
Gliricidia	5.88	2.5	After 4 years	6.9	15.3	1.1	0.092	47.4	19.7
Calliandra	6.97	3.1							
SEM	0.66	0.13		0.36	0.08	0.003	0.57	5.88	1.92
Effect of foliage supplementation	Milk yield of cows (l/d)			Growth of Calf ((g/d)					
Grass ad lib. +25% Foliage	3.324 ^a			271 ^a					
Grass + Straw ad. Lib	2.518 ^b			183 ^b					
SEM	0.42			51.6					
Grass+50% Foliage to Goats	Ipilipil	Gliricidia	Calliandra	Grass ad lib.	SEM				
Digestibility (%)	65 ^a	66 ^a	68 ^a	54 ^b	0.56				
Microbial-N (g/d)	4.2 ^a	5.7 ^a	6.9 ^a	3.2 ^b	0.08				
Growth (g/d)	58 ^a	55 ^a	54 ^a	36 ^b	3.7				

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improved 55% of average growth rate compared to goats fed on grass diet ($P < 0.01$). These forage trees generated additional annual gross incomes of US\$ 246 per household generated 115 mandays and reduce the cost of fencing around homesteads by 34%.

Conclusion

Implementation of agroforestry systems of forage tree plantations on farms may create fodder banks for high quality forage supplies, increase livestock productivity, soil fertility and provide sustainable household income to small holder farmers in Bangladesh.

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Sustainable and integrated livestock farming systems in the hot zones of the world

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Livestock farming systems encompass a whole variety of techniques and practices used by a community to exploit a given area's vegetative resource using animals and consistent with socioeconomic, cultural and environmental constraints. This paper outlines some ruminant livestock systems in Africa and in South America.

Development

Whilst animal breeding and production is an universal activity it can varied greatly from area to area. This variability can be illustrated by the following examples:

Pastoral livestock systems – a tradition relating to ethnic groups:

In Africa, pastoral systems are distinguished into two social groups: Sedentary farmers, who live off primarily products, generally in the wettest zones and wondering pastoralists whose life is entirely organized around their herd, which provides for their needs, generally in the more arid zones. The two groups share the use of common ground. Low demographic density has traditionally allowed this system to be one of very extensive breeding, even in zones which are favourable to agriculture.

Pastoral livestock farming systems are very extensive systems. The livestock load on the land and animal productivity per hectare are low. Pastoralists systems have the following common features: they manage large herds, herd one or more species belonging to one or more owners, maintain native livestock by grazing them on various natural species. There are wondering pastoralists present on all continents who move with their animals to maintain their livelihoods as well as possible. In South American sedentary farmers let their cattle free range in immense meadows.

Semi-nomads move from fixed dwelling to other fixed or temporary dwellings over a know area and route. Some undertake Transhumance, which is the seasonal displacement of herds under the guard of animal keepers, generally of paid shepherds or young men of the family. Nomadism is a means of utilising a dry area's fodder resources but nomadism is currently in decline in the world. The reduction of grazing areas and the increased population growth impose a significant reduction of fodder resources to accelerate this trend. In the Touareg peoples of North Africa animals are selected according to their robustness, of their ability to resist water deprivation and their aptitude to withstand displacement. These include camels and goats in desert zones, zebus and sheep in wetlands. Production from pastoral systems is very varied. Herds can consist of bovines and small ruminants with bovines dominating nomadic herds and small ruminants being more numerous among sedentaries systems. The control of the animals is based on selection, affects only the males, which are considered as productive at the age of 4 to 5 years old. Castration is carried out at 2 years old for males not required for breeding. Young animals are separated usually around the age of 14 to 16 months.

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