ON-FARM ESTABLISHMENT AND PRODUCTIVITY OF *GMELINA* AND *GLIRICIDIA* AS BROWSE FOR GOATS

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ABSTRACT

The on-farm establishment and productivity of *Gmelina arborea* and *Gliricidia sepium* were studied with seven farmers in two Local Government Areas of Ogun State. *Gmelina* seedlings and *Gliricidia* stakes were planted in plots located at distances of 15 to 50m to the farmer's homestead and protected from straying animals with local fencing materials like bamboo and palm branches. Core soil samples were taken randomly within each plot for chemical analysis. The growth and yield of browse plants were determined at 3 and 12 months after planting. The palatability and the use of the browse as supplement to cassava peel were also determined. The organic matter content of the soil was fairly high with organic carbon of 1.1 to 1.3%. Leaves of *Gmelina* and *Gliricidia* had high contents of nitrogen with crude protein values of 16 to 26%. The leaves were also high in mineral content. The dry matter yield of the primary growth ranged from 3 to 5 t/ha while leaf dry matter yield ranged from 0.4 to 1.4 t/ha. Goats relished *Gmelina* more than *Gliricidia* with daily dry matter intakes of 638 and 453g respectively when offered as sole feed. It is concluded that *Gmelina* and *Gliricidia* produce good quality protein feed for village goats when they are managed as shrubs in a feed garden.

Key words: *Gmelina*, *Gliricidia*, Establishment, Productivity Browse, goats.

INTRODUCTION

In humid Southern Nigeria, small ruminants are integral component of the household where they contribute to the cultural, food and socio-economic life of the people. Upton (1984) reported that the potential returns from sheep and goat keeping under the traditional management system are high. Inadequate feed supply has been incriminated as one of the

major constraints to increased production of sheep and goat. Studies at ILCA (1988) and by Teniola (1990) have used browse plants as means of increasing feed supply and quality when planted as feed gardens. These studies have shown that browse plants (*Leucaena* and *Gliricidia*) have the potential to contribute significantly to improved year-round feed supply and increased productivity of sheep and goats.

Gmelina is a perennial and very common leguminous tree in Nigeria. *Gmelina* is particularly notable for its fast growth, large green leaves and very high dry matter yield. The leaves are relished by goats. Adu *et al.* (1993) have presented results of detailed on-station establishment and productivity study of six indigenous browse plants which recommended *Gmelina* and *Gliricidia* for on-farm (in-village/town) evaluation. The present study was therefore carried out to preliminarily evaluate the on-farm establishment and productivity of *Gmelina arborea* and *Gliricidia sepium* as browse for goat feeding.

MATERIALS AND METHODS

The study involved seven farmers with two each in Tibo and Aiyetoro while there were three farmers in Ilewo-Orile. *Gmelina* was established on-farm when the rains became steady from seedlings raised in nursery bags while *Gliricidia* was established from fresh stem cuttings. The stakes which were 30 to 60cm in length were trimmed at an angle at both ends. *Gmelina* seedlings and *Gliricidia* cuttings were planted at depths of 10 to 15 cm and at 50cm and 1m apart within and between rows respectively. Each browse was established as feed garden on 6 x 4 m plots in the farmer's backyard usually at distances of 15 to 50m to the homestead. Because of land constraint, only two farmers planted both *Gliricidia* and *Gmelina*; three farmers planted only *Gmelina* while two farmers planted only *Gli-*

ricidia. Thus *Gmelina* had five replicated plots while *Gliricidia* had four replicated plots. The plots were weeded thrice and protected from straying animals using locally available fencing materials like bamboo and palm branches.

Core soil samples were taken randomly from three points within each plot using a graduated hand trowel at depths of 0 to 15cm of the top soil. The samples from each plot were bulked for chemical analysis. The growth and yield of the browse plants were determined at 3 and 12 months after planting. To determine primary fodder yield, *Gmelina* was cut at 30cm above the ground level while branches of *Gliricidia* were cut at 20cm from the base (point of branching from the main stem). The palatability of the browse was tested by feeding each freshly cut browse to three yearling bucks with average weight of 16kg. The intake was determined after an adjustment period of 5 days. Also, the effect of feeding the browse as supplement to cassava peel on live-weight gain was estimated with six yearling bucks in each town/village. In the supplementation trial, each goat received 500 g of fresh browse as supplement to cassava peel fed *ad libitum* during an 8 week test period. Subsamples of the oven-dry browse leaf samples from the 3 and 12 months harvest were analysed for nutrient composition according to the procedure of AOAC (1975).

RESULTS AND DISCUSSION

Table 1 shows the weather parameters in Abeokuta township which is between 20 and 30km to the experimental towns/village. It is plausible to assume that the amount and pattern of rainfall in the experimentation villages will be similar to that of Abeokuta. Figure 1 shows that the area has a bimodal rainfall pattern. The rainy season runs from March to October with peaks occurring in June and September. The area has a minimum and maximum temperatures of 21.9 and 38.0°C respectively. The browse plants were established in May when the rain had become steady.

Table 2 shows the characteristics of the surface soil from the three experimental sites. The soils are alfisols and are generally well-

drained. The soils are non-sticky and non-plastic. They generally tend to be slightly acidic. The organic matter content of the soil was fairly high with organic carbon ranging between 1.1 and 1.3%. The cation exchange capacity and the fairly low activity clay will seem to suggest a low capacity to hold nutrients against leaching.

Table 3 shows the chemical composition of the browse leaves at 3 and 12 months after planting. Leaves of *Gliricidia* and *Gmelina* had high crude protein content ranging between 16 and 26% with nitrogen concentration being about 10% higher in *Gmelina*. Earlier works with *Gliricidia* by Cobbina *et al* (1990) and Onwuka (1986) reported higher nitrogen content for *Gliricidia*. However, the nitrogen content reported in this study is similar to the figure reported by Adeyemo and Ademosun (1985) for the local variety of *Gliricidia*. With the ARC (1980) recommendation of 1.2 to 2.7% nitrogen in the diet of ruminants, the nitrogen level in the leaves of *Gmelina* and *Gliricidia* would seem to be adequate for sheep and goat fed these browse plants provided the nitrogen is readily digestible. The concentrations of calcium, phosphorus and magnesium were higher in *Gmelina* than in *Gliricidia*. The concentration of phosphorus in *Gliricidia* was much higher than the figure reported by Onwuka (1986) and Cobbina *et al.* (1990). The fairly high content of mineral elements in the leaves of *Gmelina* and *Gliricidia* is perhaps a good reflection of a good uptake of these elements from the soil which also indicates that soils were not deficient in these elements.

The growth performance of *Gmelina* and *Gliricidia* at the three experimental sites are shown in Table 4. *Gmelina* consistently gave higher values for all the parameters measured. Although *Gliricidia* had more leaves per plant, the bigger size of *Gmelina* leaves compensated for this. Table 5 shows that the dry matter yield of the primary growth ranged from 3 to 5t/ha at 3 months after planting. Dry matter yield increased by 200 to 300% when the browse plants were harvested at 12 months after planting with *Gmelina* producing more dry matter than *Gliricidia*. The high dry matter

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TABLE 1: WEATHER PARAMETERS IN ABEOKUTA

TABLE 1. WEATHER DATA												
a.	Mean Monthly Rainfall											
	J	F	M	A	M	J	J	A	S	O	N	D
Rain-fall, mm	5.1	33.3	69.1	120.1	149.4	172.4	154.2	103.2	185.8	103.4	15.6	9.1
No. of Rainy day	0.2	2.6	18.1	9.6	12.5	13.6	12.9	12.0	14.3	11.2	1.7	0.9
b.	Mean Monthly Minimum and Maximum Temperatures (0c)											
Minimum	21.9	23.9	27.2	24.3	23.7	22.2	22.5	22.4	22.3	22.6	23.3	23.6
Maximum	34.4	36.2	28.9	34.2	32.7	31	29.3	29.0	30.1	30.5	33.7	36.0
c.	Sunshine Hours											
No of Hrs.	3.2	5.7	5.0	5.7	5.6	4.1	2.9	2.3	8.7	6.6	6.0	4.8

*Source: Meteorological Station, Federal Secretariat, Abeokuta, 1989-92

FIG. 1 MEAN MONTHLY RAINFALL (1982-1991) IN ABEOKUTA

TABLE 2: SOIL CHARACTERISTICS OF PROJECT SITES

Soil Component	Ilewo-Orile	Tilpo	Aiyetoro
Sand, %	81.9	87.9	74.8
Clay, %	12.6	7.8	13.6
Silt, %	4.4	3.4	4.1
Organic Carbon, %	1.17	1.04	1.31
Total N%	0.098	0.085	0.09
Exchange Ca Meq/100g	1.03	1.13	1.27
Mg %	0.39	0.48	0.44
K %	0.11	0.08	0.13
PH	5.99	5.8	5.98

TABLE 3 CHEMICAL COMPOSITION (%) OF LEAVES OF *GLIRICIDIA* AND *GMELINA* AT 3 AND 12 MONTHS AFTER ESTABLISHMENT

	Age Months	3	<i>Gliricidia</i> 12	3	<i>Gmelina</i> 12
Dry matter		27.6	33.4	31.5	39.6
Nitrogen		3.57	2.69	3.92	2.97
Crude Fibre		23.08	31.6	28.6	38.4
Ether Extract		4.2	4.6	4.3	4.8
Calcium		-	0.92	-	1.01
Phosphorus		-	0.37	-	0.43
Potassium		-	3.25	-	3.17
Magnesium		-	0.46	-	0.52

yield with age and species may be a function of the root systems which have had better development at 12 months than at 3 months and which were perhaps more extensive in *Gmelina* than *Gliricidia*. There was no consistent trend within species in dry matter yield from the three experimental sites. ILCA (1988) gave a production of 11.6 to 13.9t/ha per year for exotic *Gliricidia* planted in rows spaced 1.5m apart and 50cm within row. Reynolds and Atta-Krah (1986) reported dry matter yield of 3.5t/ha per year under small farm condition and 6t/ha per year on-station in alley farming systems with *Gliricidia* planted with rows 4m apart and spaced at 25cm within row. Smith and van Houtert (1987) gave a mean yield of 14t/ha per year green foliage or 6.6t/ha per year dry matter. Teniola (1990) reported a *Gliricidia* yield of 2159kg/ha for 3 months or 8.6t/ha per year. It is pertinent to mention that caution should be taken in comparing production per hectare with production figures from small plots converted to hectares.

The results of palatability trial where the browse plants were offered as sole feed showed that *Gmelina* was better accepted by goats with a daily dry matter consumption of 638g as against 453g for *Gliricidia*. The intake figure reported was much higher than the figures of 295g (Onwuka, 1986), 153.2 and 331.1g (Adeloye, 1994) who fed only the leaves of *Gliricidia*, *Parkia Filicoidea* and *Tephrosia bacteolata* respectively. The reported intake of 453g for *Gliricidia* is very close to 466g reported by Carew (1982). When the browse plants were fed as supplement to a basal energy feed (cassava peel), average daily dry matter intakes of 182, 484 and 416g were recorded for cassava peel, *Gmelina* and *Gliricidia* respectively. These results showed increased total dry matter intake when the browse was fed as supplement.

When the intake figures and the dry matter yields of the browse plants were used to calculate the carrying capacity of the browse plants in a feed garden production system, it was esti-

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TABLE 4: GROWTH PERFORMANCE OF GLIRICIDIA AND GMELINA AT 3 AND 12 MONTHS AFTER ESTABLISHMENT

PARAMETERS	Site+	Gliricidia			Gmelina		
		A	B	C	A	B	C
Survival at 3 months, %		83	70	91	92	84	95
Browse height, at 3 months, cm		28.1	26.3	25.6	34.6	26	35.7
Browse height at 12 months, m		1.6	1.01	1.1	1.63	1.71	1.82
Stem Diameter at 3 months, cm		0.58	0.61	0.69	0.74	0.59	0.63
Stem Diameter at 12 months, cm		12.8	12.1	13.4	12.8	13.4	14.3
No. of Branches at 3 months		1.2	1.4	-	1	-	-
No. of Branches at 12 months		2.8	2.6	2.1	4.3	3.6	3.6
No. of leaves at 3 months		19.4	21.1	18.4	11.4	9.9	12.4
No. of leaves at 12 months		107	117.6	122	58	53	52
Proportion of leaf in whole plant %		53.3	58.8	55.6	59.4	63.1	61.2
Proportion of leaf + soft stem in whole plant, %		63.4	59.2	65.8	68.4	67.1	67.4

TABLE 5: TOTAL DRY MATTER YIELD (t/ha) OF PRIMARY GROWTH OF GLIRICIDIA AND GMELINA

Age, Months	Gliricidia		Gmelina	
	3	12	3	12
Primary Growth	3.21	5.47	4.87	6.39
Leaf	0.39	1.29	1.37	2.47

TABLE 6: LIVEWEIGHT GAIN(g) OF GOATS FED BROWSE AS SUPPLEMENT

		Cassava Peel	Cassava + Browse
A.	Ilewo	30.5	68.6
B.	Tibo	20.2	43.8
C.	Aiyetoro	23.6	57.6

mated that one hectare of *Gmelina* and *Gliricidia* will support 13 and 9 goats as sole feed and double that number when the browse was fed as supplement to cassava peel at the rate of 500 g per goat per day. It can be concluded that *Gliricidia* and *Gmelina* establish well on-farm and are highly productive with high leaf nitrogen of 3.1 and 3.9% respectively. When *Gliricidia* and *Gmelina* are managed as shrubs in a feed garden production system, they produce high-protein feed for village goats. Supplementing the basal energy feed (cassava peel) of these village goats with *Gmelina* and *Gliricidia* will increase their feed intake and consequently the live-weight gains of the goats. Therefore more research and development at-

tention should be directed towards the technology.

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