

EFFECT OF COMPANION CROPS ON THE ESTABLISHMENT AND SUBSEQUENT YIELD OF *LEUCAENA LEUCOCEPHALA*¹

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Leucaena leucocephala, a promising high protein forage, was established as a sole crop and in association with *Canavalia ensiformis*, maize, sweet potato and cowpea. The companion crops were cut at the optimal stage for forage yield and yielded 2.8, 2.7, 1.2 and 0.7 t DM/ha for canavalia, maize, sweet potato and cowpea respectively. Canavalia and maize reduced weed competition. However the shading effect of these crops etiolated the leucaena plants. Leucaena forage yields were recorded for the first two cuts (at 21 and 32 weeks after planting). The yields from these cuts showed that the more vigorous of the companion crops depressed the yield of leucaena in the first cut, but by the second cut the leucaena had compensated and differences between treatments had mostly disappeared. This method of establishment is therefore recommended as an alternative to planting as a pure stand and using chemical or mechanical weed control.

Key words: *Leucaena*, establishment, forages, companion crops

Leucaena leucocephala (Lam) de flit. is a perennial legume adapted to the humid, lowland tropics. It is a specialised protein forage crop capable of giving high forage yields of good quality. (National Academy of Sciences 1977). It is deep rooted and therefore drought resistant, and a number of trials have shown that it can - at least in part - replace expensive protein concentrates in ruminant diets. (Saucedo et al 1980; Flores-Ramos 1979). Substantial increases in beef production/ha have been reported where leucaena has been established in tropical pasture (Jones 1980).

Leucaena has, however, a number of limitations. One of these is its content of a toxic amino acid, mimosine. This problem has been recently reviewed by El Harith et al (1979); U ter Meulen et al 1979). A second disadvantage is the poor germination of the seed. This can be overcome by soaking the seeds in hot water for a few minutes and then drying thoroughly before planting. The temperature of the water necessary depends on the stage of dormancy. (Pound 1980). The third major disadvantage of leucaena is its slow initial establishment from planting to first cut, which is normally at 4 to 5 months. Up to this time the plants are very susceptible to weed competition when planted as a pure stand. One method of combating these weeds is with herbicides, but this leaves the almost bare soil surface open to erosion. Furthermore, recommendations of herbicides for use in leucaena are not yet well established. Another method of establishing the crop would be to grow the plants in plastic pots and then to transplant out at an age when they could compete with the weeds. A third and more positive way of tackling this problem is to take advantage of the under-utilized land in the way described in this experiment. Companion crops, selected to be those capable of high yields of forage in a short period (8-12 weeks) can be planted at the same time as the leucaena. These control weeds and erosion, and give a useful yield of forage. Savoury and Thomas (1977).

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Materials and Methods

Treatments and Design: A randomized block design with three replicates was used. Treatments were:

- Leucaena as a pure stand (Control)
- Leucaena + maize
- Leucaena + *Canavalia ensiformis*
- Leucaena + sweet potato
- Leucaena + cowpea (*Vigna sinensis*)

Crops were planted towards the end of the rainy season. The average annual rainfall is 1370 mm and the temperature range is between 24 and 27.1°C. The soil which is an organic loam overlying a calcareous subsoil has a pH of 7.5 and medium drainage.

Plot size was 8 m x 10 m and all crops were planted at a spacing of 40 cm x 40 cm. A basal dressing of fertilizer was given at the rate of 50 kg/ha N, 75 kg/ha P₂O₅ and 50 kg/ha K₂O. A top dressing of 50 kg/ha of Nitrogen (as urea) was given at 8 weeks, and thereafter approximately 10 kg of N/ha were given per month in the form of dilute, digested cattle slurry. All crops were planted at the same time and the forage crops were cut at the optimum time from the point of view of balancing quality and quantity of forage. Maize was sprayed against stem borer and leucaena against Psyllids which attacked the growing tips in the dry season.

Measurements: Plots were weeded at 10 weeks after planting and the weight of weeds per plot was measured. The height of 20 leucaena plants taken at random per plot was taken at 8 weeks after planting. Maize, canavalia, cowpea and sweet potato were cut at 8, 9, 7 and 10 weeks after planting respectively. Yields of fresh weight and dry matter were recorded. Leucaena was cut at 21 and 32 weeks after planting and yields of fresh weight and dry matter were recorded. The companion crop, *Canavalia ensiformis*, regrew after each cut and its regrowth yields were also recorded.

Results and Discussion

Table 1 shows the effect of the companion crops on weed competition and on the early growth of the leucaena plants. Weed growth was depressed compared to the

Table 1:
Effect of companion crop on weed weight and height of leucaena plants.

Companion crop	Weed weight at 10 weeks (kg/plot)	Height of leucaena plants (cms) at 8 weeks
Canavalia ensiformis	0.28	10.2
Maize	0.18	10.8
Sweet potato	0.59	6.6
Cowpea	0.42	7.3
Sole crop leucaena	0.43	7.7
(SE)	(0.06)	(0.4)
(P)	(<.001)	(< 0.05)

control by maize and canavalia - -probably due to the shading created by these vigorous and comparatively tall crops. However weed infestation increased in the presence of sweet potato which is a prostrate plant. The taller, vigorous crops also had the effect of etiolating leucaena plants whereas the effect of sweet potato was to slightly stunt the leucaena. The etiolation was another effect of the shading, whereas the stunting can be explained in terms of the competition between sweet potato and leucaena for nutrients and water. The effect of cowpea on both parameters was very slight.

Table 2:
Yields of forage age of companion crops and leucaena

Crop mixture	Yield of companion crop	Yield of leucaena (t DM/ha)		Total forage yields ³ to 32 weeks (tDM/ha)
		Harvest one	Harvest two	
Leucaena + Canavalia	2.8	1.02 ¹	3.56 ²	10.78
Leucaena + maize	2.7	1.29	3.27	7.26
Leucaena + sweet potato	1.2	1.62	3.74	6.56
Leucaena + cowpea	0.7	2.24	4.12	7.06
Sole crop leucaena	---	2.81	4.44	7.25
(SE)	(0.31)	(0.12)	(0.7)	(0.68)
(P)	(< 0.05)	(< 0.01)	(N.S.)	(<0.05)

¹ Regrowth of canavalia yielded 1.5 t DM/ha

² Regrowth of canavalia yielded 2.9 t DM/ha

³ Totals include canavalia regrowth yields

Table 2 shows the yield of forage of the companion crops and of the leucaena. Canavalia and maize gave respectable forage yields which were significantly higher than those of the sweet potato and cowpea. The data from the first leucaena cut demonstrate that the companion crops canavalia and maize had adversely affected the development of the leucaena; Yields of leucaena were depressed compared to the sole crop leucaena. Sweet potato and cowpea also depressed leucaena yield at first cut but their effect was not as marked. By the second harvest however, the leucaena plants had recovered substantially. There was still a residual effect of canavalia but this was only significant at the 5% level. The canavalia regrew after its initial cut. It was harvested and its yield recorded at the same time as the two leucaena cuts. It may have been this regrowth rather than the initial growth up to 10 weeks that depressed leucaena yields. The data for total forage yield show that apart from plots having canavalia as a companion crop there is no real difference between treatments. The forage yield from the mixture of canavalia and leucaena, up to 32 weeks, is significantly better than for the other mixtures.

There are many examples of "catch" crops being used in new plantings of perennial crops such as bananas, coffee, citrus etc., but very few instances where the

perennial crop is a legume. Savoury and Thomas (1977) in Malawi, used maize as a companion crop for leucaena and reported that the shade given by the maize reduced desiccation of the leucaena plants in drought periods. Nurse crops are often used for lucerne (*Medicago sativa*) *here the idea is to provide a more favourable micro-environment, in terms of humidity, for germination and early establishment of the lucerne (Skerman 1977) . Sorghum has been used as a companion crop with *Stilosanthus guianensis*. In the first year the two crops were harvested as a combined silage, after which the sorghum disappeared (Risopoulos 1966).

Conclusions

Although companion crops appear to depress initial growth of leucaena and its forage yield at first cut, it is suggested that the leucaena plants have the ability to compensate and by the second cut yields reach the same level as those for a pure stand. The advantages of using companion crops are that a quick return on the land is obtained in the form of forage from the companion crops, and also the land is protected from the agents of erosion. In this trial no beneficial effects of the companion crop on the moisture status of the leucaena plants during moisture stress were noted, but this has been suggested as a third advantage of this method of establishment. The reduced growth of weeds and therefore the reduced labour input where vigorous, tall companion crops are used is another major advantage.

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