FORAGE PRODUCTION FROM *LEUCAENA LEUCOCEPHALA* (LAM.) DE WIT. AS INFLUENCED BY CUTTING INTERVALS AND PLANT SPACINGS

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Abstract

Leucaena leucocephala (Lam.) de Wit yielded a significantly higher amount of great matter of 64.83 tons per hectare when grown at a close spacing of 0.3m x 0.76m producing 48.66% more fodder than at the wider spacing of 0.3m x 1.5m. While the per plant height differed significantly, plants being taller under closer spacing, the variations in per-plant fresh weight were found insignificant.

Introduction

An exotic, locally known as "Devi" and growing wild on wastelands in Sind, *Prosopis glandulosa* Torr., dispersed unchecked through the cattle, has been gradually encroaching on cultivated and productive land. Due to deep-rooted suckers, this weed puts the land out of production indefinitely for it is extremely difficult to eradicate once it has taken hold of the land. The danger is, therefore, evident. Although it is capable of providing some browse to the farm animals and some burning material to the farmers, neither the plant is relished by the animals due to strong long thorns, nor is the wood much liked by the farmers because of poor combustion properties. It is more common in southern Sind where growth conditions of high humidity with high temperatures in summer and high water-table provide highly favourable conditions for growth of this weed.

With a view to put the land under a more useful plant and a more nutritious fodder crop for the farm animals, possibilities of replacing this troublesome weed with *Leucaena leucocephala* (Lam.) de Wit. were explored. Being deep-rooted, it is capable of tapping the deep-lying water and providing green fodder practically through-out the year in southern Sind.

This tropical evergreen leguminous plant has been studied by many different aspects and has more than shown its worth in many countries due to manifold advantages. Takahashi and Ripperton (1949), who studied Ipil-Ipil as a forage for the cattle the first time, were able to take 6 cuts a year at 5—7.5 cm above ground level with a mortorscythe when the crop was 2m tall and obtain as much as 8-9 tons/acre of dry matter under 1250—1500mm rainfall in Hawaii. Whyte *et al* (1953) reported that, in Malaysia, this

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pasture crop with high dry matter content (31.6% in young twigs and 38.6% in the old), provides a succulent high protein fodder during dry periods when green feed is in great scarcity. Koshi *et al.* (1965) rated this pasture crop a valuable roughage for the ruminants. Hamilton *et al.* (1970) concluded that Ipil Ipil, when fed as a complete diet to dairy heifers, did not affect menstrus cycle length, conception rate, gestation length, calving rate, milk production or composition, while Noelviet and Beverly (1977) reported that Ipil-Ipil contains an uncommon aminoacid, mimosine which is toxic to non-ruminants at levels of about 10% in the diet, however, also adding that new low-,mimosine varieties have been evolved which hold great promise as trouble-free tropical feed stuffs for the future. They also reported that the plant enriches the soil by fixing annually more than 500 kg of nitrogen per hectare. Anon (1980) reported that this high protein-rich feed (27—34% protein) is relished by all the browsing livestock such as cattle, water buffalo and goats at both the young and mature leaf stages.

Accordingly, the plant appers to have high prospects of introduction and forage production in the southern Sind. Since there exists no information on forage production from this plant, it was decided to gather some data on fodder production, laying spacing trials under the existing ecological conditions at Tandojam in southern Sind. Except for Sandhu *et al.* (1982) no study on this aspect is available. They reported that for maximum biomass production from ipil ipil at Islamabad, the inter-plant and inter-row spacing of 0.76m x 1.5m proved the best among the three tested, viz. 0.76m x 1.5m, 1.5m x 1.5m and 1.5m x 3m.

Materials and Methods

The experiment was laid out in plots of 6m x 4.5m at Agricultural Research Institute, Tandojam in 1980 to assess the adaptability of *Leucaena leucocephala* (variety K-6) and fodder production in two plant spacings. The layout design was randomized complete block with four replications. The two inter-plant and inter-row spacings were 0.3m x 1.5m and 0.3m x 0.76m respectively. Before sowing, seeds were given hot water treatment for one minute at 80°C and soaked in cold water for one hour. Then after drying, they were inoculated with *Leucaena* rhizobium and sown by dibbling at a depth of 4 cm on April 1. Germination was studied which, initiating on third day after sowing, was completed after 5 days. The plots were fertilized with superphosphate at the rate of 50 kg/hectare by drilling holes at 15 cm from the main row. The first irrigation, applied during the month of May, was followed by two subsequent irrigations after first and fifth cuts at cutting intervals of 20 and 60 weeks respectively. Other agronomic practices, such as weeding and interculturing, too, were carried out in all the experimental plots. The net harvested areas was 9 m^2.

The average forage yield was determined from results of the following seven cuts made in a year, the first after 20 weeks of planting, followed by six subsequent cuts at regular 10-week intervals, each being given when the plants were 1-2m tall so as to get palatable green fodder:

No. of cutting	Date of cutting	Cutting interval (weeks)
First	21.8.80	20
Second	1.11.80	30
Third	11.1.81	40
Fourth	21.3.81	50
Fifth	1.6.81	60
Sixth	11.8.81	70
Seventh	21.10.81	80

In this respect, the average height and forage yield per plant were worked out from 10 plants, selected at random from each plot. Data on plant height, forage yield per plant and average forage yield per plot recorded were ultimately analysed statistically, applying Duncan's Multiple Range Test for comparing the means of the treatments.

Results and Discussion

HEIGHT PER PLANT

The effective height of a fodder plant at the time of cutting is one of the most important factors contributing towards the total yield per unit area. Wide differences in the height of plants at the time of various cuttings were, encountered in both the spacing treatments. (Table 1). In the tallest plants with height of 218.50 cm and 199.25 cm were obtained in the closer spacing at the times of sixth and seventh cuts, falling in the months of August and October. The shortest plant size of 105.75 cm corresponds to the third cut, in the close spacing, falling in January. Similar results were also obtained under the wider spacing. On the whole, taller plants were obtained in the closer spacing than in the wider throughout the cutting period.

Due to the lateral aerial parts competition in the closely growing plants whereby the plants had no chance to spread laterally, they had only vertical direction to grow in search of light for photosynthesis. In both the spacings, the smallest plants were obtained in the month of January because of both low temperatures and low relative humidity in the area. On the other hand, the average height per plant in the months of July and August was greater as compared to the other months because of both high temperatures and high relative humidity. This is a clear indication of the fact that Ipil-Ipil is a right choice of species for growing in this summer-hot and humid area in close proximity to the sea.

GREEN FODDER YIELD PER PLANT

The average green fodder yield per plant compared in both the spacings (Table 1) was found statistically non-significant. However, the highest per plant fresh weight of 532.98 gm was obtained in the wider spacing at sixth cut, followed by 470.61 gm at seventh cut. Contrary to this, in closer spacing, the lower per plant freshy weight of 504.63 gm was

Table 1

Plant height green fodder yield per plant and per plot with two inter and intra-row spacings

Spacings (meters)		1st cut 21.8.80	2nd cut 1.11.80	3rd cut 11.1.80	4th cut 21.3.81	5th cut 1.61.81	6th cut 11.81.81	7th cut 21.10.81	Fodder yield tons/ha
0.3 x 1.5	Height per plant (cm)	142.56^{b} [1)]	124.25^{bc}	96.35^{d}	116.35^{cd}	135.50^{bc}	200.00^{a}	183.37^{a}	
	Fodder yield per 2) plant (gm)	456.43	260.82	212.62	460.68	195.61	532.98	470.61	
	Fodder yield per plot (kg)	5.14^{ab}	4.08^{ab}	2.13^{b}	4.73^{ab}	3.54^{ab}	6.27^{a}	5.03^{ab}	33.28
0.3 x 0.76	Height per plant (cm)	145.50^{c} [1)]	130.00^{d}	105.75^{g}	124.25^{e}	117.50^{f}	218.50^{a}	199.25^{b}	
	Fodder yield per 2) plant (gm)	223.11	223.96	209.79	374.22	147.42	504.63	422.41	
	Fodder yield per plot (kg)	10.49^{abc}	5.47^{bc}	4.49^{c}	7.52^{abc}	7.48^{abc}	13.47^{a}	11.31^{ab}	64.83

1) Values sharing the same letters are not significantly different at P/— 0.05.
2) Non-significant.

produced in sixth cut, followed by that of 422.41 gm in seventh cut. Similar results of per plant fodder yield were also obtained in closer spacing as in the wider. In general in all the cuttings, higher per plant fresh weight was obtained in the wider spacing as compared to the closer. This was due to the fact that widely-spaced plants had higher surface area exposed to light for photosynthesis and consequently a stronger root-system also for absorption of comparatively more moisture and nutrients from the soil.

GREEN FODDER YIELD PER PLOT

Big differences in green fodder yield per plot in different cuts were found in closer spacing. The highest yield of 13.47 kg/plot was obtained in the sixth cut, followed by 11.31 kg / plot in the seventh, while the lowest yield of 4.49 kg / plot was produced in the third.

It is interesting to note that the per plot fodder yield obtained in the wider spacing followed the same trend as that in the closer. The highest per plot fodder yield of 6.27 kg was obtained in sixth cut, followed by the next higher per plot green fodder of 5.03 kg in the seventh, while the lowest per plot fodder yield of 2.13 kg was produced in the third. This was because climatically optimum favourable growth conditions for Ipil-Ipil were found in hot and humid months of July and August in southern Sind. Besides high temperatures and relative humidity, the maximum absorption of mineral nutrients from the soil to the plant and translocation of food materials to the growing points, too, takes place during these months. The higher per plot fodder yield in closer spacing in all the cuttings and lower in wider spacing was due to the fact that closer spacing had taller and more numerous plants per unit area. It appears that apart from these factors there was practically no other interplant competition. The results were comparable to and in accordance with those of Takahashi and Ripperton (1949) and Sandhu *et al.* (1982).

Perusal of table 1 clearly shows that Ipil-Ipil has fairly high production potential with a green fodder yield of 64.83 ton / hectare in closer spacing. Plants in this spacing produced 48.66% more fodder than in the wider spacing; the difference in yield was significant at 5% level of significance.

Conclusion

The results indicate that the perennial evergreen palatable multi-cut tropical leguminous plant, *Leucaena leucocephala* has a fairly high fodder production potential, when raised at a closer spacing under the summer-hot and humid climate on land with high water - table in southern Sind. The plant is, therefore, potentially capable of replacing the obnoxious weed, *Prosopis glandulosa* for production of fodder and fuelwood through afforestation of the vast productive wasteland in that area.

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