The effects of intra-row spacings and cutting heights on the yield of *Leucaena leucocephala* in Adana, Turkey

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Abstract

This research was conducted in Adana, Turkey, between 1985 and 1987. The study investigated the effects of the intra-row spacings and cutting heights on yields of 2 cultivars of *Leucaena leucocephala*, K8 and Peru.

The trial was a split-split plot design in randomized blocks with 4 replications. The main plots were the cultivars, K8 and Peru; subplots were intra-row spacings, 25, 50, and 75 cm; and sub-sub plots were cutting heights, 20, 40, and 60 cm. Row spacing was 1m.

Peru had higher leaf yields than K8. Increased intra-row spacing decreased both thin and thick dried stem yields and foliage yield per ha. The effects of cutting heights varied with the years. The highest dried foliage yield was obtained from the plots cut at 40 cm in the first year and 60 cm in the second year.

Key Words: intra-row spacing, forage yield, *Leucaena leucocephala*

Leucaena leucocephala is a multipurpose leguminous plant grown in the tropical and subtropical regions of the world (Brewbaker and Hutton 1979). This plant has been used as feed and forage for livestock, fuel, soil erosion control, and biological fertilization materials, quality cellulose for paper mills, and lumber.

L. leucocephala is naturalized between the latitudes of 30° North and 30° South (Skerman 1977). It has 3 distinct forms: Hawaiian, Peruvian, and Salvadorian types. These represent shrubby, shrubby-tree, and tree forms of the species (Skerman 1977).

A preliminary research on the performance of *L. leucocephala* in our region was conducted and published in Turkish with an English summary (Tunç and Tükel 1986). In this paper, it was reported that about 4.3–7.15 tons ha^{-1} green foliage and 470–780 kg ha^{-1} crude protein yields were obtained when planted at 1 m spacing and cut at 60 cm height. These and other observations gave us some indications that the *L. leucocephala* may be grown further up to the 37° latitude than its commonly naturalized border and may also be used as a summer forage crop for the small animal-raising farms which usually experience green forage shortages during the peak of summer months in the region.

The main purpose of this current study was to further determine optimum intra-row space and cutting heights for *L. leucocephala* in Adana, Turkey.

Material and Methods

The study was conducted in the research plots of the Field Crops Department, Agricultural Faculty, Çukurova University, located at 37° 21′ N and 35° 10′ E, throughout the years between 1985 and 1987.

The soils were young alluvial deposits of the river Seyhan having high lime contents, sandy-loam type textures, and classified as Class I land capability (Ozbek et al. 1974).

A typical coastal mediterranean climate prevails in the region with a total yearly precipitation of 642 mm. Of this total, 323 mm are received in December, January, and February (winter); 168 mm in March, April, and May (spring); 29 mm in June, July, and August (summer); and 122 mm in September, October, and November (fall), respectively.

Two *L. leucocephala* cultivars, K8 and Peru, were used. The former, originating from Mexico, is a giant Salvadorian tree type. The latter, originating from Argentina, is a heavily branching shrubby type.

Plots were arranged in a split-split plots design in randomized blocks with 4 replications. Size of the sub-sub plots were $3 \times 10 = 30$ m^2. Main plots were cultivars; sub plots were intra-row spacings (25 cm, 50 cm, and 75 cm) representing 3 planting densities as 40,000, 20,000 and 13,333 plants, ha^{-1}; and sub-sub plots were cutting heights (20 cm, 40 cm, and 60 cm).

Seeds of *Leucaena* cultivars were treated with hot water for about 3 minutes and soaked in the water overnight as described by Skerman (1977). Soil was removed from under *Leucaena* trees which were previously planted with appropriate inoculum on 6 July 1985. This soil was placed into the rows in which the water-soaked seeds were hand sown, 3 seeds per planting position intra row spacing. Seedlings were thinned at the 3 leaf stage, and only 1 was left at each planting position.

During the next 2 years the plants were cut when they reached an average height of 1.5 m Four cuts in 1986 (at 14 May, 27 June, 4 Aug., and 10 Sept.) and 3 in 1987 (at 23 June, 10 Aug., and 23 Sept.) were employed, respectively. Different cutting frequencies were due to the climatic variation; the minimum temperature for initiating growth of *Leucaena* in spring (15.5° C), as reported by Skerman (1977) and Brewbaker and Hutton (1979), was met in March 1985 and early May 1987.

Plant materials cut from each plot were separated into 3 components: thick stems > 5 mm diameter; thin edible stems < mm diameter; and leaves. This separation is customarily used for *Leucaena* (Gueverra et al. 1978).

Results and Discussion

Thick Stem Yield

There was no statistically significant difference between the 2 years in the yield of thick stems in spite of the different cutting frequencies. Neither was there any significant difference in the thick stem yield (Table 1) between the 2 cultivars.

However, increasing intra-row spacing significantly decreased the thick stem yield (Table 1). This finding was in support of the report by Gueverra and et al. (1978).

Thin Stem Yield

Mean thin stem yield did not show any significant effects for the years and the cultivars (Table 1). However, intra-row spacing and cutting heights affected the thin stem yield. Giving more intra-row spacing caused significant yield decreases. The highest yield (1.04 tons ha^{-1}) was obtained from 25 cm intra-row spacing but the lowest yield (0.78 tons ha^{-1}) was from 75 cm spacing. This was more likely due to the fact that the larger intra-row spaced plants were branching more but producing less overall yield than the narrower spaced plants, which were able to grow a greater number of plants

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Table 1. Dried yield of *Leucaena leucocephala* (tons ha^{-1}).

Treatments	1986 Thick stems	1986 Forage Yield Thin stems	1986 Forage Yield Foliage	1987 Thick stems	1987 Forage Yield Thin stems	1987 Forage Yield foliage	Mean Thick stems	Mean Forage Yield Thin stems	Mean Forage Yield Foliage
Cultivars									
K 8	2.46	0.73	4.19	2.49	0.89	3.70	2.48	0.81	3.95 b
Peru	2.32	0.93	4.57	2.43	1.02	4.26	2.38	0.98	4.42 a
Intra-Row Spacings (cm)									
25	2.89	1.00	5.20	2.46	1.07	4.40	2.84 a	1.04 a	4.80 a
50	2.32	0.79	4.17	2.29	0.94	3.80	2.30 b	0.86 b	3.99 b
75	1.97	0.70	3.78	2.31	0.87	3.76	2.14 b	0.78 b	3.78 b
Cutting Heights (cm)									
20	2.72 a	0.88 a	4.26 b	1.97 b	0.86 b	3.19 c	2.35	0.87	3.73
40	2.40 b	0.87 a	4.59 a	2.57 a	0.99 a	4.14 b	2.48	0.93	4.36
60	2.06 c	0.73 b	4.30 b	2.84 a	1.02 a	4.63 a	2.45	0.87	4.46

[1]Means in each column with the same letters are not statistically different from each others at the 0.05 level of significance determined by the "LSD" test.

per square meter, producing fewer branches but more thin stem yield.

Effects of cutting heights on the thin stem yield revealed an inverse situation for the 2 consecutive years (Table 1).

Dried Foliage Yield

Cultivar Peru with a mean 4.42 tons ha^{-1} dried foliage yield was significantly different and a higher yielding cultivar than K8 with a mean yield of 3.95 tons ha^{-1}. This difference was more likely due to the growth characteristics of the cultivars tested: the former a branching and the latter a giant tree type.

Dried foliage yield was also significantly affected by the intra-row spacings (Table 1). The highest yield (4.80 tons ha^{-1}) was obtained from the 25-cm spacing. This result indicates that the dried foliage yield can not be increased by increasing intra-row spacing more than 25 cm. As mentioned initially, more densely sown *L. leucocephala* plants produced more thick and thin stem yields. Therefore, dried foliage yields were increased as the thick and thin stem yields increased. These findings support the claims of Sumberg (1985) and Tunç and Tükel (1986), who concluded that there was highly significant and close correlation between the stem weights and the dried foliage yield for the first and second cuts of *Leucaena leucocephala*.

The highest dried foliage yield (4.59 tons ha^{-1}) was obtained from the plants cut at 40-cm heights in the first year. However, dried foliage yield was increased as the cutting heights increased, and the highest yield (4.63 tons ha^{-1}) was reached at the 60-cm cutting height in the second year. This was an interesting trend which might be explained by the combining effects of the cutting heights and the cutting frequencies applied in 2 different years.

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