HEIGHT OF BRANCHING IN LEUCAENA (*LEUCAENA LEUCOCEPHALA*) ECOTYPES UNDER ROTATIONAL GRAZING

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ABSTRACT

To evaluate and select the best branching heights and the leucaena ecotypes which give the best supply and consumption of dry matter, an experiment was carried out at the "Judibana" ranch near El Vigía, Mérida State, Venezuela, at an altitude of 65 meters (165 ft.). The experimental design used was random blocks and the treatments were in a split plot design, repeated three times. The main plots were 13 leucaena ecotypes (CIAT - 7385, 7984, 7985, 9377, 17217, 17218, 17219, 17222, 17223, 17474, 17492, 17501, 17502) and the secondary ones were three heights of branching (0.40, 0.80 and 1.20 m). Grazing with lactating cows took place every 45 days. The results indicated that the ecotypes do not differ significantly for the variables under study. However, for branching height, the variance analysis showed significant differences ($P < 0.01$). It was concluded that the best height was 1.20 m. where the best values for supply, residues, forrage consumption, as well as height and number of branches were obtained.

KEYWORDS

Leucaena, ecotypes, grazing, height of branching, supply, consumption, utilization.

INTRODUCTION

In the tropics there are few research studies on shrub legumes for grazing. The principal factors affecting the forrage production of leucaena are: varieties, soil fertility, distance between plants, climate and incidence of psyllid (Shelton and Jones, 1994). Likewise, agronomic and grazing management affect the production and availability of forage. The structure of the plant is related to management of grazing intervals (rest and occupation) and grazing pressure. Grazing frequency should be adequate so as to maintain good production and appropriate height. Intense pruning should also be carried out occasionally to lower the height and promote the growth of new branches. Moreover, the height of branching is important to forage accessibility in grazing. The objectives of this study were to evaluate and select the best branching heights and the leucaena ecotypes which give the best supply and consumption of dry matter.

METHODS

This experiment was carried out in El Vigía, Mérida State, Venezuela at the "Judibana" ranch, located at 8°37'26" latitude North, 71°42'22" longitude West, at an altitude of 65 m (165 ft.) in a humid tropical forest zone. The area under study has a clay loam texture, a slightly acid pH (6.3), low phosphorous (2 ppm), potassium (51 ppm.) and organic materials content (1.8%) with calcium levels (570 ppm). The experimental design used was random blocks and they were in a split plot design. The main plots were 13 leucaena ecotypes (CIAT - 7385, 7984, 7985, 9377, 17217, 17218, 17219, 17222, 17223, 17474, 17492, 17501, 17502), the latter being Cunningham cultivar and the secondary ones were three heights of branching (0.40, 0.80 and 1.20 m). The size of the main plots was 124 m^2 and the secondary ones were 40 m^2. The planting distance used was 1 m x 1 m with a density of 10,000 plants/ha. Grazing was carried out every 45 days during 1994 and 1995. During the dry season, there was a high incidence of psyllid (*Heteropsylla cubana*); this was reported by Pound and Martínez, 1985 and Barrientos et al., 1991 in Cuba and the Caribbean islands, also in Australia by Shelton, 1996. Difos (Dimethoate) at a dosage of 1 Kg/ha was used to control this pest. Two plants per treatment were selected before and after grazing to evaluate the supply of dry matter, residues, consumption and utilization. For height, diameter and number of branches all the plants in the central rows were selected. Height was measured from the ground to the last leaves of the longest branch. The diameter of the stem was measured with a vernier 10 centimeters under the heights studied,and to determine number of branches, those with a thickness greater than 0.8 cm. were counted. Analysis of the data was carried out with the SAS statistical program; variance analysis was done with the GLM procedure, test and regression analysis for the branching height. Square root transformation was used for the number of branches variable.

RESULTS AND DISCUSSION

1. Supply, Residue, Consumption and Utilization.

The variance analysis for all the variables under study detected significant differences ($P < 0.01$) for branching heights (BH), but not in ecotypes (E) nor in the interaction E x BH. When these ecotypes were evaluated under a clipping method, no significant differences were found either (Davila and Urbano, 1996). Razz et al., 1994, also evaluated the 17223 and 7984 cultivars in a dry tropical forest and obtained no differences, whereas Faria, 1994, under these same conditions, reported that the cultivars studied behaved differently. The average values for the different ecotypes for the variables supply, residues, consumption and utilization were 786.9, 202.0, 584.9 Kg. DM/ha /grazing and 74.3%, respectively. In Table 1, it is shown that the greatest supply (942 Kg. DM/ha/grazing) and consumption (705 Kg. DM/ha) were obtained at a height of 1.20 m, and no significant difference was found between 0.40 and 0.80 m. As the height of branching increased, the residue increased, reaching the greatest value (236 Kg. MS/ ha) at 1.20 m and the least (165 Kg MS/ha/grazing) at 0.40 m. The height of branching did not affect the percentage of utilization due to the fact that supply and consumption increased proportionally. In cutting experiments, several researchers have found that the best heights are between 50 and 90 cm. (Osman, 1981; De Lucena et al., 1992; and Sampet et al., 1994). In Venezuela, in an experiment carried out with sheep by Espinoza et al., 1994, no differences were obtained in the production per plant at heights of 30 and 50 cms., while the percentage of consumption was greater at 30 cms. The regression equation obtained for forage supply was FS (Kg DM/ ha/grazing = 502.4 + 355.4 BH (m) and for residues was RF (Kg DM /ha/grazing) = 131.2 + 88.6 BH (m), which indicates that in the range of heights tested, there is a positive lineal tendency for the two variables, but the coefficient of forage supply is four times greater than that of F. residues, which shows that heights of branching greater than those evaluated in this experiment should be studied.

2. Height, diameter and number of branches.

The leucaena ecotypes and the interaction E x BH, did not affect these variables, whereas with height of branching significant differences were obtained ($P < 0.01$). The average heights before and after grazing, diameter and number of branches were 2.04 m., 1.81 m., 3.69 cm. and 6.28, respectively. The greatest height before

and after grazing and the maximum number of branches were obtained with a height of branching of 1.20 m. and the lowest values with a BH of 0.40 m. Diameter was related to height levels more than a response to them. (Table 2). For the variable height before grazing the following relation was obtained: BGH (m) = 1.64 + 0.50 x BH (m) and for the number of branches BN = 3.81 + 3.10 x BH (m). The height of branching affects the height of the leucaena by 50%; this could be due to the fact that during grazing, the animals deform the branches downward. The number of branches increases every 30 cm. on one unit. Height of branching under grazing changes plant structures, number of branches and plant height, also it increases forage supply and consumption, forrage residue increases only 25% of the forage production, percent of utilization did not change. Leucaena ecotypes behave in a similar way.

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Table1
Effect of height of branching on forage (F) in leucaena.

Height of branching BH (m)	F. Supply	F. Residue	F. intake	Utilization
	(DM Kg ha^{-1} grazing^{-1})			%
0.40	657.3b	165.6c	491.7b	74.8a
0.80	761.2b	204.1b	557.1b	73.2a
1.20	942.3a	236.4a	705.9a	74.9a
Means	786.9	202.0	584.9	74.3

Mean values with different letters are statistically different, P < 0.05.

Table 2
Height diameter and number of branches means for each branching height.

Height of branching BH (m)	Height (m) BGH [1]	AGH [2]	Diameter (cm)	No. of branches (BN)
0.40	1.86c	1.61c	4.09a	4.94c
0.80	1.99b	1.79b	3.38b	6.49b
1.20	2.26a	2.03a	3.59b	7.42a
Means	2.04	1.81	3.69	6.28

[1] BGH: Height grazing.
[2] AGH: Height grazing.

Mean values with different letters are statistically different, P < 0.05.