Agronomic Potential and Nutritive Value of Promising *Leucaena* Species in the Yucatan Peninsula

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AGRONOMIC POTENTIAL AND NUTRITIVE VALUE OF PROMISING *LEUCAENA* SPECIES IN THE YUCATAN PENINSULA

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Abstract

Two experiments were carried out in order to evaluate the agronomic potential, the nutritive value and the tolerance to psyllid (*Heteropsilla cubana*) of nine *Leucaena* species. A randomized block design with four repetitions was used. There were significant ($P<0.01$) differences on dry matter production (i.e. leaf and twigs yield). *L. collinsii* showed the most promising result, which could be related to its high psyllid tolerance. In a second experiment, the preference indices of *Leucaena* species was assessed with sixteen male pelibuey sheep in a cafeteria trial. There were significant ($P<0.0001$) differences among *Leucaena* species. *L. esculenta paniculata* was the species most preferred . There was no relationship between chemical composition (i.e. ADF, NDF, and polyphenols) and preference and psyllid tolerance.

Keywords: Fodder trees, *Leucaena*, forage rumen degradation, psyllid tolerance

Introduction

Much of the livestock production in the tropics is based mainly on grazing animals in fallow lands and pastures. Because of the prolonged dry period and the low quality fodder,

animal production is low. It has been shown that the *Leucaena* genus have promise as supplements to poor quality roughages. However, their evaluation is centered on few species, mainly on *L. leucocephala* (Shelton and Brewbaker, 1994). Its production has wanned considerably in some areas because of the psyllid (*H. cubana*) a defoliating insect that reduces leaf yield and hence the potential value of *L. leucocephala* (Stewart and Dunsdon, 1998). Looking at the needs to solve some of these problems, this work assessed nine *Leucaena* species with the objective of determining their agronomic as well as their nutritional potential, with the purpose of their integration into animal production systems.

Material and Methods

The present experiment was carried out at the University of Yucatan, in the South-east of México, from September 1998 to February 1999. The research center is situated 9 m a.s.l., 21º 51 Northern latitude and 89º 41 Eastern longitude. The average annual rainfall is 950 mm, and the soil in the area is litosol (i.e. stony and shallow) with a pH of 6.5.

The experimental design was a randomized block with four replicates. Each replicate consisted of nine rows, 2 m apart, of each *Leucaena* species, with ten plants of the same species planted 50 cm apart within the row. A total of three harvests were carried out during the experimental period. For yield estimation, the inner eight trees in each plot were cut at 50 cm and weighed fresh, and then subsampled to estimate the yield dry matter (DM). Psyllid ratings were taken on a monthly basis, using the scale developed by the Nitrogen Fixing Tree Association. A "cafeteria" trial comprising a 10 day adaptation period followed by a 7 day response period, involved twelve young (five to six months age), female Pelibuey sheep with mean live weight of 14 ± 1.2 kg, divided into four groups of three animals per group. The sheep were allowed access to the feed (all *Leucaena* species) offered in a "cafeteria" trial where each *Leucaena* species was

randomly placed in troughs for three hours during the morning (i.e. 8:00 to 11:00 h). After that, the animals were allowed to graze in a star grass (*Cynodon nlemfuensis*) paddock. During the seven days data collection period, 100 g DM/day/animal group of all the *Leucaena* species were offered. Three male rumen cannulated sheep were used to assess the *in sacco* degradation of DM and CP at 24 h. Nitrogen (N) was analyzed using the Kjeldal procedure (A.O.A.C., 1990). Neutral detergent fiber (NDF) and Acid detergent fiber (ADF) were determined using the procedure described by Van Soest et al. (1991). The polyphenols were assayed using the prussian blue methodology.

The data were submitted to an analysis of variance. In cases when the analysis resulted in significant effect, the means were compared using the Duncan procedure.

Results

The mean heights twelve months after planting are presented in Table 1. Cumulative height was greatest ($P<0.03$) with *L. collinsii,* whereas *L. esculenta paniculata* was the lowest. Significant increase in height was observed among *L. leucocephala glabrata* and *L. shanonii magnifica.* During the second harvest *L. lanceolata* had the highest DM yield ($P<0.01$) and *L. lempirana*, *L. shanonii magnifica* had lowest yield. Psyllid damage varied ($P<0.01$) among species (Table 1). *L. leucocephala* cv. Peru was the most susceptible. On the other hand, *L. collinsii* was the most resistant.

The intakes values are presented in Table 2. *L. esculenta paniculata* and *L. leucocephala glabrata* were strongly preferred over all the others. *L. macrophyllanelsonii* and *L. lanceolata* were relatively unpalatable. The foliage chemical composition of the different *Leucaena* species is presented in Table 2. The highest CP (29.8%) content was obtained with *L. collinsii.* On the other hand, *L. leucocephala* cv. Perú, *L. leucocephala glabrata* and *L. esculenta paniculata*

showed the lowest detergent fiber concentrations concentration. Conversely, mean detergent fiber was higher with *L. shanonii magnifica, L. collinsii.* Mean rumen degradation of the DM was highest with *L. leucocephala* cv. Perú and lowest with *L. pallida.*

Discussion

The results found in the present trial highlight the excellent growth rates of new *Leucaena* species achieved during the experimental period, which includes part of the dry season. This confirms their growth potential for tropical regions. The poor yield of *L. lempirana* probably was an effect probably due to poor performance in the stony soil of Yucatán, in addition to its susceptibility to the psyllid (Table 2). The most susceptible to psyllid was *L. leucocephala*. Similar findings are reported by Castillo et al. (1997). Damage scores were found to be highly correlated with leaf chemical composition, mainly related to detergent fiber content. Forage preference, as defined by DM intake, was highest with *L. leucocephala glabrata* and *L. esculenta paniculta*, followed by *L. pallida* and *L. leucocephala* and the less palatable *L. macrophyllanelsonii, L. lanceolata* including *L. lempirana*. Observations made in this trial indicated that plant factors (i.e. chemicals and physical traits) influence forage preference.

The results of these experiments show the high agronomic and nutritional potential of the new *Leucaena* species for tropical lands. However, further studies on the "lesser-known" *Leucaena* species have to be carried out across diverse environments. Also studies need to be undertaken on the effect of animal performance.

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Table 1 - Psyllid tolerance score (1 high-5 low), plant height two months after each cut (three cuts) and yield of nine promising *Leucaena* species during late-rainy season (six months).

Species	Psyllid Tolerance score	Height after cutting (m)			Yield (Kg DM/ha)		
		1	2	3	Edible fraction	Woody fraction	Total
L. collinsii	1.0a	3.3	1.6	1.2	7864a	11773a	19637
L. lanceolata	1.5a	3.0	1.9	1.4	6072ab	7968b	14040
L. macrophyllanelsonii	1.1a	3.0	2.0	1.3	4618bc	5262bc	9880
L. pallida	1.3a	2.6	1.8	1.0	3505c	3824c	7329
L. leucocephala cv. Perú	2.9c	2.5	1.7	1.4	3991bc	3674c	7665
L. leucocephala glabrata	2.7bc	3.1	1.7	1.4	3577c	4069bc	7646
L. esculenta paniculata	2.3b	2.3	1.8	1.1	3530c	4010bc	7540
L. shanonii magnifica	1.4a	3.0	1.4	1.1	2696c	3720c	6416
L. lempirana	2.3b	2.7	1.3	1.1	2586c	2990c	5576

Means in the same column with different superscript differ (P<0.05).

Table 2 - Foliage rate of intake, by Pelibuey sheep, chemical composition, and dry matter (DM) and protein (CP) 24h-rumen degradation of nine promising *Leucaena* species.

Species	Rate of intake (g DM/min)	Chemical composition (%)			Degradation (%)	
		CP	ADF	NDF	DM	CP
L. collinsii	0.5bc	29.8	29.4	43.7	72.3bcd	77.8
L. lanceolata	0.2c	22.3	27.3	40.0	69.6d	51.5
L. macrophyllanelsonii	0.1c	24.9	31.2	43.7	61.2e	37.3
L. pallida	0.8b	23.7	26.6	37.4	58.4e	26.0
L. leucocephala cv. Peru	0.8b	25.6	21.9	31.7	80.3a	52.2
L. leucocephala glabrata	1.0b	21.1	22.7	35.2	74.6bc	46.7
L. esculenta paniculata	1.9a	24.5	24.9	36.8	69.8dc	37.0
L. shanonii magnifica	0.6bc	22.9	31.7	43.5	71.5bcd	61.7
L. lempirana	0.4c	23.5	27.3	38.9	75.4b	68.0

Means in the same column with different superscript differ ($P<0.05$).