**ILC2018 Poster and Producer paper***

**A preliminary study of spatial distribution and plant density in a leucaena-grass planting in north Corrientes, Argentina**

*Estudio preliminar de la distribución espacial y densidad de plantas de leucaena en asociación con una gramínea en el norte de Corrientes, Argentina*

LUI S GÁNDARA¹, MERCEDES M. PEREIRA¹ AND MARCOS STUP²

¹Instituto Nacional de Tecnología Agropecuaria (INTA), EEA Sombrerito, Corrientes, Argentina. inta.gob.ar
²Facultad de Ciencias Agrarias, Universidad Nacional del Nordeste (UNNE), Corrientes, Argentina. agr.unne.edu.ar

**Keywords:** Brachiaria brizantha, forage quality, forage yield, Leucaena leucocephala, subtropics.

**Introduction**

In northeast Argentina, most beef cattle graze naturalized range pastures continuously, with limited winter supplementation and restricted access to improved pastures. Calving rates are low, averaging 40–50% annually and calf weaning weights average 150–170 kg at 6 months. Overall, productivity remains low (30–40 kg LW/ha/yr), mainly due to poor cattle nutrition (Goldfarb et al. 1993; Goldfarb and Casco 1994). In past decades, several improved grass and legume species were evaluated as a strategy to overcome this problem (Goldfarb et al. 1993; Goldfarb and Casco 1998) with Leucaena leucocephala (leucaena) showing definite potential. It was introduced in the 1970s into Corrientes Province and displayed good adaptation to the environmental conditions. When leucaena was evaluated as a protein bank and sown into natural grassland or established with a sown grasses, it has shown excellent potential by increasing productivity of these systems (Gándara et al. 1986; 1993). However, these evaluations were done using much lower densities of leucaena than recommended to maximize yield of leucaena (Pachas et al. 2018). Therefore, the objective of this study was to evaluate the effects of leucaena density, taking into account light interception, on both legume and total pasture yield and forage quality in a leucaena-grass pasture system.

**Materials and Methods**

**Experimental site**

The study was conducted at the National Agricultural Technology Institute (INTA EEA Corrientes) in Corrientes Province, Argentina (27°40'25.84 S, 58°45'13.59 W). The soil at the site is characterized as an Aquic Argiudol soil (pH: 5.9; OM: 1.93%; P: 2 ppm). Monthly rainfall recorded during the study period and monthly average temperature are presented in Table 1.

**Experimental design**

Leucaena (cv. Cunningham) was sown in October 2016 using a twin-row configuration (twin rows 1 m apart) with 2, 4 and 8 m spacings between the outer rows of the twin hedge-rows (treatments D-2, D-4 and D-8, respectively). Each hedge-row plot was 15 m long and 42 m wide. The experimental design was a randomized complete block with 3 replications. Leucaena was sown manually at a seeding density of 7–10 g per linear meter (objective: 10 plants/m of row). In this way, plant densities for D-2, D-4 and D-8 should be: 66,666, 40,000 and 22,222 plants/ha, respectively. In October 2017, leucaena plants were cut to 1 m height and Brachiaria brizantha cv. Marandú (brachiaria) was sown between hedge-rows at a seeding rate of 13.3, 8.0 and 4.443 kg/ha for D-2, D-4 and D-8, respectively.

**Measurements**

Accumulation of biomass of leucaena and brachiaria was measured in June 2018 (236 days after trimming in October 2017). Figure 1 provides an image of a D-2 plot at that time. Biomass of leucaena above 1 m was measured by harvesting subplots of leucaena (5 linear m of twin-row) and biomass of brachiaria above 10 cm (4 samples/treatment of 0.25 m²). Before harvesting leucaena, average height, number of plants, shoots and branches of leucaena were measured.

---

*Correspondence: Ing. Agr. Luis Gándara, Instituto Nacional de Tecnología Agropecuaria (INTA), EEA Sombrerito, Corrientes, Argentina. Email: gandara.luis@inta.gob.ar*

*Poster presented at the International Leucaena Conference, 1–3 November 2018, Brisbane, Queensland, Australia.*
Table 1. Monthly rainfall (mm) and monthly average temperature (ºC) at INTA EEA Corrientes.

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>172</td>
<td>95</td>
<td>122</td>
<td>355</td>
<td>12</td>
<td>210</td>
<td>28</td>
<td>86</td>
<td>19</td>
<td>285</td>
<td>126</td>
<td>320</td>
</tr>
<tr>
<td>2017</td>
<td>180</td>
<td>106</td>
<td>151</td>
<td>548</td>
<td>193</td>
<td>1</td>
<td>10</td>
<td>80</td>
<td>93</td>
<td>80</td>
<td>124</td>
<td>26</td>
</tr>
<tr>
<td>2018</td>
<td>329</td>
<td>52</td>
<td>231</td>
<td>0</td>
<td>220</td>
<td>26</td>
<td>210</td>
<td>28</td>
<td>86</td>
<td>126</td>
<td>320</td>
<td>172</td>
</tr>
</tbody>
</table>

Average temperature (ºC)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>27.4</td>
<td>26.1</td>
<td>24.7</td>
<td>20.2</td>
<td>18.9</td>
<td>17.7</td>
<td>17.9</td>
<td>18.6</td>
<td>20.4</td>
<td>21.4</td>
<td>2.8</td>
<td>27.4</td>
</tr>
</tbody>
</table>

Then, leucaena was cut to 1 m above ground level and biomass partitioned into edible biomass (leaves, tender/herbaceous stems <6 mm in diameter) and lignified/woody stems (>6 mm in diameter).

Statistical analysis

Above-ground biomass, edible biomass, proportion of grass and legume, CP concentration and light interception (shade) were analyzed by ANOVA, and means were compared by the Tukey test (P<0.05). Statistical analysis was carried out using InfoStat® software.

Results

The numbers of leucaena plants/m, shoots per leucaena plant and height of leucaena plants did not differ significantly between treatments. Average numbers of leucaena plants per linear meter of individual rows were 9.1 plants/m, with 20.5 primary shoots/m and 2.1 m height. The levels of shading increased as spacings decreased (P<0.05). Average values of the measured variables are shown in Table 2.

Table 2. Total accumulated biomass of leucaena (L) and brachiaria (G), edible biomass (L+G), proportions of legume and grass in edible biomass, crude protein (CP) of the edible forage and shade.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total biomass (t DM/ha)</th>
<th>Edible biomass (L+G) (t DM/ha)</th>
<th>Proportion of legume (%)</th>
<th>Proportion of grass (%)</th>
<th>CP (%)</th>
<th>Shade (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-2</td>
<td>13.6a†</td>
<td>8.7a (6.2+2.5)</td>
<td>71a</td>
<td>29c</td>
<td>17.9a</td>
<td>82a</td>
</tr>
<tr>
<td>D-4</td>
<td>10.1b</td>
<td>7.8a (2.9+4.9)</td>
<td>38b</td>
<td>62b</td>
<td>14.4b</td>
<td>43b</td>
</tr>
<tr>
<td>D-8</td>
<td>9.2b</td>
<td>8.0a (1.2+6.8)</td>
<td>15c</td>
<td>85a</td>
<td>11.6c</td>
<td>23c</td>
</tr>
</tbody>
</table>

†Means followed by different letters within columns differ significantly at P<0.05.
Discussion and Conclusions

This study has provided valuable information on the vexing question of how far apart the twin rows of leucaena should be planted. As was expected, leucaena yield was related to initial planting density with highest yields occurring at the highest density, i.e. the narrowest inter-row spacing, while grass yield decreased inversely proportional to leucaena density. Interestingly, total edible forage from the leucaena-brachiaria pasture was independent of planting configuration, with only the proportion of legume and grass varying along with the inter-row spacing. At narrow inter-row spacing, grass biomass decreased, presumably due mainly to increased shading, and to a lesser extent to competition for nutrients and possibly water as high rainfall was registered during the experiment. This reduction of grass growth was compensated for by increased edible biomass of leucaena with the result that crude protein concentration of the available edible forage increased with higher densities of leucaena. One might expect that animal performance would benefit from the higher quality of the forage.

Pachas et al. (2018) also reported that higher biomass of leucaena and total biomass and reduced biomass of grass were associated with higher density of leucaena.

The high primary production obtained in this experiment suggests that animals grazing leucaena-grass pasture can be expected to achieve enhanced liveweight gains or that higher stocking rates can be maintained compared with unimproved grass pastures. Grazing studies are needed to confirm these hypotheses although Gándara et al. (1993) compared with a Leucaena leucocephala (Lam.) de Wit and grass pasture can be prepared for the noroeste of the Provincia de Corrientes, periodo 1978–1990. Producción Animal Serie Técnica Nº 6. INTA Corrientes, Argentina.


References


© 2019 Tropical Grasslands-Forrajes Tropicales is an open-access journal published by International Center for Tropical Agriculture (CIAT). This work is licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0) license. To view a copy of this license, visit https://creativecommons.org/licenses/by/4.0/.