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# LEUCAENA LEUCOCEPHALA FOR THE COMPLEMENTATION OF EXISTING PASTURES

R T Paterson[1], C Samur & G Sauma

*Centro de Investigación Agrícola Tropical ,*
*Casilla No. 359, Santa Cruz, Bolivia*

With the aim of complementing existing pastures during the critical dry season, *Leucaena leucocephala* was sown into 0, 10, 20 or 30% of areas of degraded, yaragua-based pastures, to form protein reserves. Animals were given free access to the legume, only during the dry periods between May and June and October to November. In the dry season of 1978, in a period of 21 days, Santa Gertrudis steers gained weight at rates of 0.23, 0.42, 0.50 and 0.70 kg/day in the 0, 10, 20 and 30 treatments respectively. In the 1979 dry season, the leucaena population was much lower due to water-logging in January of that year, and in a 155 day period between June and October, Santa Gertrudis steers gained at 0.13 and 0.30 kg/d in the control and a paddock with 9% leucaena cover respectively, while Zebu-Criollo crossbreds gained at 0.27 and 0.35 kg/d on the same treatments. Appropriate stocking rates were 0.9 and 1.2 AU/ha for the non-complimented pasture in the dry and wet seasons respectively, while the pasture with 10% of the area sown to leucaena could carry 1.1 and 1.6 AU/grazed ha, or 1.1 and 1.4 AU/ha of total area in the same periods .

Key words: cattle, grazing, leucaena, liveweight gain

The present work was designed to study the use of leucaena as a protein reserve for the dry season complementation of degraded grass pastures. Some of the animal data are after Samur et al (1980).

## Materials and Methods

The trial was situated on the property of the Cabaña Lechera Todos Santos Paz, in Guabirpa, 55 km north of the city of Santa Cruz de la Sierra , Bolivia, at latitude 17°15'S, longitude 63°10'W, altitude 320 m above sea level.

An area of apparantly uniform, degraded, yaragua (*Hyparrhenia rufa*) based pasture was divided into 4 parts, each containing 7.5 ha of pasture and 2 ha of open forest, which served as shade and protection for the grazing animals. One area was maintained as an unchanged control, while 10, 20 or 30% of the pasture in each of the other three areas was disc-ploughed, harrowed and hand sown to leucaena, leaving 2 m between rows, and 25 cm between holes, to establish 20,000 stations/ha with 2 seeds/station. The seed was of the local naturalised variety, scarified in hot water (80°C) for 3 minutes, spread to dry and sown immediately using 2.5 kg/ha. It was necessary to weed along the rows twice in the establishment period. The sown areas were fenced to protect them from grazing during the rains, and internally divided into 4 to facilitate dry-season grazing management. At the end of the grazing period (November) the leucaena was cut at 10 cm above soil level to prevent excessively tall growth, and then left ungrazed until the following June.

Plant numbers were counted in each block of leucaena to establish survival rates before grazing began in 1978 and again after grazing finished in 1980. Ten randomly selected plants from each block were stripped of leaves and green shoots to measure yield of fresh material, and sub-samples were ta-

[1] *Technical Cooperation Officer, Overseas Development Administration, London, UK*

ken for determination of yields of dry matter and protein content.

In the dry season of 1978, 40 tested, tuberculosis-free Santa Gertrudis (SG) steers of age 22 ± 3.7 months, and liveweight 242.0±32.35kg were randomly divided into 4 groups, vaccinated against rabies, foot-and-mouth disease and anthrax, and treated to control internal and external parasites. They spent two weeks in their respective paddocks before being given access to the leucaena on 14th July. After only 21 days on the trial a fire passed through the area and the animals had to be removed to spend 48 days grazing *Panicum maximum* cv. Makueni, without leucaena. They returned to the trial areas in October where they had access to the regrown legume until the first of December (51 days). This phase of the trial was terminated on 22 February 1979 after a further 83 days grazing without leucaena.

In the dry season the animals used were 32 SG steers of 12-18 months of age and initial weight of 206.3 ± 26.63 kg and 32 Zebu-Criollo (ZC) steers of 10-18 months of age and initial weight 164.5 ± 38.94 kg. After repeating the health precautions employed in 1978, the animals of each breed were randomly assigned to each of the four treatments. They were given access to the leucaena in the period June 1 to November 2 inclusive (155 days) and after a further 174 days of wet season grazing without access to the legume the trial was terminated on 24 April 1980.

At all times the animals were permitted to graze the legume. The gate was left open to allow free passage from the protein reserve to the main degraded grass area. One quarter of the legume area was opened for 3 - 4 weeks and then closed for 9 - 12 weeks to allow regrowth. Two grazing cycles were completed in each quarter during the 1979 dry season.

## Results

The freshly harvested leucaena seed produced 25% germination in 15 days on moist blotting paper at ambient temperature, while after treatment for 3 minutes in water at 80°C the germination was increased to 88%. The scarified seed emerged well in the field, but heavy rains and some short-term flooding caused seedling mortality, which required partial reseeding of the areas to fill in gaps.

After the start of the grazing in 1978 a fire caused total defoliation of the leucaena, although within 7 days all plants had produced new shoots, either from the stems, or in the case of the more badly damaged plants, from the ground level. Further grazing was followed by cutting 10 cm above ground level at the start of the rains (December). The plants once again produced new shoots, but exceptionally heavy rains in January and February 1979 produced further short-term flooding which resulted in heavy mortality of the established plants. No further mortality resulted from the 1979 grazing. Plant number, % cover and yields of dry matter (DM) and crude protein (CP) in June 1978 and April 1980 are shown in Table 1.

Animal performance during 1978-79 is shown in Table 2, while Table 3 shows the results obtained in 1979-80. In 1978-79 two SG steers died, while in 1979-80 two SG steers were sold and four ZC died. The tables refer only to animals which remained on the trial throughout the entire period.

*Table 1:*

*Leucaena numbers, cover[1] (%) and yields (kg/ha) of dry matter (DM) and crude protein (CP)*

| Period | Parameter | Paddock 10% | Paddock 20% | Paddock 30% |
|---|---|---|---|---|
| June 1978 | Plants/ha | 28,798 | 15,602 | 14,868 |
| | Survival % | 94.0 | 78.0 | 74.3 |
| | Cover % | 9.4 | 15.6 | 22.3 |
| | DM kg/ha | 13,665 | 11,481 | 10,742 |
| | CP kg/ha | 2,405 | 2,021 | 1,800 |
| April 1980 | Plants/ha | 12,205 | 4,708 | 7,073 |
| | Survival % | 61.0 | 23.5 | 35.4 |
| | Cover % | 7.7 | 5.1 | 8.7 |
| | DM kg/ha | 8,793 | 3,346 | 3,804 |
| | CP kg/ha | 1,725 | 653 | 746 |

[1] The % cover has been corrected to take into account the differences in plant sizes between the different treatments, and is directly proportional to the areas sown, that is to 10, 20 and 30% in the 3 areas respectively.

*Table 2:*

*Liveweight gains (LWG) of Santa Gertrudis steers, 1978-79, Means of 9 animals*

| Period/pasture | Parameters | Leucaena cover, %[1] 0 | 9.4 | 15.6 | 22.3 | SE (±) |
|---|---|---|---|---|---|---|
| July, 21 days | LWG kg/head/d | 0.23 | 0.42 | 0.50 | 0.70 | 0.052 |
| Leucaena + degraded yaraguá | AU[2]/ha | 0.68 | 0.72 | 0.75 | 0.74 | |
| Aug-Oct, 48 days | LWG kg/head/d | 0.38 | 0.33 | 0:42 | 0.41 | 0.039 |
| Makueni | AU/ha | 0.64 | 0.64 | 0.64 | 0.64 | |
| Oct-Nov, 51 days | LWG kg/head/d | 1.12 | 0.83 | 0.92 | 1.02 | 0.042 |
| Leucaena | AU/ha | 0.71 | 0.81 | 0.86 | 0.87 | |
| Dec-Feb, 85 days | LWG kg/head/d | 0.31 | 0.37 | 0.37 | 0.30 | 0.040 |
| Degraded yaraguá | AU/ha | 0.86 | 1.06 | 1.25 | 1.31 | |

[1] The areas seeded were 0, 10, 20 and 30% respectively

[2] 1 AU = 400 kg liveweight

The linear regression equation of LWG/day (Y) on the measured % cover of leucaena (X) in the July grazing period is:

$Y = 0.021 X + 0.221$ where $r = 0.728$, $t = 6.190$ and the relationship is significant at the 1% level

*Table 3:*

*Liveweight gains (LWG) of steers 1979-80. Means of 7 Santa Gertrudis (SG) and 6 Zebu-Criollo (ZC)*

| Period/pasture | Parameters | Leucaena cover, %[1] | | | | SE (±) |
|---|---|---|---|---|---|---|
| | | 0 | 9.4 | 15.6 | 22.3 | |
| June-Oct; 155 days | SG LWG kg/head/d | 0.13 | 0.18 | 0.20 | 0.20 | 0.022 |
| Leucaena | ZC LWG kg/head/d | 0.27 | 0.35 | 0.30 | 0.35 | 0.033 |
| | Overall kg/head/d | 0.19 | 0.26 | 0.25 | 0.27 | 0.019 |
| 2 Nov 1979 | AU/ha | 0.89 | 1.12 | 1.09 | 1.04 | |
| Nov-April, 174 days | SG LWG kg/head/d | 0.48 | 0.51 | 0.45 | 0.48 | 0.034 |
| No leucaena | ZC LWG kg/head/d | 0.51 | 0.56 | 0.46 | 0.58 | 0.023 |
| | Overall kg/head/d | 0.49 | 0.53 | 0.46 | 0.52 | 0,021 |
| 25 April 1980 | AU/ha | 1.22 | 1.70 | 1.83 | 2.04 | |

[1] The areas seeded were 0, 10, 20 and 30% respectively

The linear regression equation of LWG/day (Y) over all animals on the measured % cover of leucaena (X) in the June-October period is:

Y = 0.009 X + 0.197, where r = 0.283, t = 2.085 and the realtionship is significant at the 5% level

## Discussion

Leucaena does not thrive on poorly drained soil (Hill 1971; Ruskin 1977) and the present work confirms that even established plants will die if exposed to standing water for several days after an extended period of continued defoliation.

Where plants are cut only once per year, it is thought that 2 m between rows of leucaena is desirable to allow animals to penetrate into the block, but that it would have been advantageous to sow 5 - 6 kg/ha of seed in continuous rows rather than 2.5 kg/ha in stations 25 cm apart, in order to increase the plant population and to create greater within-row competition , which may have reduced the thickness of the woody stems (Samur et al 1980).

The leucaena block was divided into 4 in order to ration the legume during the dry season, but the rate of regrowth after grazing was such that 3 divisions would have been adequate, providing for 3 - 4 weeks of grazing followed by 6 - 8 weeks of rest before the second grazing cycle. Two such cycles would completely provide for a 5 month dry season.

Although 6 animals died during the 2 grazing years of the trial, no symptoms of Mimosine toxicity were noted. In the first year one SG animal from the control group died of unknown causes, and one from the 30% area of physical injury . In the second year, Anaplasmosis killed 4 ZC animals, 2 from the control group and one each from the 10 and 30% areas. These were obtained from a private farm some 80 km distant where they had always been exposed to tick-borne diseases.

All animals readily entered and grazed in the leucaena area, but the ZC animals spent more time in the forested part than did the SG, resting there during the part of the day when biting insects were at their most active. The SG, particularly in the 1979 dry season, were frequently bothered by the insects, and this may, in part, explain why their performance in the second year was poorer than in the short 1978 grazing period.

In view of the high mortality of the leucaena in the 1978-79 wet season, animal performance can only be compared between years in general terms. Animal performance in 1978 from the area which contained about 9% legume cover was 80% better than the control, while in 1979 a similar grass - legume ratio improved animal production by 50% in a longer period, at a higher stocking rate. The control paddock supported about 0.9 AU/ha in the dry season, rising to 1.2 AU/ha during the rains. A 10% protein reserve could carry 1.1 AU/ha in the dry period while producing greater LWG. During the wet season, while part of the area was closed up to accumulate material, it was possible to graze harder the rest of the paddock , since the protected area, and not the paddock in general, provided a reserve of both quantity and quality for the following dry season. In this period 1.6 AU/ grazed ha (discounting the reserved area) or 1.4 AU/ha of total area, were carried without any decrease in individual animal performance. No compensatory growth effects were noted during the rains in the animals which had not had access to the legume reserve.

In the October - November period of 1978, on freshly growing grass, access to leucaena had no effect on LWG despite the strong response noted in the dry season. Even degraded pastures can support high animal growth rates until flowering reduces their quality. Once this occurs, the use of a legume reserve can substantially increase LWG.

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