PRODUCTIVITY OF *LEUCAENA LEUCOCEPHALA* IN THE DALY BASIN, NORTHERN TERRITORY

L. FALVEY*

ABSTRACT

Two experiments with leucaena at Douglas Daly Experiment Station are reported. Grazing leucaena under a set stocking regime gave a slight but significant liveweight advantage over a green panic—Townsville stylo pasture and a buffel grass —Townsville stylo pasture. Weaner heifers rotationally grazing leucaena on 50 per cent of the area in conjunction with a Townsville stylo—grass pasture gained 16 kg more over the dry season than heifers grazing a Townsville stylo—grass pasture only. No compensatory weight gain was recorded over the following wet season. This response to leucaena was only recorded when the legume proportion of the basal pasture was low.

INTRODUCTION

In the Top End of the Northern Territory, Townsville stylo (*Stylosanthes humilis*) has been the most commonly recommended improved pasture species. The higher dry matter digestibility and crude protein content of this species has led to markedly higher cattle productivity over native grass pastures (Wesley-Smith 1972). There is, however, evidence that dietary protein is lacking during the dry season even on Townsville stylo pastures (Norman 1968): One means of increasing the protein content of the diet is to introduce a legume of higher quality such as *Leucaena leucocephala*, which combines the attributes of high productivity, high palatability and high crude protein content compared to other available fodder, with an ability to withstand repeated defoliation (Hill 1971).

Leucaena has been investigated in the Northern Territory by Sturtz (pers. comm.) at Berrimah, near Darwin and by Fisher (1971) in the north Tipperary area. At Berrimah the varieties were of low productivity and leaf drop was pronounced during the dry season. This was attributed to the low availability of subsoil moisture during the dry season. In the north Tipperary region on Blain soil, however, the species grew prolifically and further investigation seemed warranted.

Gray (1968) noted that few experiments concerning the grazing of leucaena had been conducted. Those reported have indicated that a measurable advantage can be obtained by allowing animals access to the species (Shaw *et al* 1968; Partridge and Ranacou 1974). A mixed diet of leucaena and some other species is usually recommended to avoid problems associated with mimosine toxicity.

This paper reports two experiments; a set stocked exploratory grazing experiment comparing leucaena with other improved pastures, and an experiment in which rotational grazing of leucaena as a supplement to a Townsville stylo—grass pasture was evaluated.

MATERIALS AND METHODS

Both experiments were conducted on Blain sand (Aldrick and Robinson 1972) at Douglas Daly Experiment Station in the Daly Basin, Northern Territory, which is in a tropical monsoon region receiving a mean annual rainfall of 1100 mm.

(*i*) *Experiment No.* 1

Three pastures each of 4 ha: leucaena and volunteer couch grass (*Cynodon dactylon*), green panic (*Panicum maximum* var. *trichoglume*) and Townsville stylo,

*Animal Industry and Agriculture Branch, Department of Northern Territory, Darwin, N.T. Present address: Faculty of Agriculture, Chiang Mai University, Chiang Mai, Thailand.

and buffel grass (*Cenchrus ciliaris*) and Townsville stylo were each stocked with eight yearling Brahman-Shorthorn cross heifers between July and November 1972. All pastures had been established for 2-5 years and had been grazed in the previous wet season to ensure that pastures were not atypical for the time of the year.

Leucaena had been established in rows three metres apart at a density of about 1200 trees ha^{-1}.

The Townsville stylo content of the green panic and buffel grass pastures was estimated to be 35 per cent in both cases, and the yields of these two grasses were estimated to be similar and greater than the yield of the couch grass under the leucaena.

(*ii*) *Experiment No.* 2

The leucaena area was slashed to 50 cm in December 1972 to keep the leucaena within reach of grazing animals and divided into four paddocks each 1 ha. Two adjacent 4 ha paddocks containing Townsville stylo and *Brachiaria pubigera* in the proportions of 20 per cent and 80 per cent respectively of the available dry matter were utilized as the basal pasture for this experiment. On July 17, 1973 the paddocks were stocked with weaner Brahman-Shorthorn cross heifers that had all received anthelminthic treatment.

A control group of eight animals grazed only the basal Townsville stylo—Brachiaria pasture whereas the leucaena group of sixteen animals grazed a similar area with access to leucaena. Both treatments therefore had stocking rates of 2 beasts ha^{-1}. A regrown 1 ha paddock of leucaena was opened to the leucaena group and the grazed one shut at the same time each week. At the completion of each four week grazing cycle, stock were weighed, their condition was scored and were replaced in the alternate Townsville stylo-Brachiaria paddock to minimize the effects of any variation between the two basal pasture paddocks. Animal performance was monitored until June 3, 1975.

Paddocks had been stocked according to the same management system in the six months preceding the experiment to control pasture growth and test experimental procedures. Iodized salt licks were provided to all animals during the 1974 dry season.

The rate of leucaena regrowth immediately after grazing was estimated by hand picking leaves and twigs of up to 4 mm diameter from several trees. Samples of leucaena (leaves and twigs, immediately prior to grazing), Townsville stylo and Brachiaria were collected every six weeks and analyzed for crude protein content, phosphorus content and *in vitro* dry matter digestibility (Newman 1972). Visual estimates of botanical composition on a dry weight rank basis ('t Mannetje and Haydock 1963) were also carried out at regular intervals. Dry matter availability of ground level pasture was estimated by using a small forage harvesting machine on March 27, 1974 and by visual estimation at other dates. Faecal samples of similar size were collected *ex rectum* from all animals during the dry season. Samples were dried at 100°C for 24 hours (Falvey and Woolley 1974) and analyzed for nitrogen and phosphorus content.

RESULTS

(*i*) *Experiment No.* 1

The mean live-weight gain of the animals grazing leucaena was generally greater than that of the other groups, and significantly ($P < 0.05$) greater for the weighing periods of July-August and November.

(*ii*) *Experiment No.* 2

(*a*) *Liveweight Gains*

Liveweight data are presented in Figure 1. During the 1973 dry season the heifers allowed access to leucaena gained 16 kg more weight (significant at $P < 0.01$) and showed higher average condition scores than those grazing the basal pasture only.

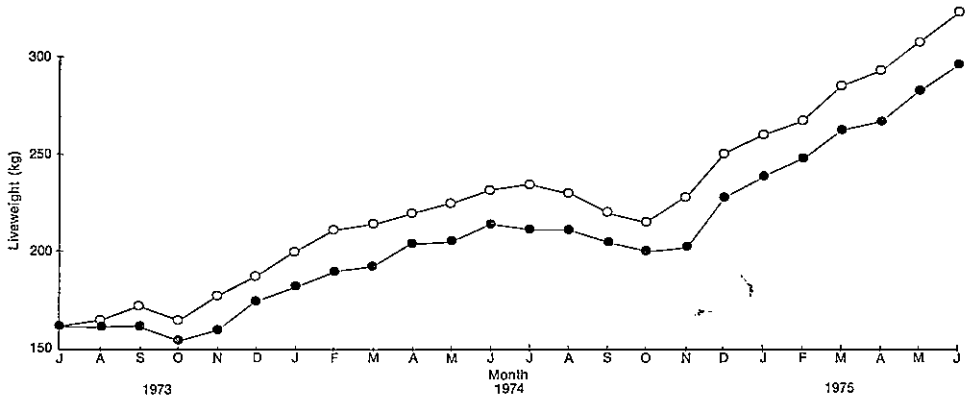

FIGURE 1

Liveweights of heifers grazing pastures with and without supplementary leucaena.
O Leucaena • Basal Pasture Only

Over the 1973/74 wet season this gap continued to widen although the difference in liveweight change was not significant.

During the 1974 dry season, there was no significant difference in liveweight changes although condition scores were always higher for the leucaena group between July and December. In the 1974/75 wet season the leucaena group gained more weight but the difference was again not significant.

(*b*) *Pasture Composition*

In July 1973 the Townsville stylo content of the basal pasture paddocks was estimated to be 20 per cent of the dry matter. Townsville stylo was selectively grazed and only a negligible amount was present by late dry season. In the 1974 season, however, the Townsville stylo content was about 45 per cent of dry matter in the late wet season and by late dry season was still present.

Dry matter measurements of the pastures on March 27, 1974 indicated that the understorey of the leucaena paddock and the amount of herbage from the two Townsville stylo-Brachiaria paddocks were approximately 2,400 kg ha^{-1}. The understorey of the leucaena paddock and the material on the other two paddocks were estimated to be similar at all other dates.

(*c*) *Faecal nitrogen and phosphorus*

Faecal nitrogen results are presented in Table 1. Values for animals allowed access to leucaena were higher than those of the control group in the 1973 dry season; however, the trend was reversed in the 1974 dry season. Faecal phosphorus levels tended to be slightly higher in the leucaena group.

TABLE 1

Faecal nitrogen (% in dry matter) determinations.

Pasture	Faecal nitrogen and date				
	21.vi.73	26.vi.74	24.ix.74	24.x.74	20.xi.74
Leucaena + Basal Pasture	1·70	1·44	1·18	1·62	1·42
Basal Pasture only	1·18	1·25	1·30	1·46	1·54

(*d*) *Plant quality*

Changes in the crude protein content throughout the year of the three main species involved in this experiment are presented in Figure 2. Leucaena provided a

feed of higher crude protein throughout the year (up to 48.6 per cent in very young regrowth) whilst that of Townsville stylo was reasonably high during the wet season but fell below 11.0 per cent in the late dry season. Brachiaria exhibited a pattern of crude protein content typical of tropical grasses.

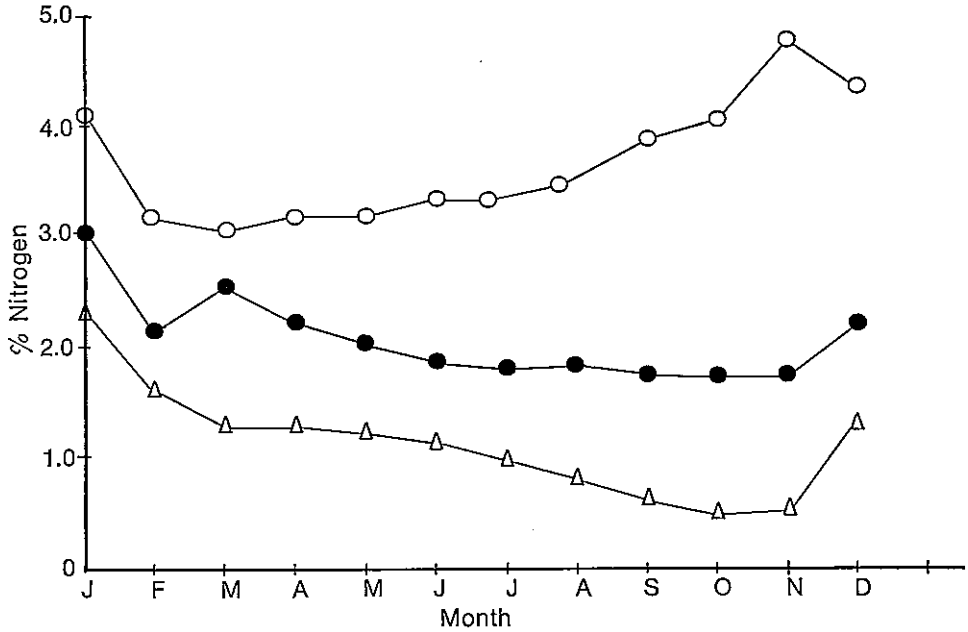

FIGURE 2

Mean nitrogen content of leucaena, Brachiaria and Townsville stylo.

O Leucaena • Townsville stylo △ Brachiaria

The phosphorus contents (not presented) of Townsville stylo and Brachiaria were similar and showed a marked decline in the dry season whereas the phosphorus content of leucaena, particularly the young regrowth, was much higher and did not decline in the dry season.

In vitro digestibility figures (not presented) of leucaena and Townsville stylo were similar throughout the wet and early dry seasons but during the late dry season leucaena had a higher digestibility (53.5 per cent compared with 25 per cent). Brachiaria showed generally lower *in vitro* values than Townsville stylo, reaching a similarly low value of 27 per cent.

(*e*) *Rate of regrowth of leucaena*

The rate of leucaena regrowth based on regrowth periods of three weeks varied from 10 kg dry matter ha^{-1} wk^{-1} in the late dry season to 84 kg dry matter ha^{-1} wk^{-1} during the early wet season.

Leucaena was not usually completely defoliated during the weekly grazing periods until mid-dry season. Towards the end of the dry season, leucaena was completely defoliated within two days.

DISCUSSION

The exploratory investigation of Experiment No. 1 indicated that an advantage can be obtained by grazing leucaena in the Daly Basin region. The lack of spatial replication in this experiment meant that differences may have been due to location;

however, as paddocks were situated side by side with the leucaena paddock in the middle, the differences are probably valid. The rate of leucaena regrowth may have been lowered under these conditions of rapid defoliation. It was considered probable that a system of deferred grazing would utilize leucaena more efficiently, as has been suggested previously by Takahashi and Ripperton (1949).

Experiment No. 2 was therefore devised to utilize leucaena more efficiently by providing a quantity of the high protein forage at least once every week. Even during the late dry season, it was calculated to contribute between 55-115 g of crude protein per head per day, which represents a very cheap protein supplement. The significantly higher liveweight gain during the 1973 dry season of the leucaena group is attributed to the additional nitrogen content in the animals' diet which is reflected by the higher faecal nitrogen values of the pre-experimental animals. The lack of significant difference between treatments during the 1974 dry season is probably due to the high Townsville stylo content of the basal pastures. Although Townsville stylo was present in the 1973 dry season, the quantity available was lower and its palatability was probably reduced by late rains during June. Leucaena, and to a certain extent Brachiaria responded to the unseasonal rain while the already dead Townsville stylo did not. During the 1974 dry season, selective grazing of Townsville stylo within the basal pastures was very marked and the resultant higher nitrogen diet may then have reduced the need for a nitrogen supplement. This is also indicated by the similar faecal nitrogen results.

Previous work has indicated liveweight responses to leucaena fed as a supplement rather than when set stocked (Shaw *et al* 1968; Partridge and Ranacou 1974). The finding of this work substantiates the potential value of leucaena, and indicates that it would probably be of greater value when rotationally fed as a supplement to pastures that contain little other legume.

ACKNOWLEDGEMENTS

I wish to acknowledge the technical assistance of Mr. H. Mollmann and his staff at Douglas Daly Experiment Station.

REFERENCES

ALDRICK, J. M., and ROBINSON, C. S. (1972)—Report on the land units of the Katherine-Douglas Area, N.T. 1970. Animal Industry and Agriculture Branch, Darwin, Land Conservation Series No. 1.

FALVEY, L., and WOOLLEY, ANNE (1974)—Losses from cattle faeces during chemical analysis. *Australian Journal of Experimental Agriculture and Animal Husbandry* **14:** 716-719.

FISHER, M. J. (1971)—Pasture species for the Tipperary area, Northern Territory. C.S.I.R.O. Division of Land Research Technical Paper No. 31.

GRAY, S. G. (1968)—A review on *Leucaena leucocephala*. *Tropical Grasslands* **2:** 19-30.

HILL, G. D. (1971)—*Leucaena leucocephala* for pastures in the tropics. *Herbage Abstracts* **41:** 111-119.

'T MANNETJE, L., and HAYDOCK, K. P. (1963)—The dry weight rank method for the botanical analysis of pasture. *Journal of British Grassland Society* **18:** 268-275.

NEWMAN, D. M. R. (1972)—A modified procedure for large-scale pasture evaluation of digestibility *in vitro*. *Journal of the Australian Institute of Agricultural Science* **38:** 212-213.

NORMAN, M. J. T. (1968)—The performance of beef cattle on different sequences of Townsville lucerne and native pasture at Katherine, N.T. *Australian Journal of Experimental Agriculture and Animal Husbandry*. **8:** 21-25.

PARTRIDGE, I. J., and RANACOU, E. (1974)—The effects of supplemental *Leucaena leucocephala* on steers grazing *Dicanthium caricosum* in Fiji. *Tropical Grasslands* **8:** 107-112.

SHAW, N. H., 'T MANNETJE, L., and HALL, R. L. (1968)—Pasture development: *Leucaena leucocephala* for supplementary feeding. C.S.I.R.O. Division of Tropical Pastures Annual Report 11-13.

TAKAHASHI, M., and RIPPERTON, J. C. (1949)—Koa Haole (*Leucaena glanca*). University of Hawaii Agricultural Experiment Station Bulletin No. 100.

WESLEY-SMITH, R. N. (1972)—Liveweight gains of shorthorn steers on native and improved pastures at Adelaide River, Northern Territory. *Australian Journal of Experimental Agriculture and Animal Husbandry* **12:** 556-572.

(Accepted for publication February 16, 1976)