THE EFFECTS OF SUPPLEMENTAL *LEUCAENA LEUCOCEPHALA* BROWSE ON STEERS GRAZING *DICHANTHIUM CARICOSUM* IN FIJI

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ABSTRACT

Steers (1.5 ha^{-1}) *grazing paddocks of Nadi blue grass* (Dichanthium caricosum) *in which nil,* 10% *or* 20% *of the area was planted with fertilised* Leucaena leucocephala *gained* 215, 300, *and* 500 g *liveweight gain* hd^{-1} day^{-1} *over a three and a half year period. This represents* 110, 170 *and* 270 *kg liveweight gain* ha^{-1} yr^{-1} *respectively. The application of leucaena browse for Fijian beef farms is discussed.*

INTRODUCTION

Many hillside areas in the drier zones of Fiji have been planted with Nadi blue grass (*Dichanthium caricosum*) which may be regarded as a semi-improved species for low fertility conditions. It flowers in May/June at the beginning of the dry season after which the quality and quantity of growth decline rapidly. The crude protein content of grass samples ranges from 6.3% in the wet season to less than 2.5% in the dry season, which is insufficient for good growth of cattle.

Leucaena leucocephala, locally known as "vaivai", is commonly found on coralline soils around the coasts of the islands of the Fiji group, having been first recorded by Seeman in 1867. Local farmers have claimed better growth and condition on cattle browsing leucaena although horses frequently suffer hair loss from mane and tail. The use of leucaena as a forage crop has long been investigated in Hawaii by Takahashi and Ripperton (1949) and was recommended to Fiji as early as 1942 in a letter from Ripperton (Jack 1942). Payne (1955) observed the growth of the local strain as a fodder but little further work was done in Fiji. Elsewhere overseas, work in selection and breeding of leucaena (Hutton and Gray 1959) has continued, but Gray (1968) stated that few grazing trials measuring the yield of animal production had been conducted. Since then, work has been undertaken in Queensland (Shaw 1968; Jones 1970, 1973.)

Following the visit in 1966 of the late W. W. Bryan of the C.S.I.R.O. Division of Tropical Pastures, as consultant to the Fiji Department of Agriculture, the quantitative evaluation of leucaena as a supplement to the existing grazing was planned.

METHODS

An area of gently rolling to moderately steep hill land on the Sigatoka Research Station was used. The nigrescent soil, derived from basic parent material, typically shows six inches of dark grey friable clay passing sharply into shattered and weathered tuff (Twyford and Wright 1965). It is moderately acid with high contents of exchangeable calcium and magnesium and low potash, while acid soluble phosphate is low to negligible. The initial vegetation, previously unfertilised, was mainly Nadi blue grass (*Dichanthium caricosum*) with small patches of reed (*Miscanthus japonicus*) and some guava (*Psidium guajava*).

Three treatments were compared—no leucaena supplementation, 10% of the area sown to leucaena, and 20% of the area sown to leucaena. In some cases the leucaena was in one block, in others in two, depending on the slopes of the paddocks.

The areas selected for leucaena generally had deeper colluvial soil than the

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convex slopes. These were ploughed and disced and leucaena seed (cv. Peru), inoculated with *Rhizobium*-bearing soil, was sown at 6.7 kg ha^{-1} in rows two metres apart in October 1968. A fertilizer mixture of superphosphate, ammonium sulphate and potassium sulphate (3, 2, 1) was applied along the rows at 250 kg ha^{-1} (calculated on the whole area under leucaena). Establishment was uneven and one of the 10% paddocks had to be resown. Grass invasion and other weeds, mainly *Cassia tora* and *Mimosa pudica*, were removed by hand along the rows. The leucaena was allowed to establish and strengthen without grazing in the drought year (1,029 mm) of 1969, but the shrubs were trimmed by cane knife when growing over 1.5 m. A topdressing of 250 kg ha^{-1} superphosphate and 125 kg ha^{-1} potassium sulphate was applied in July 1969 and superphosphate at 225 kg ha^{-1} in December 1971 and May 1972.

In 1970 and 1971 groups of six steers were rotated between the two paddocks of each treatment, while in 1972 groups of three steers grazed each paddock continuously. In the leucaena treatments access was allowed for varying periods each week. This represented one to two days or three to four days per week for the 10% and 20% treatments respectively, to control growth but to prevent overgrazing. Three lots of steers grazed the trial—from November 10, 1969 to March 1, 1971, small Friesian steers of 155 kg initial weight; from March 22, 1971 to May 16, 1972, local Zebu-type steers of 225 kg initial weight; and from August 1, 1972 to August 10, 1973 similar steers of 200 kg initial weight. All steers were drenched with Nilverm prior to and during the trial when considered necessary. One fence-breaking steer was replaced in 1972 in the grass-only treatment by another steer of similar type and weight. Salt blocks were provided in 1972-73.

During the trial, leucaena that had grown out of browsing reach was trimmed by knife every six months, occasional *Solanum torvum* and more serious "mile-a-minute" (*Mikania micrantha*) were hand weeded in the leucaena areas, and guava sprayed in the grazing area. The reeds were gradually eaten out by the steers.

RESULTS AND DISCUSSION

The patterns of liveweight gain of the different groups of steers are shown in Figure 1 together with the rainfall throughout the trial periods.

The liveweight gains per head per day and per hectare per year are given in Table I.

TABLE I

Daily liveweight gains of steers grazing leucaena and the gains per hectare for the grazing periods

Treatment	Liveweight gain—g hd^{-1} day^{-1} or (kg ha^{-1})			
	2.iii.70 to 1.iii.71	22.iii.71 to 20.iii.72	18.viii.72 to 10.viii.72	Mean
Nadi blue grass	280±30 (150)	200±20 (105)	170† (95)	215 (110)
Nadi blue grass with 10% of area in leucaena	315±15 (170)	255±30 (145)	340 (185)	300 (170)
Nadi blue grass with 20% of area in leucaena	510±30 (275)	490±25 (260)	510 (280)	500 (270)

†Least significant difference ($P<0.05$) = 100 (50)

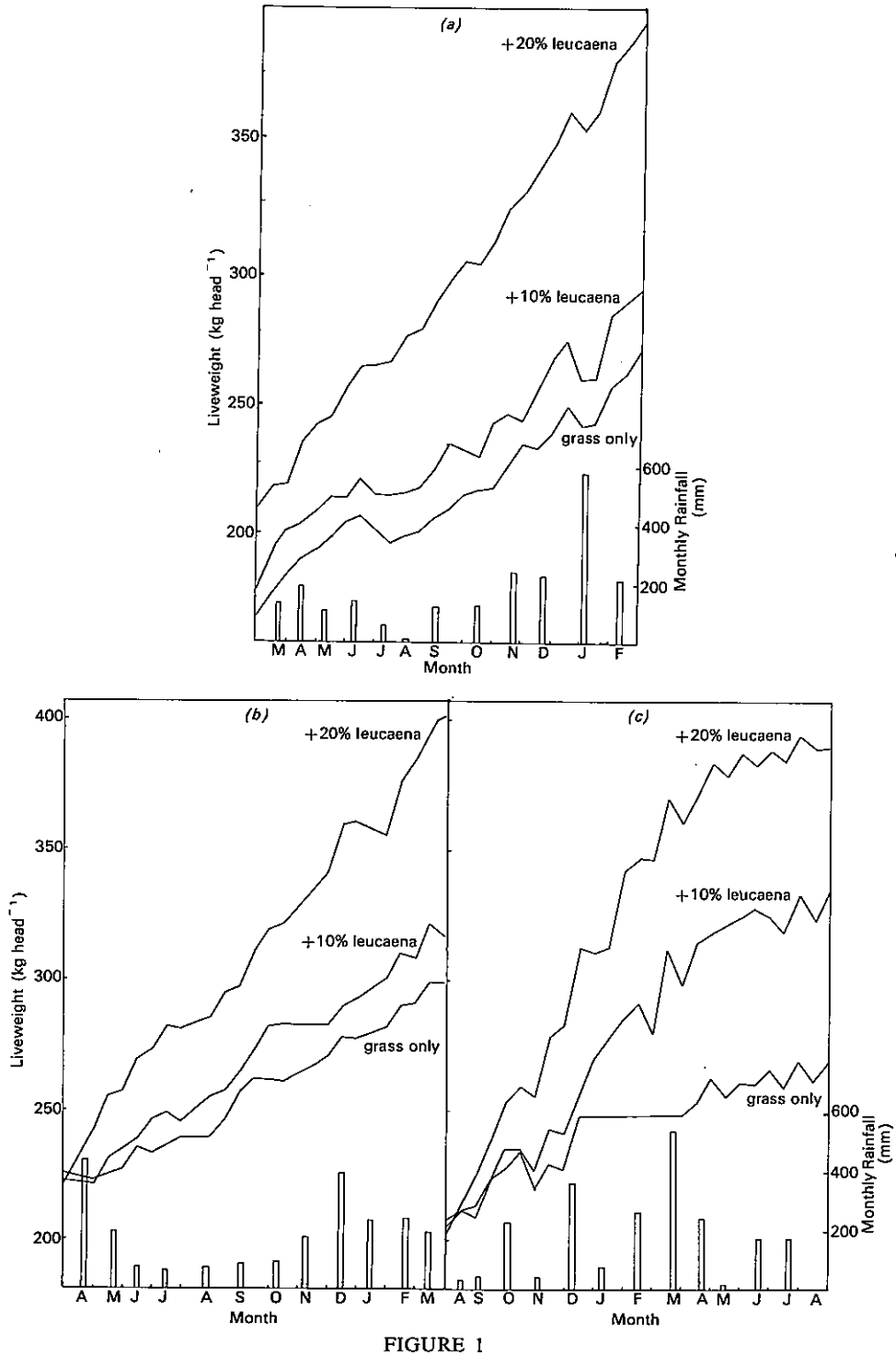

FIGURE 1

Effects of supplementary areas of fertilized leucaena on cumulative annual liveweight gain (kg head^{-1}) of steers grazing Nadi blue grass: (a) 1970-71, (b) 1971-72, (c) 1972-73.

It can be seen that in 1970 and 1971 performance from the 10% leucaena treatment was relatively poor, reflecting the poor establishment and subsequent growth in those paddocks. A break in grazing from May to August 1972 was introduced to try to strengthen the poor stands, producing a better growth rate in the 10% treatment in 1972.

Comparison of the monthly rainfall figures with the growth rates suggests that only in 1970 was the dry season severe enough to cause weight loss in the low leucaena and unsupplemented steers while not affecting the 20% leucaena group. In 1971 leucaena supplementation produced higher growth rates throughout the year. This pattern was also repeated in 1972/73 although the rates of gain were reduced in the dry season. In the first two yearly periods, the steers were small during the dry season having started the trial in March while in the last period the trial started in August thus carrying animals of about 360 kg at the start of the next dry season.

This higher grazing pressure reduced feed availability, the Nadi blue grass being very closely grazed in the control. This suggests that the overall stocking rate of 1.5 beasts ha^{-1} was too heavy for unimproved Nadi blue grass; however, due to its creeping form of growth, it was generally able to persist and recover later. In the 20% leucaena the grass was not so heavily grazed and might have been able to withstand a slightly higher stocking rate, giving higher production per unit area. At the end of the trial the leucaena was as vigorous as at the start in the 10% and 20% treatment, although it had died out in localised waterlogged patches. The practise of removing cattle when they have eaten all the available leucaena leaf to allow the plant to recover and produce a good leaf area before browsing again may involve extra management, but it does represent a system which does not deteriorate under Fiji conditions. The blue grass growing between the rows of leucaena was thicker than in the grazed area which could have been due to extra nitrogen available from the legume but also to the lower grazing pressure as the animals tended to concentrate on the legume leaf while it was available.

No problem of hair or weight loss were experienced under these grazing conditions which approximates those likely on Fijian beef farms.

Compared to liveweight gains of 520 to 630 g day^{-1} obtained in other countries (Furr 1965; Shaw 1968; Jones 1970) performance in this experiment was lower, possibly reflecting the poorer quality of the basic grazing, the indifferent types of steers used, and the smaller area of leucaena available. Also the influence of stocking rate was not studied in the present trial. Shaw (1968) used four steers on nine acres of spear grass/Townsville stylo including three acres of leucaena while Jones (1970, 1973) used stocking rates of 1.7 and 1.5 steers ha^{-1}.

The use of leucaena has an immediate application to Fijian beef farms for planting in weaning paddocks on the better classes of hill land. Most newly established beef farms consist of about 225 ha of steep hill land generally covered with mission grass (*Pennisetum polystachyon*). Older ranching areas have been sown with Nadi blue grass but its distribution is no longer recommended due to the difficulty of establishing large areas of legumes without cultivation to break up the sward. The quality of both grasses drops rapidly in the dry season causing problems with weaner ill-thrift, trials here (McIntyre *et al.* 1972 and unpublished data) strongly suggesting that poor nutrition is the major cause. Moreover, the regular handling of weaners with controlled access to leucaena should aid their subsequent management.

Until current research in Fiji shows general pasture improvement by oversowing legume seed and broadcasting fertiliser to be economical, the more labour-intensive but fertiliser-sparing use of supplementary leucaena in small paddocks is recommended to farmers by the Department of Agriculture, especially on farms where Nadi blue is the main grass. The first completed year (May 1974) of a stocking rate trial has shown a calculated 125 kg ha^{-1} liveweight gain from Nadi blue grass

and 315 kg ha^{-1} from the blue grass improved with siratro and superphosphate, at a similar stocking rate of 1.5 beasts ha^{-1} with 370 kg ha^{-1} at 2.5 steers ha^{-1} (Unpublished work). No results are yet available for animal performance on natural or improved mission grass which can be readily oversown with legume seed following burning.

Two main problems experienced with leucaena are establishment and management. In general establishment has not been too difficult if the effects of drought and waterlogging are discounted. Leucaena is unable to withstand waterlogging. Weed competition with the leucaena at establishment can be reduced by handweeding or by spraying with herbicide when the first seedlings appear. Once established the only weed problem is with the creeping "mile-a-minute" which has to be cut by hand during the wet season. In Fiji most strains of leucaena have the potential to develop into trees ten metres high, if widely spaced, or into the commonly-seen vaivai thickets growing to about four metres in densely sown stands. Although the control of stocking rate may contain most excess growth, this was not possible in the present fixed stocking rate trial nor would it be ideal in large paddocks with uneven growth. Experience in this trial showed that it was necessary to cut back some tall growth in both leucaena treatments. Relatively cheap paid labour or cheaper farmer labour should be able to handle paddocks of leucaena without excessive costs provided tall growth is checked regularly.

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