THE GROWTH OF YOUNG BULLS ON GRASS AND GRASS/LEGUME PASTURES IN SUB-TROPICAL BOLIVIA

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Sixteen Brangus bulls aged between 8 and 10 months, with an initial liveweight of 186 + 5.6 kg, were used to assess the effect of grazing Green Panic only for the 6 montha of the dry season, or a Green Panic/Glycine mixture for the first 3 months, or for the second 3 months. or for the whole of the 6 months. Animals were set-stocked at 3 beasts/ha which was equivalent at the start of the trial to approximately 1.3 animal units/ha. During the following rainy season the animals were grazed as a single group in the general farm rotation to measure any compensatory growth. At the end of the dry season, the group which had grazed grass only had gained significantly less weight than the other groups, which were not statistically different from each other. The advantage due to the legume was approximately 40 kg per head. Six months after the experimental grazing treatments were terminated, the difference had widened to 50 kg/head, indicating the absence of any compensatory growth effect Liveweight gains in the 6 month dry season were 163 g/head/d (0.5 kg/ha/d) from grass only and 399 g/head/d (1.0 kg/hald) from the areas/legume association. It is concluded that unfertilized grass/legume pasture without supplementary feed can produce Brangus bulls of about 340 kg at 20 to 22 months of age, and that a weight of 450 to 500 kg at 28 to 30 months should be possible.

Key Words: Cattle, grazing, grass/legure mixtures, liveweight gain

In the period 1964-1967, the initial testing of a number of pasture plants was carried out at the Santa Cruz Department (Horrell 1976 personal communications). Amongst these, the grass Panicum~ maximum var. trichoglume, Eyles cv. Petrie (Green Panic) has been highly persistent on well drained soils, either in pure stands or in association with Glycine wightii (R. Grah. ex Wight and Arn.) Verde cv. Tinaroo. Individual paddocks of pastures sown during this period are still in existence. They continue to be productive, competing well against weeds, despite the current poor standard of pasture management.

While the persistence of these pasture species has shown their high degree of tolerance to local conditions, no records exist of the level of animal performance obtained on the grass monoculture, or from the association of the grass and legume. This work was designed to measure the potential of the pastures during the critical dry season using weaner cattle.

Materials and Methods

The trial was carried out at the Estacion Experimental Agrlcola deSaavedra, situated 65 km north of the city of Santa Cruz de la Sierra, Bolivia, at latitude 17! 14' S, longitude 63! 10' W, altitude 320 m above sea level.

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Animals: Twenty Brangus entire males and 16 females were used. The animals were born in July and August 1976, and weaned in March/April 1977. They were grazed as one group until the start of the trial on 1 May when the average age of the animals was 9 months and the average weight was 176 + 24 kg (x + SE-). All animals were routinely vaccinated against endemic diseases and sprayed to control parasites according to the local practice of spraying when it was observed that the animals were heavily tick infested (about every two months). The animals had free access to rock salt, but no other supplementation was given.

Experimental Design and Treatments: The 16 most uniform males (designated test animals), weighing 186 + 5.6 kg, were assigned at random to 4 grazing treatments as 4 replications of a randomised block design. The remaining 4 males and 16 females were then divided between the groups to equalize total grazing pressure on the trial paddocks. The grazing treatments were applied from 1 May to 27 October (Periods 1 and 2 see below), but liveweights on common grazing were measured for a further period of 6 months (Period 3, see below), so that overall growth rates were followed for 366 d from 1 May 1977 to 2 May 1978, Weights were taken at 14 d intervals after overnight fasting. The grazing treatments, under continuous set-stocking, were:

(1) Green Panic (GP) only in Periods 1 and 2 (180 d)

(2) Green Panic and Glycine (GP/Gly) in Period 1, normal farm grazing in Period 2

(3) Normal farm grazing in Period 1, Green Panic and Glycine in Period 2

(4) Green Panic and Glycine in Periods 1 and 2.

Pastures: The following pastures were utilised in the trial:

Green Panic Only: This was a paddock sown to Green Panic in 1970. In 1977 it was almost pure Green Panic with the exception of a small area dominated by the unpalatable grass Digitaria insularia (L) Fedde which comprised about 4% of the paddock.

Green Panic Glycine Association: Two separate paddocks of this mixture were used in the trial, one for treatments 2 and 3, and the other for treatment 4. The two paddocks were very similar to each other, both having been sown in 1970. Apart from a few shrubs, weed infestation was minimal, and in May 1977 legume content was estimated at 40% on a dry weight basis. The three trial paddocks were slashed by machine in early April 1977 and rested for 4 weeks prior to the commencement of the trial.

Normal Farm Grazing: Under normal farm grazing management, a rotational graz ing system is employed. Pastures vary according to the soil type, but in order of decreasing importance they are comprised of the grasses: Hyparrhenia rufa (Nees) Stapf (Jaragua); Panicum maximum cvv. Green Panic, Makueni, Coloniao (Guniea grasses); Pennisetum purpureum Schumach cv. Merkeron (Elephant grass). No fertilizer was ever applied to any of the pastures.

Chemical Analysis: Random grab-samples of both Green Panic and Glycine were taken at intervals of 2 weeks throughout the dry season. These were analysed for crude protein, crude fibre, calcium and phosphorus.

Stocking Rate: Grazing on the experimental areas was at 3 beasts/ha for the 6 months of the trial period. At the start this represented 524 kg/ha liveweight, or 1.3 animal units (AU)/ha for each paddock (1 AU = 400 kg liveweight). In the subsequent period, October 1977 - 1978, all males were grazed together in one group, and females in another, on normal farm grazing.

Grazing Periods: : The trial was divided into the following periods for application of the grazing treatments:

Period 1: 1 May to 28 July 1977 (89 d; first half of dry season)

Period 2: 29 July to 27 October 1977 (91 d; second half of dry season)

Subsequently all animals were grazing for:

Period 3: 28 October to 2 May 1978 (186 d; wet season)

Results

Climate Rainfall and mean monthly temperatures in the period of the trial are shown in Table 1, together with the 27 year means. In the first 3 months of the trial

Table 1 :
Mean monthly rainfall and temperature

Period	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Rainfall, mm													
1977-78	7	20	16	123	30	52	212	71	172	103	135	5	946
27 year mean	63	5	41	36	61	101	125	178	200	141	94	68	1162
Temperature, °C													
1977-78	21.4	21 9	23.2	21.6	24.5	25.6	25.8	26.3	26.3	26.7	26.6	24.7	-
27 year mean	21.6	19.9	19.4	21.6	24.3	25.2	25.6	26.1	25.8	25.8	25.1	23.5	-

(Period 1), rainfall was much below average (43 mm total compared with 157 mm), while August was considerably wetter than normal. Mean monthly temperatures in the period of the trial mirrored closely the long term means, except for the slightly warmer than average conditions experienced in June and July 1977.

Animal Performance: Table 2 shows the total liveweight gains of the test animals, together with their daily growth rates for each stage of the trial, while in Table 3 are shown the grazing pressures applied to the 3 treatment paddocks in grazing periods 1 and 2 (May to October 1977) together with liveweight gains expressed on a per hectare basis. These data are calculated from the observed weight changes in all animals in each treatment group, both test and non-test animals.

In grazing period 3, all the animals were kept on common farm grazing. No measure of actual grazing pressure was possible, but for the farm as a whole it was estimated to be 2.1 AU/ha.

Animal Health: At the end of February 1978, one non-test animal from Treatment

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Table 2:
Liveweight gains of bulls grazed on Green Panic (GP) atone Oh with Glycine legume (GP/gly) or grazing mixed grasses (Farm grazing). Values are means of 4 "test" animals on each treatment (May- 1977 to May 1978)

	Grazing treatments				
	GP only	GP/Gly then Farm grazing	Farm grazing then GP/Gly	GP/Gly only	SEx
Initial weight, kg	186	188	180	159	11
Liveweight gain, g/d					
Dry season					
First 90 d (Period 1)	l24a	287b	99a	273b	48
Second 90 d (Period 2)	201a	322b	503c	522c	21
Overall 180 d	163a	304b	303b	399b	31
Wet season					
186 d(Period 3)	403a	5l9b	526b	454b	22
Overall 366 d	285	413	416	427	41
Final liveweight, kg	290	339	332	346	13

abc Means in same row without letter in common differ significantly at P< .05 according to Duncans New Range Test

died as a result of a severe injury on a barbed wire fence. No other health problems were noted.

Pasture: Table 4 summarises the results of chemical analyses of samples taken at two-weekly intervals.

Second Dry Season In the period 2 May to 3 November 1978 (186 d), 5 bulls from the trial group were grazed for 155 d on Green Panic/Glycine pasture at a stocking rate of 1,52 animals/ha. In the 186 d they gained 116 + 12 kg (620 g/d). Liveweight gain/ha/d was 1.02 kg which was similar to that obtained in the previous dry season.

Discussion

The present work used continuous set-stocking at approximately 3 beasts/ha. In the tropics, this system has given production as good as that from other more complex management practices (Mannetje et al 1976).

The early part of the dry season of 1977 was considerably drier than average (Table 1), and while the feed on offer in the paddock of Green Panic plus Glycine always appeared adequate, by late August all animals on Green Panic only were beginning to lose weight. The stocking rate was consequently lowered in this treatment during the month of September to allow the pasture to recuperate. The trial did not seek to compare different stocking rates, but observations in the field would suggest that, in the dry season under discussion, the stocking rates chosen were close to the optimum. By the end of the dry season the grass-only paddock had been

grazed to a height of about 8 cm while the grass legume areas were grazed to about 12 cm.

Table 3:
Liveweight gains and grazing days per hectare for all animals (test and non-test animals) on pastures6~h6S of Green Panic (GP) alone, or with Glycine (GP/Gly) Oh grazing mixed9 m grassesed (Farm grazing)

	Grazing treatments			
	GP only	GP/Gly then Farm grazing	Farm grazing then GP/Gly	GP/Gly only
Animals/ha	3.11	2.91	2.91	3.03
Grazing pressure at start (1 May 1977), AU/ha[1\]	1.33	1.32	1.32	1.31
Production/ ha				
First 90 d (Period 1)				
Liveweight gain, kg	41	72	-	63
Grazing days, per ha	280	262	-	273
Second 90 d (Period 2)				
Liveweight gain, kg	72	-	109	118
Grazing says, per ha	255[2]	-	262	273
Total 180 d dry season				
Liveweight gain, kg	90	180	180	181
Grazing days, per ha	535	524	524	546
Grazing pressure at end (27 Oct 1977) , AU/ha	1.56	1.61	1.61	1.76

[1]AU - animal unit of 400 kg liveweight
Stocking rate reduces to 2.3 animals/ha for month of September due to shortage of feet

Table 4:
Chemical analysis of pasture samples 1% on dry mattes basis)

Pasture	Period	Crude protein	Crude fibre	Calcium	Phosphorus
Green Panic	June-July	7.8	30.1	0.40	0.33
	August-September	10.9	27.3	0.80	0.51
	October	10.6	25.1	0.77	0.48
Glycine	June-July	12.0	30.3	1.39	0.23
	August-September	13.0	28.1	1.65	0.30
	October	12.1	28.8	1.76	0.30

All paddocks recovered quickly with the onset of the rains, and it was noted that no increase occurred in weed infestation in the various paddocks due to the continuous grazing during the dry season.

Animal production whether expressed per head or per hectare was higher from legume pasture than from grass-only pasture during the dry season. This is in agreement with other results from the tropics (eg Haggar et al 1971 in Nigeria; Shaw and Mannetje 1970 in Australia; Buller et al 1970, in Brazil). It was also of interest to note that those animals which spent only 90 d out of 180 on the legume-grass pasture gained as well as those with access to legume-grass for the whole 6 months.

At the end of the first grazing phase of 89 d, group 2 animals grazing Green Panic and Glycine had gained almost 17 kg/animal more than group 3, which had not had access to the legume-grass mixture. By Day 140, this difference had disappeared, and the gains of these 2 groups were almost identical to Day 366. At Day 180, group 4 animals which had spent the whole time on Green Panic plus Glycine had gained 17 kg/head more than groups 2 and 3, and 42.5 kg more than group 1 (Green Panic only). At Day 366, however, the difference between groups 4 and 3 had narrowed to 4 kg, and between groups 4 and 2 to 5 kg (due to the small weight loss of group 4 animals in the first fortnight after removal from the trial paddock at the start of the rains in November; see Figure 1), Generally, animals which had received legumes during their first dry season of grazing grew faster than those which had grazed grass alone, even during the following rainy season when all 4 groups of test animals grazed together. These results support the suggestion that larger animals will grow more rapidly on pasture than smaller animals of the same genetic potential (NRC 1970). Our results do not indicate any compensatory growth effect. Ralston et al (1966) showed that the rate of compensatory growth was inversely related to the rate of gain during the period of restriction. It is possible that the growth on the Green Panic pasture was not sufficiently low to demonstrate a compensatory effect when the restriction period ended.

The chemical analyses of the pasture indicate that calcium and phosphorus levels were adequate throughout the dry season for the animals to grow at a rate of at least 0.50 kg/d (NRC 1970). The crude protein content increased in the August-September period as a result of fresh growth following rain. These analytical data are mirrored by the animal weight gains which show good agreement with NRC (1970) which predicts the following growth rates for 200 kg steers in the presence of adequate calcium and phosphorus:

Crude protein (% in DM)	Liveweight gain (kg/d)
7.8	0.00
10.0	0.25
11.1	0.50

These figures suggest that animal performance in the present work can be explained largely on the basis of crude protein content of the forage.

The practical implications of the trial are considerable. Normal practice in the area of Santa Cruz is to produce slaughter animals off natural pasture or from Hyparrhenia

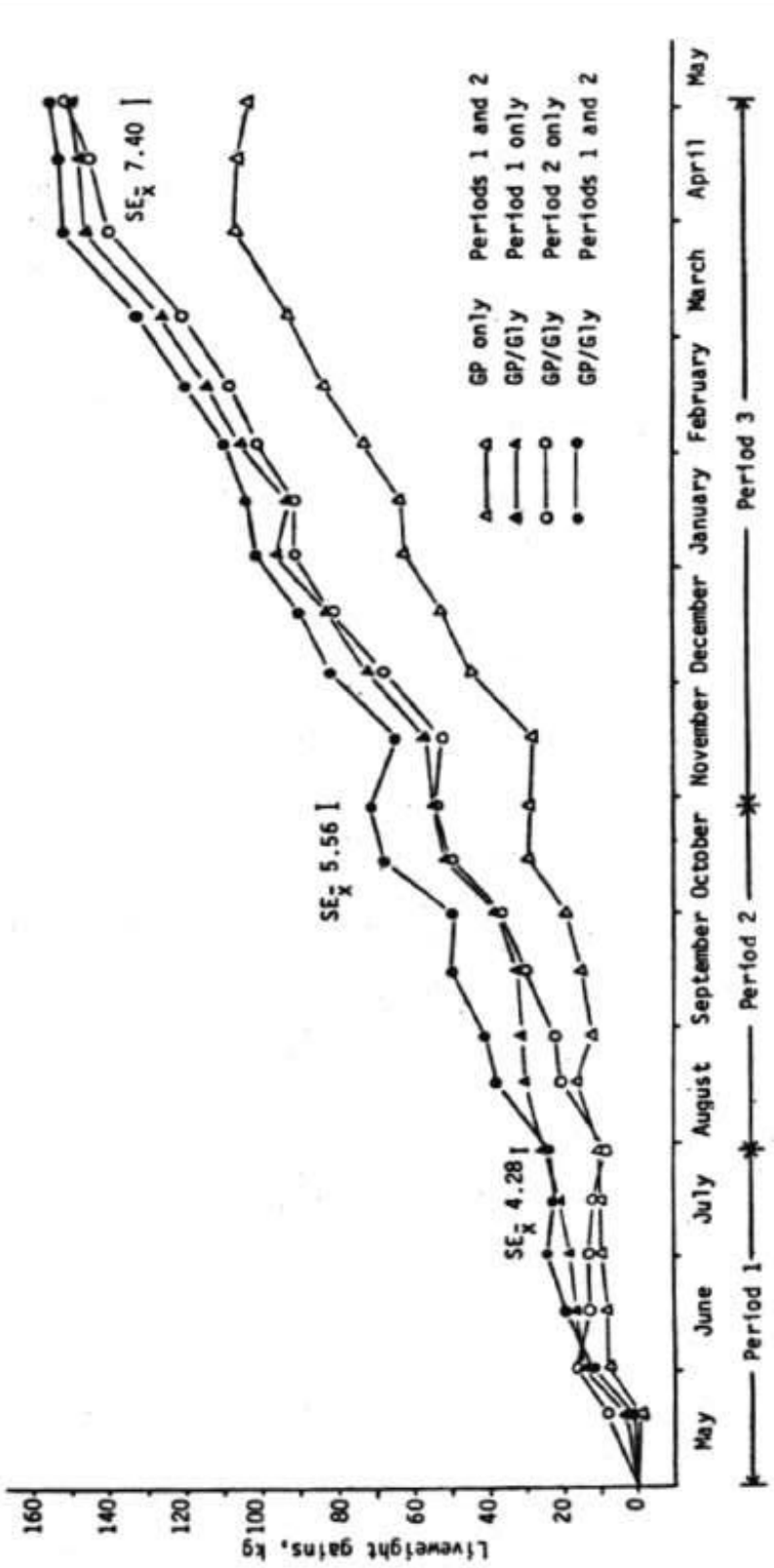

Figure 1:
Mean cumulative liveweight gains (kg) of four test animals

rufa (Jaragua) without the use of legumes or feed supplement. The pasture is often allowed to become over-mature during the dry season with the result that protein content reaches very low levels. Animals frequently lose weight during each dry season, before a slaughter weight of about about 400 kg is reached at an age of 4 to 5 years.

The present work indicates (with Brangus bulls) that animals can be grown to about 340 kg at 20 to 22 months of age on legume-grass pasture, without the use of either fertilizers or feed supplements, If the growth rates of the 5 animals which were weighed throughout a second dry season (115 kg in 186 d) can be considered to be representative of the potential of the pastures and the animals used, then at an age of 26 to 28 months, at the end of their second dry season of grazing improved pastures only, a liveweight of about 450 kg may be obtained with this breed, During the subsequent wet season, a slaughter weight approaching 500 kg at 28 to 30 months of age, with carcass value and quality considerably better than under the traditional system, should be possible.

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