BEEF PRODUCTION FROM THREE PASTURES AT GRAFTON, N.S.W.

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ABSTRACT

Beef cattle production from two improved pasture associations was compared with that from natural pasture in the Clarence River Valley, New South Wales. Several stocking rates were used on all pastures. Cows grazing improved pastures were heavier at the start and end of joining and had more calves than cows grazing natural pasture.

Calves grown on improved pastures were heavier at weaning than calves grown on natural pasture. At weaning, calves from the improved pastures at stocking rates of 0.65 *and* 0.8 *cows and calves* ha^{-1} *were suitable for slaughter. The results suggest that with pasture improvement it should be possible to produce cattle suitable for slaughter where this is not possible on natural pasture and also to join heifers at an earlier age than the district average of three years.*

The success of a naturalised ecotype of white clover (Trifolium repens) *under grazing in this sub-tropical environment was demonstrated. It was concluded that pasture improvement by fertilizing natural pasture with superphosphate and oversowing naturalised white clover would result in increased stocking rates, growth rates and fertility of beef cattle in the Clarence region.*

INTRODUCTION

Beef herds grazing natural pasture in the Clarence River Valley have low growth rates and fertility due mainly to inadequate nutrition (Osborne 1959; Sparke and Lamond 1968). Duncan (1966) reported that pasture improvement was practised on only 8 % of the area grazed by beef cattle.

O'Brien (1970) reported that a winter-spring growing naturalised ecotype of white clover (*Trifolium repens*) was both persistent and productive when grown in small plots in the sub-tropical environment of north-eastern New South Wales. However, there are no reports on its effect on beef production when sown into pasture. The seed is uncertified and at the commencement of this experiment there was little interest in the production of seed. There was, however, considerable interest in the use of commercially available spring-summer growing legumes such as Ladino white clover (*Trifolium repens*), lotononis (*Lotononis bainesii*) and siratro (*Macroptilium atropurpureum*).

The experiment reported here therefore aimed at obtaining some information on the potential beef production at different stocking rates on natural pasture which had been unfertilized or fertilized with superphosphate and oversown with naturalised white clover or a mixture of commercially available legumes.

METHODS

Pastures and stocking rates

In 1968, an area on a soil of shale origin at Grafton, N.S.W., was divided into three paddocks. The environment was described by O'Brien (1972). The area had no previous history of fertilizer application and carried summer growing naturalised and native grass species, the most prominent species being carpet grass (*Axonopus affinis*), pitted blue grass (*Bothriochloa decipiens*) and a range of minor species which included *Cappilipedium* sp., *Aristida* sp., *Cymbopogon* sp., *Sporobolus*

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sp., *Eragrostis* sp., *Paspalum dilatatum* and *Dichanthium* sp. The following pasture treatments were applied, one to each paddock:

Pasture A. Unfertilized natural pasture.
Pasture B. Natural pasture fertilized with 625 kg ha^{-1} molybdenised superphosphate (0.03 per cent Mo) and oversown in June with 4.5 kg ha^{-1} of a naturalised strain of white clover (*Trifolium repens* L; O'Brien 1970).
Pasture C. Natural pasture fertilized with 625 kg ha^{-1} molybdenised superphosphate and oversown with 4.5 kg ha^{-1} ladino white clover and 1.1 kg ha^{-1} lotononis (*Lotononis bainesii*) in June and 4.5 kg ha^{-1} siratro (*Macroptilium atropurpureum*) in November, 1968.

The pastures were not initially sown for experimental purposes but solely for grazing demonstrations. All legumes germinated satisfactorily but failed to persist because of dry weather in the spring and summer of 1968-69. In January, 1969, a light sowing was made in Pasture C of naturalised Japanese lespedeza (*Lespedeza striata*), a summer growing annual legume.

It was then decided to re-sow the clovers and lotononis and obtain some information on the likely carrying capacity of the three pasture types. However, because of pre-experimental treatment it was not possible to randomise pasture treatments. The three paddocks were therefore further sub-divided and the following stocking rate treatments allocated at random within the pasture types:

Pasture A. Three stocking rates (0.5; 0.65 and 0.8 cows ha^{-1}).
Pasture B. Four stocking rates (0.65; 0.8; 1.1 and 1.4 cows ha^{-1}).
Pasture C. Four stocking rates (0.8; 1.1; 1.4 and 2.0 cows ha^{-1}).

In March 1969, 51 pregnant three-year-old Hereford heifers were allocated at random to the resulting 11 plots. In April 1969, a further application of 375 kg ha^{-1} superphosphate was made in pastures B and C and the clovers and lotononis were again oversown. Siratro was not re-sown in pasture C. The lespedeza was oversown at 0.8 kg ha^{-1} and the clovers at 4.5 kg ha^{-1} using a roller drill (O'Brien 1968). The lotononis was oversown at 1.1 kg ha^{-1} using a roto-seeder (O'Brien 1968). Maintenance dressings of 250 kg ha^{-1} superphosphate were applied in April 1970 and 1971.

The botanical composition of the pastures stocked at 0.8 and 1.1 cows ha^{-1} was estimated in September 1969 and October 1971 from 25 quadrats (0.37 m^2) in each of 8 strata in pastures A and B and in 7 strata in pasture C.

Animals and management

Five cows grazed each plot on pastures A and B and four grazed each plot on pasture C. Oestrus was detected in the cows by observation twice daily, at 8 a.m. and 4 p.m. for 15 weeks commencing on November 1, 1969. Cows which displayed oestrus were mustered and joined with two bulls chosen at random from three bulls kept in pens. This technique was abandoned in January 1970, when, at one weighing, all cows were yarded with the bulls and two cows from pasture B mated, though oestrus had not been detected. For the last three weeks of joining in 1970, therefore, one bull was allocated to each pasture block and bulls and cows rotated over the stocking rate plots within pastures. In November, 1970, one bull was allocated to each of the three pasture blocks and bulls only were rotated at four-day intervals within pasture treatments and every three weeks between pasture treatments. This method was used in conjunction with oestrus observation, so that if a cow, not in a plot with a bull, displayed oestrus it was taken to a bull for service. Cows were pregnancy tested by palpation in March each year.

Calving took place between August and November. Bull calves were castrated at a mean age of 164 days. Calves were weaned in March 1970, and in April 1971 and 1972 at a mean age each year of 185 days and were removed from the experiment. Cows and calves were weighed without fasting at 9 a.m. every four weeks.

Supplementary feeding

Cows were fed lucerne hay (18 kg per cow per week given 5 times a week) when the mean liveweight of any group decreased to 250 kg in 1969 and 275 kg in subsequent years. At these liveweights death was considered to be imminent. When supplementary feeding was necessary, cows at the highest stocking rates on pastures B and C were fed crushed sorghum (12 kg per cow per week) in addition to the hay. Calves were not permitted access to the supplement.

In 1969, supplementary feeding of cows grazing pastures B and C at the stocking rate of 1.4 cows ha^{-1} ($B_{1.4}$ and $C_{1.4}$) and pasture C at the stocking rate of 2 cows ha^{-1} ($C_{2.0}$) was necessary between October 9 and November 6. In 1970, supplementary feeding of cows grazing pastures $B_{1.4}$ and $C_{2.0}$ commenced on August 8. On September 9 supplementary feeding commenced of cows grazing all other plots except pasture B at 0.65 and 0.8 cows ha^{-1} ($B_{0.65}$ and $B_{0.8}$ respectively) and pasture C at 0.8 cows ha^{-1} ($C_{0.8}$). Supplementary feeding continued until December 16. In June 1971, cows grazing pasture C at 1.4 and 2 cows ha^{-1} were removed from the experiment when supplementary feeding became necessary again.

RESULTS

Rainfall was recorded at two sites each less than 2 km on either side of the experimental area and the mean from both sites is presented in Table 1 together with the standard mean rainfall 1931-60 (Commonwealth Bureau of Meteorology) for Grafton, 9 km from the trial site. Rainfall on the experiment was lower than the standard mean for Grafton in three of the four years.

TABLE 1

Rainfall for the period 1968-1972 (mm) compared with that for a standard period at Grafton, N.S.W.

Year	J	A	S	O	N	D	J	F	M	A	M	J	Total
1968/69	47	136	8	20	30	44	59	136	10	34	100	10	634
1969/70	14	180	21	82	73	58	129	44	67	37	15	6	726
1970/71	6	11	84	70	94	286	164	187	85	22	22	85	1,116
1971/72	20	32	106	10	40	87	174	181	93	68	55	15	881
Grafton*	55	45	45	62	81	109	137	141	130	66	55	72	998

*Standard period 1931-1960 (Commonwealth Bureau of Meteorology)

Pastures

The establishment of both clovers after the first sowing was good but that of the lotononis was only fair while that of the siratro was poor. Because spring-summer rain was below average and poorly distributed these legumes died while in the seedling stage. The later sown lespedeza established satisfactorily and, although only a light sowing rate was applied, it persisted throughout the experiment. Very good establishment and growth of the clovers and lotononis occurred following the second oversowing.

In September 1969, Ladino white clover occurred in 95% of all quadrats in pasture C at the stocking rate of 0.8 cows ha^{-1} and was estimated to cover 6% of the total ground area. In October 1971, the frequency of occurrence and cover of this legume was estimated at 65% and 5%. By comparison, the estimates of frequency of occurrence and cover of the naturalised white clover in pasture B at the same stocking rate were 100% and 6% in September 1969 and 100% and 75% in October 1971. The estimates of frequency of occurrence and cover for the lotononis in pasture C were 70% and 2% in September 1969 and 50% and 4% in October 1971, while those for lespedeza were 35% and 1% in 1969 and 65% and 7% in 1971.

Carpet grass became the dominant grass species in all pastures as a result of the constant grazing. However, the estimate of cover for the paspalum increased from less than 1% in 1969, to 7% in 1971 in pasture B.

Estimates of botanical composition of pastures B and C at the stocking rate of 1.1 cows ha^{-1} indicated the frequency of occurrence and cover of all legumes in September 1969 were similar to estimates made at the stocking rate of 0.8 cows ha^{-1}. However, in October 1971, the frequency and cover of the Ladino white clover (25% and 0.5%) and lotononis (5% and 0%) was much lower than at the lower stocking rate while the naturalised white clover (100% and 80%) and lespedeza (95% and 10%) were higher.

Animal production

At joining in 1968, prior to their allocation to the plots, the mean weight of the heifers was 285 ±2 kg. The mean monthly liveweights of cows stocked at

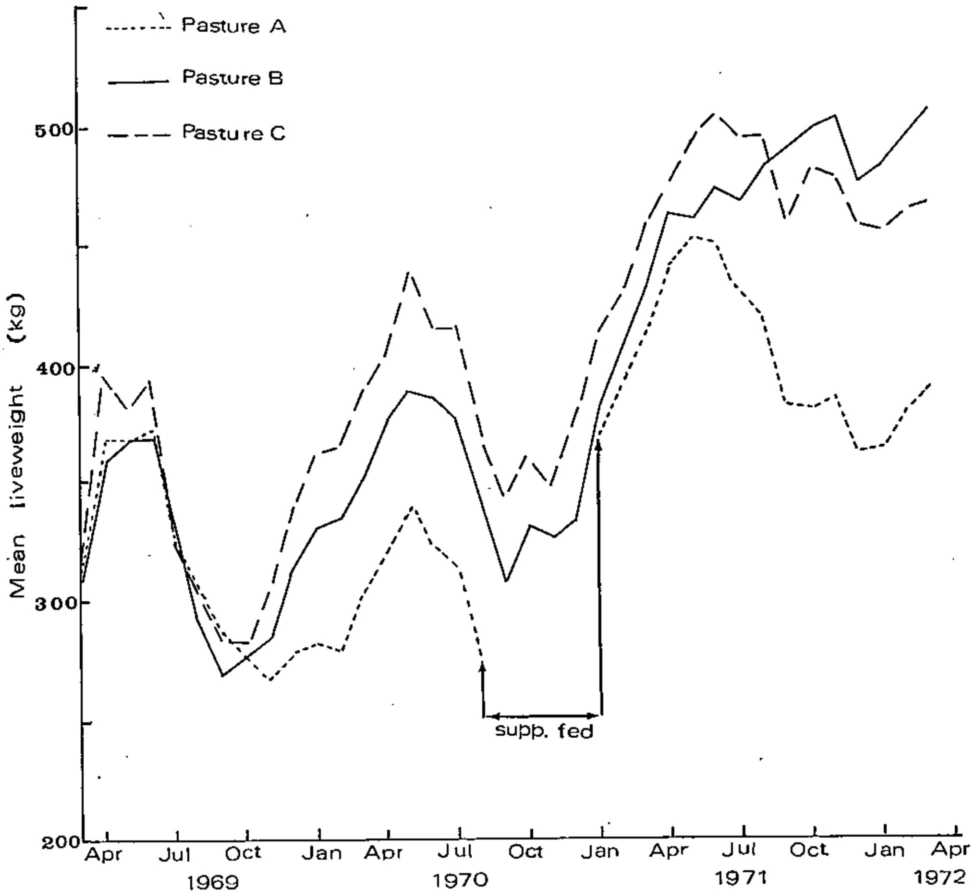

FIGURE 1

The mean monthly liveweights of cows grazing three pastures at 0.8 cows ha^{-1} in 1969-72 at Grafton, N.S.W.

0.8 ha^{-1} on all pastures are presented in Figure 1. In all years cows grazing the improved pastures maintained higher liveweights than cows grazing natural pasture.

The mean liveweights of cows at the start and end of joining each year are presented in Figure 2. Seasonal effects markedly influenced cow liveweights at these times on all pastures. Poor seasonal conditions in the year of pasture estab-

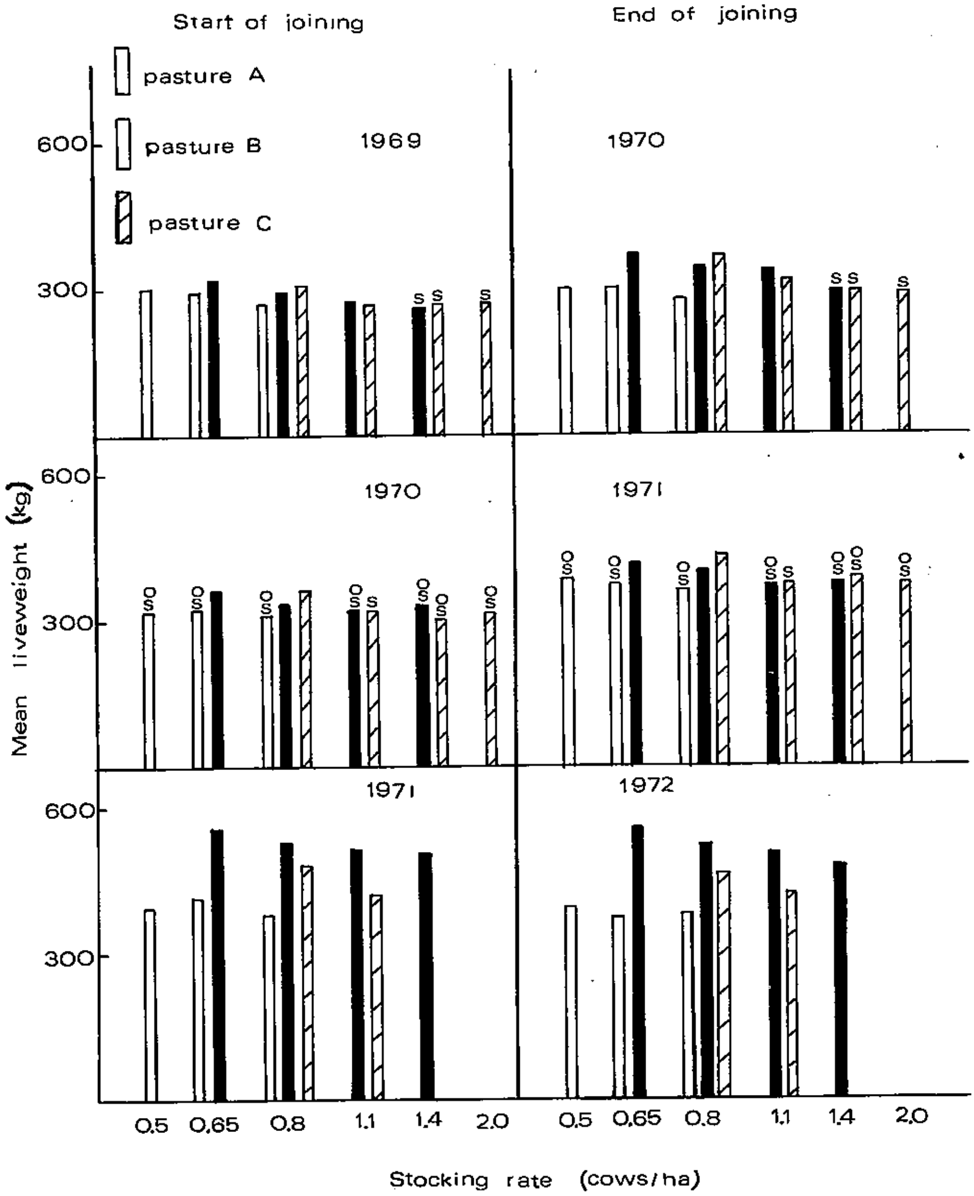

FIGURE 2

The mean liveweights at the start and end of joining of cows grazing three pastures at different stocking rates for three years at Grafton, N.S.W.

S —Results influenced by supplementary feeding

O—No calves reared

lishment (1969-70) would have been the main factor leading to the similarity of cow liveweights on pastures A and B at the commencement of joining in 1969. However, the difference between pastures A and B in cow liveweight at the end of joining in 1970 (Fig. 2) indicates an ability both for these improved pastures to respond more rapidly than natural pasture following spring rain and for cows grazing them to make greater liveweight gains during the joining period.

The percentages of cows pregnant on the three pastures were combined for all years and are presented in Table 2.

TABLE 2

Percentage of cows pregnant on three pastures at several stocking rates at Grafton, N.S.W. (means of three years' data)

Pasture type	Stocking rate (cows ha^{-1})					
	0.5	0.65	0.8	1.1	1.4	2.0
Unfertilized natural pasture	40	47	33	—	—	—
Natural pasture, superphosphate, naturalised white clover	—	80	73	60	53	—
Natural pasture, superphosphate, Ladino white clover, lotononis lespedeza	—	—	67	58	*	*

*Cows removed from these plots in 1971.

The mean liveweight of calves at birth and weaning are presented in Figure 3. Calf liveweights at weaning were corrected to 185 days. Calves grown on both improved pastures (pastures B and C) at stocking rates of 0.8 cows ha^{-1}, or lower, were suitable for slaughter when weaned at six months of age. Calves on the natural pasture were only in store condition at weaning. At six months of age the calves from the improved pastures at stocking rates of 0.65 and 0.8 cows ha^{-1} in 1970 were more than half the weight that their dams were at joining, at three years old, while the 1972 calves were three-quarters of this weight.

Regressions of stocking rate (x) on mean liveweight of calves at weaning (y) were calculated for pastures A and B in 1970 and 1972. Regressions were not calculated for pasture C because of the influence of supplementary feeding in 1969-70 and removal of stock from two stocking rate plots in 1972. Nor were they calculated for 1971 on all pastures because of the small numbers of calves born in 1970. The regression equations for 1970 were

Pasture A $y = 191 - 126.9x \pm 13$ ($r^2 = 0.75$; $P > 0.05$)
Pasture B $y = 229 - 92.6x \pm 7$ ($r^2 = 0.97$; $P < 0.05$)

and for 1972 they were

Pasture A $y = 272 - 187.8x \pm 16$ ($r^2 = 0.99$; $P < 0.05$)
Pasture B $y = 278 - 40.2x \pm 16$ ($r^2 = 0.81$; $P > 0.05$)

There was no significant difference between the slopes of the regressions for pasture A in 1970 or 1972, but the elevations of these regressions were significantly different between years ($P < 0.05$). However in pasture B both the slopes ($P < 0.05$) and elevations ($P < 0.001$) of the regressions differed between the two years. The differences in the elevations between the two years for both pastures were a reflection of the more favourable rainfall recorded in 1971-72.

DISCUSSION

The treatment applied to the experimental area in 1968, one year prior to the commencement of the work reported here, meant that it was not possible to

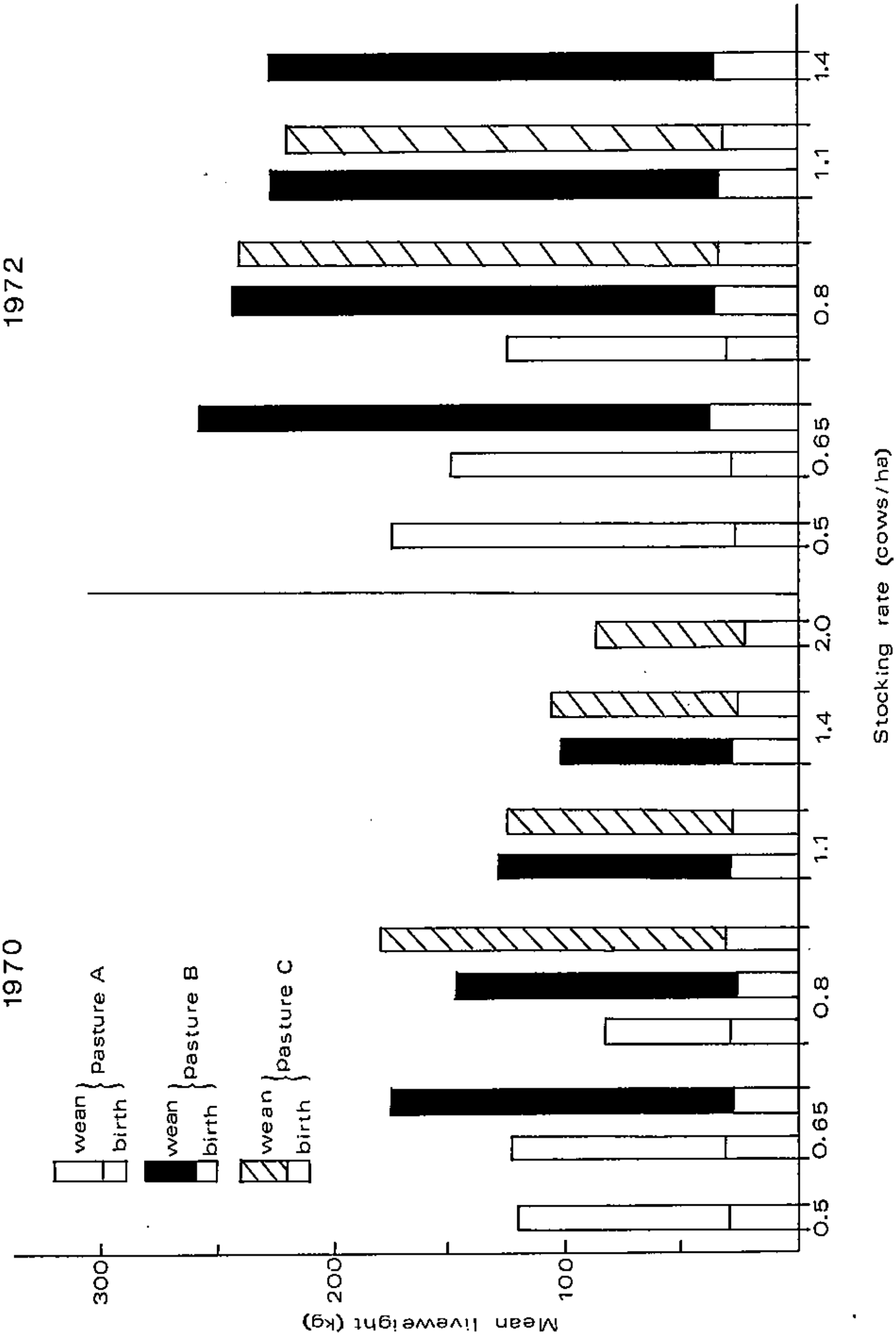

FIGURE 3
The mean birth and weaning weights of calves from three pastures at different stocking rates at Grafton, N.S.W.

S—Results influenced by supplementary feeding of cows.

allocate the pasture treatments at random. However, while no objective evidence can be given as to the uniformity of the area, every attempt was made to balance the three pasture blocks in terms of catchment, slope and pasture species. Therefore, while it was not valid to make statistical comparisons between pastures, the increases in cow and calf production and stocking rates on the improved pasture blocks compared with the unimproved were so large, particularly once the pastures had become established that the differences could not be reasonably attributed solely to differences between blocks.

It is normal practice in the Clarence River Valley of New South Wales to wean calves at 9-10 months of age and these calves are then sold in store condition for fattening in more favourable areas outside the region (Duncan 1966). The results presented here suggest that, following pasture improvement, it may be possible to fatten weaner cattle on properties in the Clarence region.

The better growth rate of calves on the improved pastures suggests that heifers, if grown on improved pasture following weaning, should reach puberty at a much earlier age than heifers grown on natural pasture. Thus with pasture improvement it should be possible to join heifers before the usual district joining age of 3 years.

It is notable that the weaning weights of calves on pasture B were heavier than those of calves on pasture A in 1970 even though this was the year of establishment of the naturalised white clover and rainfall was below average. The non-significant regression of weaning weight on stocking rate for pasture B in 1972 suggests that, in a year of normal rainfall, when the pasture had become established, stocking rates of at least 1.4 cows and calves ha^{-1} may be maintained with little reduction in calf growth rates.

It is generally accepted that nutritional status, as shown by liveweight during the joining period, markedly influences fertility (Lamond 1969). Sparke (1967) suggested that many cows in the Clarence River Valley of New South Wales were conceiving only in alternate years. The results of this experiment support these suggestions. However, they also indicate that weight gains of 45 kg during the joining period can be achieved following pasture improvement, even in the initial establishment phase of the pasture. This was the weight gain which Sparke and Lamond (1968) suggested was necessary for satisfactory fertility. Therefore, although some difficulty was experienced in detecting oestrus during joining in 1969-70, it is not likely that this would have influenced fertility data for that year for cows grazing unfertilized natural pasture, since none of these cows gained 45 kg during the joining period. However, it may have influenced the fertility data of cows grazing the improved pastures at stocking rates of 1.1 cows ha^{-1} or lower, since these cows gained more than 45 kg during the joining period. Nevertheless the fertility of these cows was considerably higher than that of cows grazing natural pastures (Table 2) but the small number of experimental cows could have influenced the fertility data.

Cows grazing the improved pastures at stocking rates of 0.65 and 0.8 cows ha^{-1} did not receive supplementary feeding at any time during the experiment. However, it would be unwise to draw conclusions on optimum stocking rates of the three pastures from the results of this experiment alone because of the lack of replication. Nevertheless, the results do indicate that large increases in beef production can be made with concurrent increases in stocking rate following this type of pasture improvement.

There was little difference in beef production from the two improved pasture associations, at comparable stocking rates, so that the less expensive grass/naturalised white clover pasture is recommended for this region. The decline in persistence of the Ladino white clover compared with the increasing production from the naturalised ecotype supports this recommendation. However the increase in density of the lespedeza suggests that lespedeza may be a successful inexpensive legume for pasture improvement in the area.

During the term of this experiment, the estimated harvest of naturalised white clover seed in the region increased from 400 kg in 1968 to 12,000 kg in 1971. It is estimated that approximately 4,000 ha of natural pasture in the Grafton district was oversown with naturalised white clover in 1972. The estimated amount of superphosphate applied to pasture in the district also increased from 7,500 tonnes in 1968 to 12,000 tonnes in 1972.

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