COTTONSEED MEAL AND GRAIN AS SUPPLEMENTS FOR GRAZING BEEF CATTLE

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Summary

In eight grazing experiments with beef cattle, grain sorghum and/or cottonseed meal were examined as supplements to native pasture. In one experiment, grain sorghum fed before weaning gave a significant growth response. In another, it did not. In both, supplementation after weaning did not increase an already reasonably high rate of gain.

In six other experiments involving weaner or yearling cattle, a response to supplementation was observed. This response was correlated more with the crude protein intake ($r = 0.81$) of the supplement than with the total digestible nutrient intake ($r = 0.26$) of the supplement.

Measured over a period usually of two months, compensatory gains were observed only in one experiment when both groups recorded high rates of gain after supplementation ceased. In the other experiments where post-feeding performance was measured, there was no significant difference in three experiments or a difference in favour of the fed group in one experiment in post-feeding performance.

I. INTRODUCTION

Tropical pastures when mature are deficient in digestible protein and total digestible nutrients, high in fibre and their palatability is low (Amdt and Norman 1959; McDonald 1968). The decision as to type of supplement used for cattle grazing these pastures must depend upon economics and a determination of the relative importance of these deficiencies. Sutherland (1959) considered that protein was the most important factor. Not only must the supplement correct the deficiency but the response to the supplement must be of a sufficient order to warrant the expenditure and to maintain an advantage for the fed stock during the subsequent season of active growth. McClymont (1956) indicated that the response to supplementation of cattle on pasture is usually less than would be expected on the basis of feeding standards.

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Eight experiments were conducted on private grazing properties to examine the effects of grain sorghum, cottonseed meal and a mixture of the two, fed at various rates, on growth rate during the feeding period and over a post-feeding period. It was not possible to examine more than two treatments at a time on any one property so that direct comparisons between treatments are not possible.

II. EXPERIMENTAL PASTURES AND ANIMALS

The first five experiments were carried out in the Eidsvold district (mean annual rainfall 780 mm) on pastures principally of *Heteropogon contortus, Dichanthium* spp. and ***Themeda australis***. In the first two experiments, Hereford calves were used over a period extending before and after weaning. The third experiment utilised Hereford yearling steers and the fourth and fifth Hereford weaners. The stocking rate for all experiments was one beast to 4.9 ha.

The sixth experiment was in the Springsure district (mean annual rainfall 670 mm) on pastures principally of *Dichanthium* spp., ***Penicum*** spp., ***Aristida*** spp., and *Heteropogon contortus* with Hereford weaner steers stocked at one steer to 7.3 ha.

The seventh and eight experiments were carried out in the Emerald district (mean annual rainfall 630 mm) on pastures of *Astrebla* ***squarrosa,*** *Chloris* ***spp.***, *Bothriochloa* ***decipiens*** and ***Dichanthium*** spp. stocked with one Hereford weaner ***steer*** to 3.2 ha.

III. EXPERIMENTAL PROCEDURE

In general, the animals were randomised into two comparable groups, one of which was retained as a control grazing pasture and the other was offered on a group basis a supplement to this native pasture. In each experiment, equal numbers of animals were allocated to groups but, due to lost tags and missing animals, some animals did not complete the experiment. Within every experiment, stocking rates of the groups were comparable and paddocks were changed at each monthly weighing. Where possible a further weighing was carried out approximately two months after cessation of supplementary feeding. The treatments were —

Experiment 1 — supplement of 0.45 kg cracked grain sorghum per calf per day creep fed from June 28 until September 26, 1957 when all calves were weaned. The supplement was continued until December 12.

Experiment 2 — supplement of cracked grain sorghum fed at the rate of 0.45 kg per calf per day from May 3 1 to July 10, 0.68 kg to September 4, 1.36 kg to November 3, 1958 and 1.13 kg to January 14, 1959. All calves were weaned on July 10.

Experiment 3 — supplement of 0.45 kg cottonseed meal per yearling steer per day from May 13 to July 2, 0.9 1 kg to September 11, and 1.8 1 kg to October 21, 1959.

Experiment 4 — supplement of 1.25 kg cottonseed meal per weaner per day from June 2 to December 20, 1960.

Experiment 5 — supplement of 1.13 kg cottonseed meal per weaner per day from May 18 to November 6, 1961.

Experiment 6 — supplement of 0.45 kg cottonseed meal and 0.45 kg cracked sorghum per weaner steer per day from July 16 to November 5, 1959.

Experiment 7 — supplement of 1.36 kg cracked grain sorghum per weaner steer per day from July 31 to November 21, 1958.

Experiment 8 — supplement of 0.45 kg cottonseed meal per weaner steer per day from May 6 to November 10, 1959.

Differences between groups in bodyweight gain during the feeding and post-feeding periods were examined using analysis of covariance to remove the effect of weight at the commencement of the feeding or post-feeding periods respectively.

IV. RESULTS

The treatment (0.45 kg crushed sorghum per head daily) resulted in a significant growth, response to weaning ($P<0.01$) in the first experiment but no response in the second (Table 1) . However, the control group in the first experiment lost weight during this period while in the second the control group gained. During the post-weaning period, there was no significant difference between the gains of the control and fed groups in either experiment, although the supplement was fed at a higher rate after weaning in experiment 2. However, in both instances, gains of over 0.45 kg per head per day were recorded for the control group.

In the only other experiment using crushed sorghum, experiment 7, feeding at the rate of 1.4 kg per head daily to weaner steers resulted in the fed group gaining 0.08 kg per day which was significantly different from the loss of 0.05 kg per day of the control group ($P < 0.01$) .

In experiment 3, during the period to July 2, the control group lost 0.55 kg per day while the fed group lost 0.16 kg per day and, during the period from July 2 onwards, the control and fed groups gained 0.01 kg and 0.19 kg per day respectively. This resulted in an overall performance of +0.08 kg per day for the fed group and -0.16 kg per day for the control group, which difference was significant ($P < 0.01$) . There was a significant difference in bodyweight change due to the supplement both in the first and second periods ($P < 0.01$).

In all the other experiments, the supplement was fed at a constant rate. While in each experiment, the control group recorded weight gains ranging as high as 0.15 kg per day for experiment 8 (Table 1), the fed group gained appreciably more weight than the control ($P < 0.01$) in each experiment.

The possibility of a relationship between the bodyweight response to the supplement in experiments 3 to 8 and the crude protein (C.P.) and the total digestible nutrients (T.D.N.) consumed daily in the supplement was examined, sorghum being considered to have 10 per cent C.P. and 80 per cent T.D.N. and cottonseed meal 40 per cent C.P. and 75 per cent T.D.N., based on mean values supplied by Government Biochemist (W. C. McCray, personal communication). The correlation coefficient between C.P. intake and increased bodyweight gain was 0.81 ($P < 0.05$), while that between T.D.N. intake and increased gain was 0.26.

No significant difference was recorded in post-feeding gains of the two groups in experiments 3, 7 and 8. However, in experiment 4, the supplemented group

TABLE 1

Weight changes of cattle during the feeding and post-feeding periods

Experiments and Treatments	Number and Class of Animals	Weight changes (kg/head/day)				
		Feeding period			Post-feeding period	
		Duration (days)	To Weaning	After Weaning	Duration (days)	Gain
1. Control	20 calves	95	— 0.05	0.51		
Grain sorghum	20 ,,		0.09**	0.47		
S.E. of difference between means			± 0.02	± 0.04		
2. Control	20 calves	228	0.12	0.50		
Grain sorghum	20 ,,		0.12	0.54		
S.E. of difference between means			± 0.04	± 0.03		
3. Control	19 yearlings	161		— 0.16	54	0.95
Cottonseed meal	19 ,,			0.08**		0.83
S.E. of difference between means				± 0.03		± 0.10
4. Control	21 Weaners	201		0.12	62	0.33
Cottonseed meal	20 ,,			0.48**		0.51**
S.E. of difference between means				± 0.02		± 0.04
5. Control	20 Weaners	172		0.08		
Cottonseed meal	20 ,,			0.36**		
S.E. of difference between means				± 0.02		
6. Control	21 Weaners	112		0.04	56	1.22*
Cottonseed meal + grain sorghum	15 ,,			0.34**		1.07
S.E. of difference between means				± 0.03		± 0.06
7. Control	15 Weaners	113		— 0.05		0.64
Grain sorghum	15 ,,			0.08**	154	0.61
S.E. of difference between means				± 0.03		± 0.03
8. Control	14 weaners	188		0.15		0.82
Cottonseed meal	15 ,,			0.27**		0.70
S.E. of difference between means				± 0.03		± 0.09

* $P<0.05$ ** $P<0.01$

gained significantly more weight than the control group after feeding ceased ($P < 0.01$). The control group in experiment 6 outgained the fed group during the post-feeding period ($P < 0.05$) when both groups gained rapidly.

V. DISCUSSION

The results from two experiments would suggest that grain sorghum when fed to suckling calves may produce a growth response when pastoral conditions are poor, but there is obviously a need for more study of the creep-feeding of supplements to calves under tropical pastoral conditions.

Supplements fed to older cattle, weaners and yearlings were generally beneficial when control cattle had weight changes from -0.16 to +0. 15 kg per day. However, when control cattle gained in excess of 0.45 kg per day, little benefit resulted. This would imply that there is a maximum level of performance in the control animals above which the provision of a supplement cannot be expected to confer a weight advantage. Our results suggest that this level is between 0.15 and 0.50 kg bodyweight gain per day. Above this level, presumably the supplements replace nutrients ingested from the pasture rather than adding to total intake.

From the present experiments, it would seem that bodyweight response was more closely related to the intake of supplementary protein than to that of energy. This is in accord with the results reported by Sutherland (1959), Norman (1963) and Balch (1967). Norman (1963) demonstrated a linear relationship between the quantity of digestible crude protein fed as a supplement and the bodyweight change of cattle at Katherine in the Northern Territory. However, he used peanut meal compared to the cottonseed meal used here. Both, being oil-seed meals, may be subjected to high temperatures during processing and this is known to reduce the rate of ruminal proteolysis (Chalmers and Synge 1954) so that variable results may occur due to processing factors.

Substantial responses to supplementary feeding were obtained in most experiments and it appears that the severity of the dry season enhances these but reduces the magnitude of subsequent compensatory weight gains. This is in agreement with the observations of Auty (1964). The higher levels of supplementation also may have reduced the magnitude of the subsequent compensatory weight gains. Norman (1963) found that animals fed 1.4 kg per head per day peanut meal retained 49 per cent of their weight advantage over controls six months after supplementation ceased, while those fed 0.45 kg per head per day retained only 35 per cent of their weight advantage.

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