SORGHUM GRAIN SUPPLEMENTATION OF CATTLE FED FORAGE-HARVESTED OATS

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Summary

Eight groups each of eight steers were fed in yards on diets of sorghum grain and forage-harvested oats. Grain comprised from 0 to 86% of the dietary dry-matter intake.

Substitution of grain for forage was constant at 59.4% of the grain intake, and grain conversion to carcase (0.081 kg carcase/kg grain dry-matter intake) was unaffected by the level of grain consumption. Growth rate and fasted average daily gain alone were unsatisfactory measures of carcase weight gain, as the dressing percentage of the steers increased with increasing levels of grain in the diet.

I. INTRODUCTION

A prerequisite for controlling the economic efficiency of animal production is the capacity to manipulate animal performance and feed utilization. Manipulation of feed utilization in grazing management implies, among other things, regulation of grazing pressure (Tainton 1974). Supplementary grain affects both animal performance and roughage intake by partially replacing dietary roughage (Blaxter and Wilson 1963), and therefore has an obvious role in manipulating the physical efficiency of production.

The experiment reported here was designed to measure the efficiency of utilization of supplementary sorghum grain (*Sorghum vulgare*) by steers fed forage-harvested oats (*Avena sativa*), and the effect of the supplement on their intake of forage.

II. MATERIALS AND METHODS

(a) Design and Treatments

Seventy-six Hereford steers approximately two years of age and mean initial fasted live weight (LW) 286.4± SE 2.1 kg were used. A broad spectrum anthelmintic + and a cobalt bullet++ were administered to each animal and treatment groups were confined in dirt yards each 112 m^2 in area and having 6 m of trough space.

Following an introductory period of ten days during which they were fed oats forage ad lib. plus 2 kg/d grain, the steers were stratified on the basis of fasted LW (24 h without feed, 16 h without water) and were randomly allocated eight to each of the following treatments and 12 to a pre-treatment slaughter group.

Treatment 1 oats ad lib.
2 oats ad lib. + 1 kg grain/d
3 oats ad lib. + 2 kg grain/d
4 oats ad lib. + 3 kg grain/d
5 oats ad lib. + 4 kg grain/d

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'Treatment 6 oats ad lib. + grain ad lib.
7 oats 2/3 treatment 6 intake + grain ad lib.
8 oats 1/3 treatment 6 intake + grain ad lib.

Full grain feeding in treatments 6 to 8 was introduced gradually during the first eight days and grain allowances in treatments 2 to 5 were fed daily. The grain was hammermilled and had added to it 1% limestone, 1% sodium chloride, and 1% urea. The oats was forage-harvested daily with a flail-type forage-harvester immediately prior to feeding and was fed separately from the grain. The steers were slaughtered after 114 days of feeding.

(b) Measurements

Individual fasted LW's were measured at the commencement and termination of the experiment. Full weights were obtained weekly and hot carcase weights were obtained at slaughter.

Samples of forage and grain were taken daily and bulked weekly for analysis for dry-matter (DM) and crude protein. Forage residues were weighed daily and bulked weekly, and grain residues were weighed weekly. Feed residues were analysed for DM and weekly group feed DM intakes (DMI) were calculated. Feeds were analysed essentially according to A.O.A.C. (1970).

(c) Statistical Analyses

The initial carcase weights of the steers were estimated by using the equation $y = 0.597x - 18.0$ where y = hot carcase weight and x = fasted LW. The constants were derived by regression methods from the pre-treatment slaughter group. The growth rate for each animal was estimated from the linear regression of its weekly LW's against time. Carcase average daily gains (ADG) and fasted ADG were calculated by dividing the difference between the final and initial weights by the number of days in the experiment. Carcase ADG, fasted ADG, growth rate and dressing percentage (DW% = 100 x hot carcase weight/fasted LW) in all treatments were compared by standard analyses of variance.

The response to supplementary grain within the production system was measured by the slope of the relationship between grain consumption per unit of forage consumption and carcase gain per unit of forage consumption (Gulbransen 1974). .

The relationship between grain dry-matter intake and forage dry matter intake was estimated by linear regression.

III. RESULTS

The crude protein contents (DM basis) of the grain and forage consumed were 12.0% and 12.5% respectively (forage range 17.0 to 9.5%).

Mean feed DMI, growth rate, fasted ADG, carcase ADG and dressing percentage for each of the eight treatments are presented in Table 1.

The relationship between grain intake and forage intake was $y = 7.50 - 0.594x$ ($SE_b = 0.0606$; $P < 0.01$), where y = daily forage dry matter intake and x = daily grain dry matter intake (Equation 1).

The relationship between grain consumption per unit of forage consumption and carcase gain per unit of forage consumption was $y = 0.033 + 0.081x$ ($SE_b = 0.0007$; $P < 0.01$) where y = carcase ADG per kg forage DMI and x = grain DMI per kg forage DMI (Equation 2).

TABLE 1

Feed intake and performance of steers fed different proportions of grain and forage-harvested oats

Treatment	Forage DMI (kg/d)	Grain DMI (kg/d)	Growth Rate (kg/d)	Fasted ADG (kg/d)	Carcase ADG (kg/d)	Dressing %
1	7.71	0	0.74	0.61	0.22	50.1
2	6.55	0.88	0.85	0.71	0.33	51.8
3	6.19	1.76	0.88	0.73	0.33	51.4
4	6.38	2.63	1.02	0.88	0.43	52.1
5	5.60	3.51	1.06	0.89	0.48	53.4
6	3.26	8.02	1.47	1.28	0.77	55.6
7	2.36	9.35	1.54	1.35	0.83	56.2
8	1.42	8.43	1.37	1.17	0.73	56.2
LSD P=0.05			0.195	0.174	0.103	1.47

The proportions of both fasted ADG and growth rate which were recovered as carcase ADG are presented in Table 2.

TABLE 2

Recovery of growth rate and fasted gain as carcase gain

	1	2	3	4	5	6	7	8	LSD P=0.05
Carcase ADG / Growth rate	0.30	0.39	0.37	0.42	0.45	0.52	0.54	0.53	0.058
Carcase ADG / Fasted ADG	0.36	0.47	0.45	0.48	0.54	0.60	0.62	0.62	0.068

IV" DISCUSSION

The depression of forage DMI by supplementary grain was effectively constant at 59.4% of the grain DMI (Equation 1) , and this degree of substitution suggests that on good quality pasture there is probably scope for using supplementary grain to make quite large changes in the grazing pressure without altering the stocking rate. Consumption of poor quality roughages is less affected by supplementary grain but the animal response is usually larger (Blaxter and Wilson 1963) and approaches a true measure of the value of the supplement.

Both fasted ADG and growth rate are commonly measured as indices of the performance of beef cattle. If either of these parameters is to adequately fulfil this function it should bear a clear and preferably proportional relationship to carcase growth. Morris (1969), using data from six feed-lot experiments, found that the mean recovery of fasted ADG as carcase gain was 62.0 ± SE 0.24%. With the exception of one experiment none of the nutritional treatments he studied affected this parameter. However, his diets were not as varied as those used in this experiment, and Table 2 shows that fasted ADG and growth rate are equally unsatisfactory measures of animal performance when diets differ widely in their proportions of grain and roughage. It is evident that the increase in dressing percentage (Table 1) resulting from increased animal size reinforces the effect of reduced gut fill (Tayler and Wilkinson 1972) in disguising real differences in carcase growth. Carcase data are therefore essential in evaluating diets differing widely in grain/roughage content.

The response of the production system to grain supplementation was 0.081 kg carcase/kg grain DMI (Equation 2), and did not vary with the level of intake by the animal. This response compares favourably with feed utilization data commonly reported for lot-fed cattle of this size (Preston and Willis 1970). Since the utilization of supplementary grain is not greatly affected by either roughage quality or the quantity of grain consumed (Gulbransen 1974), it is likely that data derived in the manner described here can be sensibly extended to the grazing situation. Also, since the technique measures the response to increments of grain consumed in a roughage-based system, rather than the total dietary efficiency, the estimates should not be affected by the increased energy expenditure incurred in grazing. If this is the case then a grazing system incorporating supplementation with grain should be about as efficient atconverting grain to carcase as a lot-feeding system, provided that pasture utilization is not impaired. This hypothesis is supported by the results of other experiments (Gulbransen unpubl.) with steers grazing good quality oats.

The major determinant of the practicability of feeding grain for beef production is the relationship between grain and beef prices, although in a grazing system the pasture -management and animal performance benefits should not be overlooked. However, the work reported here suggests that it may be possible to obtain the consistently high animal performance and carcase quality characteristic of lot-fed cattle by incorporating supplementary grain into grazing systems, with little or no loss in the efficiency of grain utilization.

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