ENERGY AND NITROGEN SUPPLEMENTATION OF GRAZING BEEF CATTLE IN A MEDITERRANEAN ENVIRONMENT

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Summary

Grazing beef cattle supplemented with *3* kg day^{-1} barley grain made significantly greater liveweight gains than unsupplemented cattle in each of four summer experiments, but the level of response varied from year to year. The inclusion of small quantities of lucerne in the supplement enhanced weight gains, but no benefits were associated with the use of non-protein nitrogen (NPN) supplements fed as urea.

I. INTRODUCTION

A problem of the livestock industry of the Mediterranean environment of southern Australia arises out of the deficiencies of sown pastures based on subterranean clover (*Trifoliumsubterraneum* L.) and annual grass species for animal production during the *4-5* months period of summer drought experienced each year. As the incidence of rainfall decreases in late spring the pasture herbage senesces with a concurrent decline in digestibility (Allden 1968), and both cattle and sheep lose weight or make only small gains for a period of several months (Franklin 1956; Donald and Allden 1959).

This paper reports on field studies designed to assess the relative significance of energy and nitrogen (N) in correcting the deficiencies of summer pastures for young beef cattle.

II. MATERIALS AND METHODS

The work was carried out between 1968 and 1972 at the Mortlock Experiment Station, Mintaro, S.A. The average rainfall is *602* mm per annum with an effective growing season for pastures of *7.5* months. The soils and vegetation have been described by Mulcahy (1954).

(a) The Experimental Animals and their Treatment

The cattle used in the experiments were bred in the northern pastoral areas of S.A. and purchased as lines of yearling stores. They grazed together for at least 5 months before the start of an experiment. Cattle were weighed at regular intervals and immediately before consignment for slaughter.

Supplements of grain and hay were fed each day to individual animals in portable bails, and the residues recorded. Urea and molasses were provided in roller drum dispensers on a group basis. Animals were brought to the full level of supplement over a 2-3 weeks period, so that the amount of feed received by an animal during an experiment was slightly less than the product of daily supplement and time.

(b) The Pastures and Supplements

The pastures used in all experiments were composed of the sown annual species Wimmera ryegrass (*Lolium rigidum* Gaud.) and subterranean clover (*T.subterraneum* L.) together with volunteer annual grasses (barley grass (*Hordeum leporinum* Link.) and *Bromus* spp,). Miscellaneous annual legumes and cape-weed (*Arctotheca calendula* (L.) Levyns) were also present in small amounts. Barley stubble was included in one experiment.

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Estimates of herbage yield were made during the course of the experiments and samples of the pasture and of the supplements were taken for N determinations and for estimates of dry matter digestibility (d.m.d.) using either *in vivo* or *in vitro* techniques. The studies were carried out on mature herbage and the duration of each experiment was determined by the onset of rainfall which promoted the 'germination and continued growth of pasture.

III. EXPERIMENTAL AND RESULTS

(a) Experiment 1

A daily supplement of 3 kg dry matter (d.m.) barley grain (2.2% N, 84% d.m.d.) was fed to a group of 10 twenty months old Shorthorn steers, initial mean weight 456 kg, for 81 days from 3.1.69 to examine the value of a high energy supplement to improve growth during the period of summer drought. The amount of herbage available to the animals exceeded 3000 kg ha^{-1}. Herbage N was 2.1% and 2.0% at the beginning and end of the experiment, and the *in vivo* d.m.d. of sampled herbage 49% and 34% for the , corresponding occasions.

The feeding of a grain supplement resulted in a gain of 0.08 kg day^{-1} (6.5 kg for the period) compared with a loss of 0.18 kg day^{-1} (-20.0 kg) for the control groups, the difference being significant. The amount of barley consumed for each kg gain over the control group was 10.6 kg (9 kg d.d.m.).

(b) Experiment 2

Yearling Poll Hereford steers (initial mean weight 320 kg) received a daily supplement of 3 kg barley and lucerne hay (80:20 w/w) during a 127-day period from 5.1.70. Other cattle grazing with this group were unsupplemented. The mature pasture as sampled on 26.2.70 contained *2.2%* N *(in vitro* d.m.d. of 47%), and was adequate in the quantitative sense, there being 3900 kg ha^{-1} of herbage present.

. The most significant feature of the results was the much smaller amount of supplementary d.d.m. per unit gain when compared to the previous experiment. The supplemented animals gained 47.5 kg (0.37 kg day^{-1}) , whereas the controls lost 16.9 kg (-0.13 kg day^{-1}). The d.d.m. requirement for each kg gain over the control was 4.7 kg.

(c) Experiment 3

Yearling Shorthorn and Shorthorn x Hereford steers (initial mean weight 348 kg) were subjected to the following treatments in an experiment of factorial design involving (a) two types of grazing (mature pasture v barley stubble), (b) two grain supplement treatments (3 kg barley daily v nil) and (c) two NPN supplements (70g urea with 225 g molasses daily v nil). Pastures contained 1.7% N, d.m.d. 56% at the beginning of the experiment and 1.6% N, d.m.d. 53% at the end. Corresponding values for the barley stubble were lower, being 0.68% N and d.m.d. 51%, and 0.58% N, d.m.d. 44%.

The results showed a highly significant response to barley supplementation, but no significant effects were observed for urea additions. Cattle. grazing pastures made greater gains than those grazing barley stubbles but the difference was not significant ($P<.1$). For each kg gain over the control group 6.8 kg d.d.m. barley was required.

Even though the N content of the pastures and stubbles differed appreciably there was no suggestion of an N x pasture type or N x barley supplement interaction. The main effects are illustrated in Figure 1.

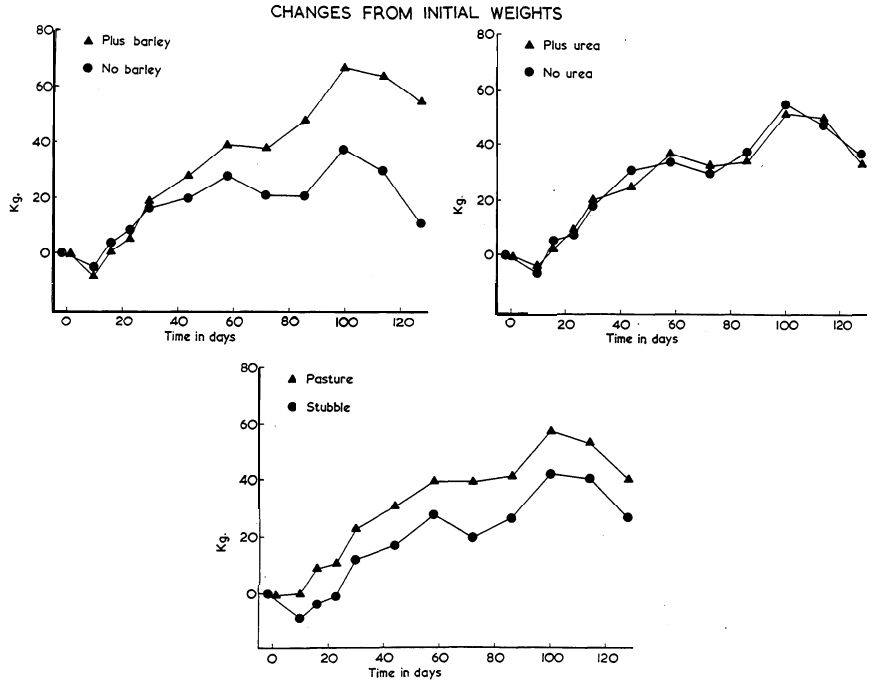

Fig.1. Experiment 3: The main effects of barley supplementation (top left), urea additives (top right) and pasture (below) in relation to weight change.

(d) Experiment 4

During the summer of 1972 the studies included a comparison of lucerne hay (3.7% N and d.m.d. 73%) and barley (2.1% N and d.m.d. 87%) fed alone and in a mixture with the object of obtaining an estimate of the value of lucerne. In addition to these three treatments a fourth treatment of urea plus molasses was included for comparison with the barley-lucerne mixture. These two supplements contained similar amounts of both digestible energy (50 MJ day^{-1}) and nitrogen (65g day^{-1}) but from contrasting sources namely starch and plant protein v sucrose and NPN. The experimental cattle were Hereford yearling steers, mean initial weight 293 kg. Animals were slaughtered at the end of the experiment, and live weight gains and carcase weights were compared after adjusting for differences in initial weight in an analysis of covariance.

The two supplements based on barley produced significant liveweight and carcass gains over the remaining groups, whereas the molasses and urea mixture was used inefficiently. Although the results suggest that lucerne hay with or without barley enhanced feed conversion to weight gain the differences were not significant. Carcass weights did not consistently reflect liveweight gains.

The results for the 108 day period commencing 24.1.72 are presented in Table 1.

TABLE I.

Daily Supplement	Weight gain kg+	Weight gain over control kg	Carcass weight kg+	D.M. kg^{-1} gain over control Liveweight kg	Carcass kg
Control	34.8^{a}	-	150^{a}	-	-
Barley 3kg	79.8^{b}	45.0	179^{b}	5.9	9.1
Barley 2.4kg) Lucerne 0.6kg) 3kg	90.5^{b}	55.7	177^{b}	4.8	9.9
Lucerne 0.6kg	48.3^{ac}	13.5	157^{ac}	3.6	6.9
Molasses 3.2kg) Urea 140g .)	59.8^{c}	25.0	166^{c}	7.7	12.0

+Values with similar superscript not different (P>0.05)

IV. DISCUSSION

The lack of responses to NPN supplements, and the high levels of N in the harvested herbages provide no evidence to support the general use of NPN supplements for cattle grazing mature grass-clover swards during periods of summer drought in this environment.

Responses to energy-rich concentrates have been substantial, although the requirements for gain over the control animals have shown wide variations both within and between experiments, which suggests that cattle may have been substituting supplement for herbage. Such effects have been noted for cattle in the pen (Gulbransen, 1974) and for grazing sheep (Allden and Jennings 1962). If supplementary feeding is to be used as a management strategy by graziers the factors which contribute to the inconsistent responses observed in experiments must be defined more precisely. Without such information the economic-analysis of results has little meaning. Suffice it to say that "profitability" in our studies has depended almost entirely on weight gains made during periods of pasture growth and on buying and selling prices. Supplementary feeding has more often contributed to losses than to profits.

V. ACKNOWLEDGEMENTS

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