RESPONSE OF COWS IN EARLY LACTATION WHEN OFFERED MAIZE SILAGE TO APPETITE AND RESTRICTED AREAS OF PASTURE

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SUMMARY

One group of cows in early lactation was grazed on a fresh area of pasture each day sufficient to provide near full feeding. Three other groups were offered 80, 60, or 40% of this area and provided with maize silage to appetite. Supplementation continued for 5 weeks and for 11 weeks thereafter equal numbers of cows were stocked at 3.7 and 4.9 cows/ha.

Maize silage intake increased with increasing pasture restriction and represented 37, 47, and 54% of daily dry matter (DM) intake. Milk and fat yields declined as the proportion of maize silage in the diet increased but effects on liveweight were not significant. Cow performance after supplementation ceased was not affected by previous treatment. Inclusion of silage reduced apparent digestibility of DM, energy, and nitrogen and ME content. Tissue retention of nitrogen was higher on the silage diets than when pasture alone was fed but both nitrogen and calcium retention declined with increasing proportions of silage. Tissue retentions of magnesium and phosphorus were not significantly affected by diet.

INTRODUCTION

When feed shortages occur in early lactation, a common practice on New Zealand dairy farms is to provide the herd with supplements of hay or silage. Although various aspects of the practice have been examined (Wallace and Parker, 1966; Hutton and Parker, 1966), the relationships between degree of pasture shortage, supplement intake, cow performance and pasture utilization have not been defined. Because of this the experiment now described examined the performance of recently calved cows subjected to a range of pasture restrictions and offered maize silage to appetite.

EXPERIMENTAL

Thirty-six sets of identical twin cows of mixed age which on average had calved 21 ± 9 (mean ± S.D.) days earlier were used. They were divided in four groups (100P, 80P, 60P, and

40P) according to an incomplete block design, with each group being provided with a fresh area of pasture after milking each morning. The area offered each day to 100P was considered sufficient to provide full feeding with 80, 60, and 40% of this area offered to groups 80P, 60P, and 40P, respectively. By 10 a.m. each day troughs containing fine-chop maize silage (33% DM) were placed on the area of pasture to be grazed by groups 80P, 60P, and 40P. Silage offered was 10 to 20% in excess of expected intake during the succeeding 20 hours.

The treatments started on October 9, 1975, and continued for 35 days. For 11 weeks thereafter when no supplement was fed, half the cows from each group were rotationally grazed over an area resulting in a stocking rate of 3.7 cows/ha with the remainder similarly treated except that the stocking rate was 4.9 cows/ha.

The yield of milk was measured at each milking. Composition was determined by infrared analysis on Wednesday and Friday of each week on samples bulked over the previous four milkings. The intake of maize silage was calculated from the weights offered and refused each day. Cows were weighed after a 15-hour fast at the start and end of the 5 weeks of supplementation and thereafter twice weekly.

During each week of supplementation the amount of pasture present before and after grazing was measured on two of the areas grazed by each group. At five sites within each area the herbage enclosed within a frame of 2974 cm^2 was cut to ground level, washed, dried and then weighed.

Three cows from each treatment were transferred to digestibility stalls after completing their 5 weeks of supplementation. For 14 days they were fed to appetite on freshly cut pasture and maize silage in proportions similar to those they had experienced during the previous 5 weeks. Faeces and urine were collected during the last 7 days.

RESULTS

Pasture Utilization

The progressive restriction in area of pasture grazed is indicated by the DM offered per cow in Table 1. Post-grazing DM yields were highest for 80P, least for 40P and similar in the case of 100P and 60P.

TABLE 1: PASTURE UTILIZATION AND FOOD INTAKE

	100P	*80P*	*60P*	*40P*	*SE*
Pasture yield (kg DM/ha):					
Pre-grazing	3263	3236	3218	3249	38
Post-grazing	2187	2359	2114	1896	56
Utilization (%)	34	30	33	42	1.6
DM offered (kg/cow/day)	35	27	21	14	0.5
Intake (kg DM/day):					
Pasture	11.8	8.1	6.9	5.8	—
Maize	—	4.8	6.2	6.7	0.1

ANIMAL PERFORMANCE

Also in Table 1 are the pasture DM intakes derived from the above data and the measured intakes of maize silage. Silage intake increased as the amount of pasture offered decreased, with the result that silage DM comprised about 37, 47, and 54% of total DM intake for 80P, 60P, and 40P, respectively.

Milk and fat yields were the highest where the entire diet was pasture (100P) and they decreased with increasing proportions of maize silage in the diet (Table 2). The treatments did not differ in their effects on the fat and lactose content of the milk but the inclusion of maize silage reduced the protein content.

The treatments also did not differ in their effects on liveweight change during the 5 weeks of supplementation. All groups gained weight, averaging 0.38, 0.36, 0.31 and 0.37 (± SE 0.14) kg/day for 100P, 80P, 60P, and 40P, respectively.

TABLE 2: MILK YIELD AND COMPOSITION DURING SUPPLEMENTATION

	Milk (kg/wk)	*Fat*	*Fat (%)*	*Protein (%)*	*Lactose (%)*
100P	113.8	5.13	4.53	3.19	5.02
80P	109.4	4.93	4.57	3.16	4.99
60P	106.4	4.76	4.51	3.10	5.01
40P	100.4	4.45	4.46	3.11	5.02
SEd[1]	3.68	0.16	0.07	0.03	0.03
Significance of effects:					
Pasture *vs.* silage	**	**	NS	*	NS
Linear term	*	**	NS	NS	NS

[1] Standard error of mean difference.

TABLE 3: PERFORMANCE OF COWS ON DIGESTIBILITY TRIAL, RATION DIGESTIBILITY AND RETENTION OF MINERALS

	100P	*80P*	*60P*	*40P*	*SE*	*Contrasts* *Pasture vs Silage*	*Linear Term*
DMI:							
kg/day	13.06	13.43	12.99	12.23	0.35	NS	*
% LW	3.34	3.33	3.54	3.14	0.36	NS	*
Silage DMI (% of total)	—	33	46	54	—	—	—
Fat yield (kg/day)	0.77	0.75	0.74	0.63	0.05	NS	NS
Digestibility (%):							
DM	75.9	71.8	68.3	69.3	1.2	**	NS
Energy	74.2	69.5	65.0	66.0	1.5	**	NS
N	73.5	70.1	64.8	65.1	2.1	*	*
ME (MJ/kg DM)	10.9	10.1	9.4	9.6	0.3	*	NS
Tissue Retention (g/day):							
N	— 1.7	18.0	11.3	3.7	5.8	*	*
Ca	16.6	18.7	14.1	12.1	1.3	NS	*
Mg	— 2.6	— 2.0	— 1.4	— 1.1	0.7	NS	NS
P	— 0.43	— 1.5	— 3.3	— 2.4	1.1	NS	NS

DIGESTIBILITY

The trends in DM intake and fat yield shown by the 12 cows during the digestibility trial were similar to those found during supplementation in the field (Table 3). The inclusion of maize silage in the diet reduced the apparent digestibility of DM, energy, and nitrogen (N) and metabolizable energy (ME) concentration. Tissue retention of N (N ingested — (faecal N + urine N + milk N)) was higher on the silage diets than when pasture alone was fed but in the case of both N and calcium (Ca), retention declined with increasing proportions of silage. The addition of silage also increased retention of magnesium (Mg) but decreased that of phosphorus (P) although neither effect was significant.

COW PERFORMANCE AFTER SUPPLEMENTATION

Cow performance during the 11 weeks' grazing that followed the period of supplementation was unaffected by previous treatment. This was so for liveweight change, milk yield and composition.

DISCUSSION

The results of this experiment demonstrate the advantages of providing an abundance of high-quality pasture to cows in early lactation. The adverse effects on cow performance of restricting the area of pasture grazed could not be compensated for by the provision of maize silage to appetite. In contrast to results of a stall feeding trial (Bryant and Donnelly, 1974), a progressive decline in butterfat production occurred as intake of maize silage increased (Fig. 1).

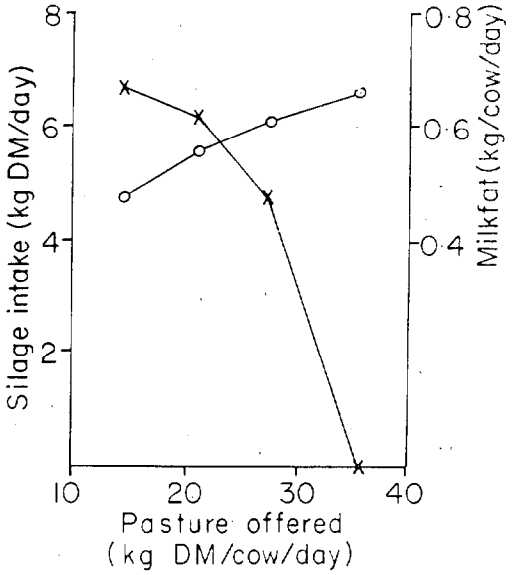

FIG. 1: *Relationships between pasture offered, yield of milk fat and* ad libitum *silage intake.*

The less severe restrictions in pasture area resulted in disproportionate increases in silage intake. For example, when area of pasture offered was restricted by 20%, silage intake constituted about 37% of total daily DM intake. One explanation of this is that the cows preferred to graze so that pasture remaining after 24 hours was not reduced below 2360 kg DM/ha. This implies that the amount of DM offered to the all-pasture group, though generous, was insufficient to ensure maximum intake.

It is generally accepted that the level of intake during the first 8 to 12 weeks of lactation can influence production over the whole lactation (Broster, 1976). It is therefore of interest that in this experiment the decreased cow performance during supplementation did not persist after supplementation ceased. This may be a reflection of the timing of supplementation in relation to calving, the mildness of the underfeeding, or that measurements were not continued over the whole lactation. Irrespective of which factors were important, there is clearly a need for a greater understanding of the effects of underfeeding in early lactation on the performance of the pasture-fed cow.

Although mineral supplements improve the performance of animals fed maize silage, a profitable response is unlikely when pasture comprises much of the diet (Hutton and Rattray, 1976). This complementary effect of pasture is confirmed by N, Ca, P, and Mg retentions in Table 3. The implications of the improved N retention in the mixed rations is uncertain for, during supplementation in the field, the treatments did not differ in their effects on liveweight gain.

The experiment provided an indication of the magnitude of the increase in milk yield per hectare of grazed pasture when a supplement like maize silage is used to increase stocking rate (Fig. 2). When pasture alone was fed, butterfat production was

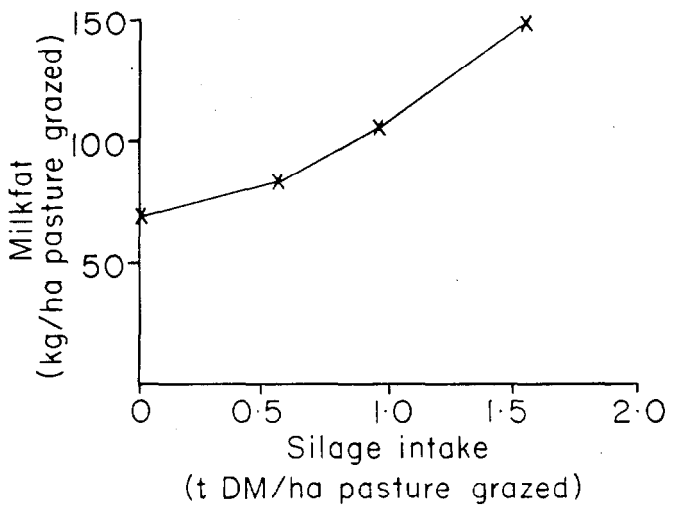

FIG. 2: *Relationships between milk fat yield and silage intake for each hectare of pasture grazed.*

at the rate of 69 kg per hectare of pasture grazed. A production of twice this rate would have required about 1450 kg DM as maize silage, a response equivalent to 21 kg DM for an extra 1 kg of butterfat.

REFERENCES

Broster, W. H., 1976. In *Principles of Cattle Production* (Eds. H. Swan and W. H. Broster), p. 271. Butterworths, London.
Bryant, A. M.; Donnelly, P. D., 1974. *N.Z. Jl agric. Res., 17*: 299.
Hutton, J. B.; Parker, O. F., 1966. *Proc. N.Z. Soc. Anim. Prod., 26*: 71.
Hutton, J. B.; Rattray, P. V., 1976. *Proc. N.Z. Soc. Anim. Prod., 36*: 120.
Wallace, L. R.; Parker, O. F., 1966. *Proc. Ruakura Fmrs' Conf*: 3.