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# Relationships between amount of feed on the farm, autumn-winter grazing management and dairy cow performance

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## ABSTRACT

A recent grazing experiment at Ruakura with dairy cows involved in each of 3 years, 8 farms of 6.48 ha. Linear regression procedures were used to derive relationships between milkfat yield to 31 December, amount of feed on the farm at various times, length of rotation during winter months, and average herd live weight and condition at calving.

Fat production was closely related to feed on the farm during July to September but not to feed present in May, June, October or November, or to live weight and condition at calving. The amount of feed present in August or September was not significantly related to that present in May. Feed present in September increased as the area grazed each day by the herd increased in May, and decreased in July and August.

For a given amount of feed on the farm during July to September, early calving herds produced more milkfat per cow and per hectare by 31 December but at a lower level per day than late calving herds.

**Keywords** Cows; milkfat; winter grazing management; rotation; calving date; herbage mass

## INTRODUCTION

Trends in on-farm and processing costs will bring changes in the dairy industry. Those farmers seeking to increase levels of production and profit will be increasingly forced into not only higher stocking rates but also earlier calving. Undoubtedly the higher the stocking rate and the earlier the calving, the more imperative it becomes to identify and adopt the best possible management during autumn and winter.

Experimental data on the effects on subsequent milk production of contrasting grazing management in autumn and winter are limited and the results conflicting (see Bryant, 1982 a).

To assist the formulation of hypotheses about the important factors involved in autumn-winter management and the planning of future experiments, data from a recent grazing experiment at the Ruakura No. 2 Dairy were examined. Relationships were derived between milk production and the amount of feed on the farm at various times, and between feed on the farm at one time of the year with that at another.

## EXPERIMENTAL

The data were from an experiment that examined the effects on farm performance of stocking rate, calving date and nitrogen fertiliser during the three seasons, 1979/80 to 1981/2. Eight farmlets each of 6.48 ha were involved in each year. The design was at 2 × 2 × 2 factorial, the factors being stocking rate of 3.86 and 4.32 cows/ha, early and late calving, and nitrogen *v* no nitrogen fertiliser. Mean calving dates during the 3 years averaged 21 July and 14 August. Spread of calving was 8 weeks or less. Nitrogen fertiliser used was 86, 137 and 56 kg N/ha in successive years applied in 2 to 3 dressings over the whole farm during April to August. An exception was in the first year when all herds were stocked at 3.86 cows/ha.

Milk yield and composition from individual cows was measured on 2 consecutive milkings each week. Amount of feed (kg DM/ha) on each of the 32, 0.202 ha paddocks making up each farm was estimated weekly using a combination of visual assessment and calibration cuts. The 4 to 5 estimates made each month were meaned to provide an average for each month.

Relationships between pairs of variables and the influence of the factors of calving date, year, stocking rate, and fertiliser were examined. Often calving date, but rarely the other factors, had a significant effect on the elevation of the relationships. Within calving date estimates of the relationships were therefore obtained by allowing different intercepts for the 2 times of calving.

Milkfat yields expressed as total per cow and per hectare, and average daily per cow and per hectare, for the period calving to 31 December were used as measures of cow performance. Fat production subsequent to December was not included. This is relative to summer rainfall rather than to autumn-winter

**TABLE 1** Summary of data based on herd averages.

| Variable | Early calving Mean | Early calving Range | Late calving Mean | Late calving Range |
|---|---|---|---|---|
| Milkfat yield to 31 December (kg) | | | | |
| /cow | 116 | 99-137 | 112 | 97-123 |
| /cow/d | 0.73 | 0.61-0.87 | 0.83 | 0.78-0.93 |
| /ha | 465 | 388-546 | 449 | 392-493 |
| /ha/d | 2.95 | 2.63-3.52 | 3.35 | 3.12-3.86 |
| Days in milk | 158 | 144-168 | 133 | 125-139 |
| Condition at calving | 4.9 | 4.5-5.5 | 5.1 | 4.8-5.4 |
| LW at calving (kg) | 391 | 371-411 | 400 | 385-412 |
| DM on farm (t/ha) | | | | |
| May | 1.92 | 1.32-2.25 | 1.90 | 1.43-2.24 |
| September | 1.34 | 1.13-1.74 | 1.53 | 1.20-2.02 |
| December | 2.78 | 2.20-3.22 | 2.87 | 2.43-3.21 |

management. All analyses were based on 24 data points, 12 each from early and late calving herds. Data for some of the variables are summarised in Table 1.

## RESULTS

The non-significant regression coefficients in Table 2 indicate that milkfat yield per cow was poorly related to the amount of feed on the farm in May, June, October and November. In contrast, production per cow significantly increased with increasing amounts of feed on the farm in July, August and September. For the other indices of fat production also (Table 3), the amounts of feed on the farm in July to September were more closely related to milkfat yield than amounts during May and June. For all indices, the poorest relationships were obtained during October and November.

The significant difference in intercepts for total milkfat yield per cow (Table 2) and per hectare (Table 3) indicate that for a given amount of feed on the farm in a particular month, production from early calving herds was higher than those calving later. In contrast, at a given amount of feed, average daily milkfat per cow and per hectare tended to be greatest for late calving herds. The higher total production of the early calving herds was because on average they had accumulated 158 days in milk by 31 December compared to 133 days for late calving herds. The regression within calving dates of milkfat yield on days in milk showed that for each extra day in milk prior to 31 December, total milkfat yield increased by 0.59 ± 0.34 kg/cow and 2.96 ± 1.39 kg/ha.

Cow condition and live weight at calving were not closely related to subsequent production. An increase in condition of 1 score was associated with increases in milkfat yields (kg) of 1.6 ± 9.0/cow, 0.06 ± 0.06/cow/d, -40 ± 38/ha and -0.06 ± 0.24/ha/d. Comparable data for an increase in 10 kg live weight were

**TABLE 2** Summary of milkfat to 31 December (kg/cow, Y) on feed on farm (kg DM/ha, X) May to December

| Feed on farm in - (X) | $C_L$-$C_E$ ± SE† | b ± SE | $R^2$ |
|---|---|---|---|
| May | -3.99 ± 4.01 | 0.009 ± 0.007 | 12 |
| June | -3.93 ± 3.90 | 0.013 ± 0.007 | 16 |
| July | -5.61 ± 3.09 | 0.020 ± 0.005*** | 48 |
| August | -9.79 ± 3.00** | 0.030 ± 0.006*** | 60 |
| September | -10.29 ± 3.12** | 0.033 ± 0.007*** | 55 |
| October | -5.67 ± 4.33 | 0.007 ± 0.007 | 9 |
| November | -6.77 ± 4.31 | 0.011 ± 0.007 | 14 |
| December | -5.64 ± 3.63 | 0.016 ± 0.006* | 29 |

† In this and Table 3:

$C_L$-$C_E$ = Intercept for late minus intercept for early calving herds.

b = Regression coefficient.

$R^2$ = Correlation coefficients squared multiplied by 100.

0.5 ± 2.3 kg/cow, 0.016 ± 0.014 kg/cow/d, -18 ± 8 kg/ha, and -0.07 ± 0.07 kg/ha/d.

Because of the importance to milkfat yield of the amount of feed on the farm in August and September, the effects of early winter management were examined. August feed was not significantly related to feed present in May, increasing by only 16 ± 17 kg DM/ha for an increase of 100 kg DM/ha in May. For September the increase was 24 ± 15 kg DM/ha.

Effects of length of rotation during the winter months were shown by regressions of feed on the farm in August or September on the area grazed each day by the herd in the previous months. Increases in the area grazed in May by 100 m²/d were associated with an increase in September feed of 142 ± 45 kg DM/ha whereas grazing an extra 100 m²/d in June, July and August was accompanied by a reduction in

**TABLE 3** Summary of regressions of milkfat yield (kg/cow/d, $Y_1$; kg/ha, $Y_2$; kg/ha/d, $Y_3$) to 31 December on feed on farm (kg DM/ha, X) in May and August.

| | Feed on farm in - (X) | $C_L$-$C_E$ ± SE | b ± SE | $R^2$ |
|---|---|---|---|---|
| $Y_1$ | May | 0.11 ± 0.025*** | 0.00005 ± 0.00004 | 50 |
| | August | 0.07 ± 0.014*** | 0.00021 ± 0.00003*** | 86 |
| $Y_2$ | May | 14.7 ± 15.3 | 0.068 ± 0.026* | 28 |
| | August | 37.1 ± 14.4* | 0.110 ± 0.028*** | 45 |
| $Y_3$ | May | 0.45 ± 0.09*** | 0.0004 ± 0.0002* | 57 |
| | August | 0.29 ± 0.08*** | 0.0008 ± 0.0002*** | 76 |

September feed of 77 ± 33, 39 ± 12 and 24 ± 6 kg DM/ha respectively.

A consequence of these various relationships was that milkfat yield was also related to grazing rotation during May to August. For example, a 100 $m^2$ increase in the area grazed each day in May was associated with an increase subsequent milkfat yield of 1.8 ± 1.6 kg/cow and 17 ± 6 kg/ha. In contrast, a 100 $m^2$ increase in July was associated with a reduction in milkfat of 2.0 ± 0.6 kg/cow and 11 ± 2 kg/ha.

## DISCUSSION

The relationships described here rely heavily on variation in the data arising from year, stocking rate, fertiliser and calving date effects. Including these variables in the analyses accounted for more of the variation than did the simple model involving calving date. For that reason their inclusion was inappropriate where the objective was to derive hypotheses from regression analyses. Even so the range for some variables was limited. The validity of the derived relationships is therefore speculative and changes in 1 variable cannot be taken to be the cause of changes in the other.

There was a strong association between feed on the farm during July to September and milkfat yield. Presumably this was because increased amounts of feed at this time allowed better feeding in early lactation. Further, increases in condition and live weight at calving were not associated with increased milkfat yields. This again suggests that management should have been aimed at achieving increased feed on the farm during July to September rather than increasing live weight or condition. It is emphasised however that the poorest conditioned herd averaged a score of 4.5 at calving. The observations made here may not apply to herds of lower condition.

There is uncertainty as to how much feed should be present in July to September. Increased amounts in August and September are also associated with increased amounts during October to December (Bryant, 1982 b). A stage may be reached where the amount present in August or September, and therefore subsequently, are such that milkfat yields are compromised by a deterioration in pasture quality.

The poor relationships between milkfat yield and feed present in October and November may reflect that herd requirements at that time were met by the high prevailing rate of pasture growth, irrespective of what occurred previously.

The relationships between feed on the farm in August or September with that in May, and with length of rotation at various times are of particular interest. Length of rotation during May varied from 50 to 100 days, and 20 to 80 days during August. The relationships suggest that the accumulation of feed early in the autumn by means of rotations during May approaching 100 days were not in the interests of high milkfat production. The advantage of the slower August rotations has implications for the feeding of cows calving prior to September. They should have been offered limited feeding until the onset of spring growth in September in the interests of maintaining feed on the farm in July to September at high levels.

It is emphasised that the form of the analysis used here means that any inferred recommendations must be treated with caution until verified by appropriate experiments. The objectives of such experiments should include defining how much feed should be present in spring, how best this is achieved, and the influence of calving date and stocking rate. An experiment to answer some of these questions is now in progress.

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