FACTORS AFFECTING LACTATION YIELDS OF FRIESIAN COWS IN SOUTH EAST QUEENSLAND

I.A. PAPAJCSIK* and J. BODERO*

SUMMARY

Monthly herd recording data were analysed to examine the effect on lactation milk yield of age of cow, month and year of calving, lactation length and herd. Significant interactions with herd were obtained for all other factors, indicating that the response of lactation yield to changing age, month and year of calving was herd dependent. As a result the calculation of age and age by month of calving correction factors based on data pooled from many herds may not be applicable to individual herds. (Keywords: lactation, month of calving, age, herd, lactation length).

INTRODUCTION

Age of cow, month and year of calving, lactation length and herd management can bias estimates of lactation milk yield, resulting in incorrect decisions to cull or to select for breeding stock. The aims of this study are to estimate the effect of month of calving on lactation milk yield, to compare the age distributions and the month by month calving distributions of three herds, and to estimate the effects of herd, year of calving, age of cow and lactation length, as well as their interactions, on lactation milk yields.

MATERIALS AND METHODS

The data used are monthly herd recordings of individual cows from three farms, considered to be representative of low, medium and high yielding herds in the Beaudesert area of south east Qld. The total data set comprised 748 lactations from 359 cows, collected over the period June 1978 to June 1982. Removal of incomplete records reduced the data to 513 lactations from 312 cows. Multiple lactations of a cow are considered to be independent of each other, as in several studies, such as that of Schaeffer and Burnside (1976).

For the purpose of analysis, the data were classified into three age classes (one or two years, three, four or five years, and older cows) and three lactation length classes (less than 200 days, between 200 and 330 days and longer than 330 days).

The following models were fitted to the lactation milk yields of the cows in each herd, using least squares techniques:

yield = f (month of calving) Model 1

yield = f (age of cow, lactation length, year of calving, all interactions) Model 2

Based on the significant effects in model 2, a further extended model, incorporating the factor herd and its interactions with these effects, was fitted to the whole data set.

The monthly calving patterns and the age distributions of the cows were compared for the three herds using a Chi-Square test.

* School of Australian Environmental Studies, Griffith University, Nathan, 4111. Qld.

RESULTS

The effect of month of calving on lactation milk yields in the three herds is illustrated by the graphs in Figure 1.

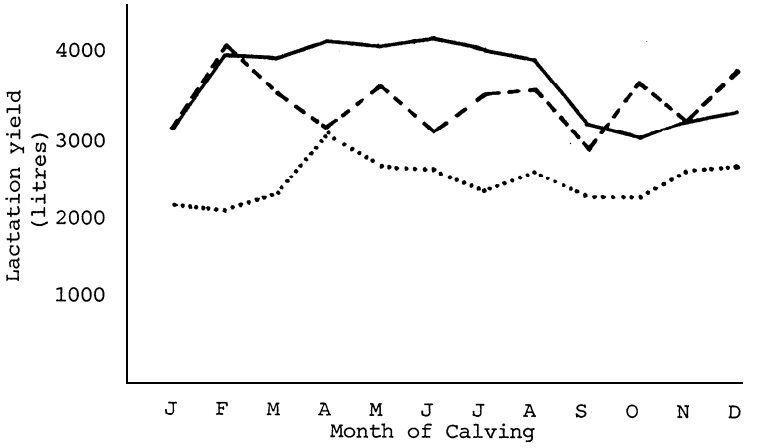

Fig. 1. Least squares means of lactation milk yield for each month of calving. Herd 1 ——— ; herd 2 - - - - - ; herd 3 .....

The effect of month of calving on lactation milk yields for each herd can be summarised as follows:

Herd 1 The lactation milk yields of cows calving between February and August were significantly higher than those calving between September and January ($P<0.05$).

Herd 2 There were no significant differences between the lactation yields of cows calving in any month ($P>0.05$).

Herd 3 The lactation milk yields of cows calving in April were significantly higher than those of cows calving in any other month ($P<0.05$).

In order to investigate possible reasons for the different month of calving responses obtained in the three herds, their monthly calving patterns and age distributions were compared. Figure 2. shows the percentage of cows calving in each month in each herd. Calving did not occur randomly throughout the year, but was concentrated in the winter months, with approximately 37% of lactations in each herd beginning in June, July or August. The calving pattern for herd 1 differed significantly ($P<0.05$) from those of the other two herds, which did not differ from each other ($P>0.05$).

The age distributions of the cows in the three herds are shown in Table 1. Herd 1 had a smaller proportion of young cows and a larger proportion of old cows than the other two herds ($P<0.05$).

When model 2 was fitted to the data from each herd, none of the interactions was found to be significant ($P>0.05$). The percentages of the total variation in lactation milk yield accounted for by the three main effects are given in Table 2. To investigate the effect **oh** lactation yield of herd and its interactions with age, year and lactation length, model 2 was revised to include the factor herd. This extended model was fitted to the combined data. The ANOVA table and the percentage of total variation accounted for by each effect are given in Table 3.

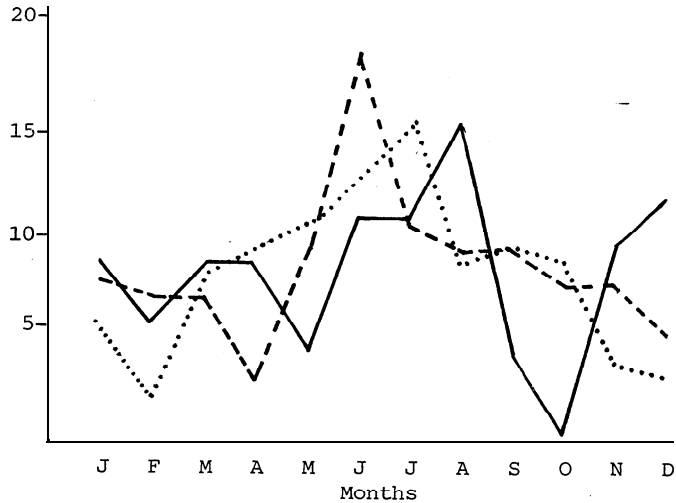

Fig. 2. Percentages of cows calving in each month in each herd.

Table 1 Numbers and percentages (in parentheses) of cows in each herd and age class

	Herd 1	Herd 2	Herd 3
Age class 1	38 (18)	50 (35)	66 (42)
Age class 2	90 (42)	51 (37)	47 (30)
Age class 3	86 (40)	40 (28)	45 (28)

Table 2 Percentages of total variation of lactation milk yield accounted for by age of cow, lactation length and year of calving.

	Herd 1	Herd 2	Herd 3
Age class	17 *	16 *	1 ns
Length class	44 *	26 *	20 *
Year	5 *	1 ns	12 *

* indicates significance at 5%.

DISCUSSION

Cows were calved seasonally on all three farms, with approximately 37% of all lactations beginning in winter. This management practice is presumably adopted so that cows can take advantage of winter incentive payments and good summer pasture late in the lactation. A similar practice is used in temperate climates, where most cows calve in autumn to take advantage of new spring pasture (Wood 1970; Cunningham 1972). The effect of month of calving on lactation milk yield was markedly different for the three herds. Herd 1 exhibited a strong seasonal dependence of lactation yield on month of calving, whereas herds 2 and 3 showed no such effect, except for the higher production by April calving cows in herd 3. Since herd 1 contained a larger proportion of older cows and a smaller proportion of younger cows than herds 2 and 3, this may indicate that in herds with a younger age structure milk yield is less affected by month of calving than in herds with an older age structure.

Table 3 ANOVA table obtained when extended model 2 was fitted to the combined data from all three herds.

Source	df	MS($\times 10^{-5}$)		Percentage of total variation explained
Herd	2	392	*	11.0
Age	2	266	*	7.5
Year	3	27	*	1.0
Length	2	884	*	25.0
Herd x age	4	51	*	2.9
Herd x year	3	62	*	2.2
Herd x length	4	38	*	2.6

* indicates significance at 5%

The significant interactions in Table 3 indicated that the effects of age, lactation length and year of calving on lactation yield were herd dependent, so no average response, which would be applicable to all herds could be determined. For example if age correction factors calculated from the pooled data are used, then a heifer yielding 2500 l would be expected to yield 3544 l when mature. However if she were in herd 3 then her expected mature production based on herd 3 age correction factors would be only 2660 l. A number of papers considered the possibility of interactions between herd and age at calving, lactation length or year of calving (Gacula et al. 1968;Lee and Hickman 1972), although Gacula et al. (1968) concluded that such interactions were not significant ($P>0.05$). There are also apparently conflicting results obtained in papers which excluded the possibility of such interactions. For example Auran (1973) attributed 23.8% of the variation in lactation yields to age of cow, whereas Singh and Raut (1982) found that the number of times a cow had calved had no significant effect on her lactation yield ($P>0.05$). In particular, neither of the Australian papers reviewed (Chambers and Hammond 1981;Everett et al. 1982) included interactions with herd in their models.

Many papers have calculated tables of age or age by month correction factors based on data from many herds, in order to standardise lactation yields. The significance of the age by herd interaction obtained in this analysis may mean that such age correction factors are not applicable to any particular herd, and that their use could be misleading.

REFERENCES

CHAMBERS, S. and HAMMOND, K. (1981). Proc. 2nd Conf. of Aust. Assoc. Anim. Breed. and Genet., Melbourne p.99

CUNNINGHAM, E.P. (1972). Ir. J. Agric. Res. 11: 1

EVERETT, R.W., TAYLOR, J.F. and HAMMOND K. (1982). Aust. J. Agric. Res. 33: 731.

GACULA, M.C.Jr., GAUNT, S.N. and DAMON, R.A.Jr. (1968). J. Dairy Science. 51:428.

LEE, A.J. and HICKMAN, C.G. (1972). J. Dairy Science. 55: 432.

SCHAEFFER, L.R. and BURNSIDE, E.B. (1976). Can. J. Anim. Sci. 56: 157.

SINGH, R.P. and RAUT, K.C. (1982). Ind. J. Anim. Sci. 52: 375.

WOOD, P.D.P. (1970). Anim Prod. 12: 253.