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RELATIONSHIP OF AGE AND LIVEWEIGHT AT FIRST CALVING TO SUBSEQUENT LACTATION YIELDS OF FRIESIAN HEIFERS GRAZING TROPICAL PASTURES

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SUMMARY

The relationship between age at first calving, liveweight at first calving and milk yield in the first lactation was studied on 78 purebred Friesian heifers grazing tropical pastures without supplementation. In addition, 61 and 41 records of milk yield in the second and third lactations respectively were analysed for relationship to liveweight at first calving.

Age at calving was not significantly related to milk yield in the first lactation, though liveweight at first calving was significantly related to milk yield in the first ($r = 0.57$; $P < 0.01$), second ($r = 0.51$; $P < 0.01$) and third ($r = 0.46$; $P < 0.01$) lactations. The regression coefficient showed a slight, though non-significant, decrease with succeeding lactations.

Possible explanations for this relationship and application of the results are discussed.

I. INTRODUCTION

In tropical dairying areas, a large number of dairy heifers are not mated until 2 years of age. On the Atherton Tableland in Queensland, this practice is often adhered to. Farm managers feel that heifers calving at 2 years of age have not attained sufficient body size and subsequent lactation performance is adversely affected.

For heifers grazing temperate pastures and consuming moderate levels of concentrates, liveweight at first calving has been shown to bear little relationship to first lactation milk yield (Bailey and Broster 1954; Broster and Tuck 1967; Swanson 1967; Swanson *et al.* 1967). However, there is little information on the relationships between age, weight and milk yield of Friesian heifers grazing tropical pasture without supplements. The present paper presents an analysis of these relationships, using data from a commercial herd of Friesian cows.

II. MATERIALS AND METHODS

ENVIRONMENT. Kairi Research Station is situated 700 m above sea level, latitude 17° 14' S and longitude 145° 25' E. Mean annual rainfall is 1 232 mm, with 830 mm falling in the months January to March inclusive. Mean maximum and minimum temperatures range from 28.8 to 18.0°C in summer to 20.8 to 10.6°C in winter respectively. Soil type is predominantly red basalt of high fertility.

Pasture species are predominantly glycine (*Glycine wightii* cv. Tinaroo)—green panic (*Panicum maximum* var. *trichoglume*) mixtures, with small amounts of grazing from elephant grass (*Pennisetum purpureum*), kikuyu (*P. clandestinum*) and guinea grass (*Panicum maximum*). Throughout these observations, pastures were grazed at a relatively light stocking rate of one mature cow equivalent to 0.8 ha.

ANIMALS. From 1965 to 1972 inclusive 78 purebred Friesian heifers were reared and milked for at least one lactation in the Kairi herd. All cycling heifers of liveweight greater than 280 kg were mated to calve in the months October to December inclusive. A concentrate supplement was fed to all heifers to 6 months of age, after which no further supplement was fed.

Age at first calving in heifers ranged from 21 to 43 months with 10 heifers calving before 24 months and 10 after 36 months. Liveweight at first calving ranged from 363 to 681 kg with 14 heifers below 409 kg at first calving and 7 heifers above 590 kg. Lactation yields for the first, second and third lactations were in the ranges 2 043 to 5 448, 2 304 to 6 174 and 2 406 to 6 469 kg respectively.

Milk production was recorded daily throughout each lactation, and liveweight recorded twice a week before the anticipated calving date. Liveweight at the last weighing before calving was taken as the weight at first calving for use in these regressions.

ANALYSIS. Analyses were by least squares regression and analysis of variance. Analysis of variance was carried out by grouping data into classes based on age of heifers and year of calving, while linear regression equations were calculated using liveweight and age at calving as independent variates. Data from all heifers were analysed and in addition data from heifers in the groups 454 to 544 kg liveweight and 24 to 27 months at calving were analysed separately.

III. RESULTS

No significant relationship emerged between age at calving and milk yield in the first lactation for heifers in the weight range 454 to 544 kg at calving or for data from all heifers.

Liveweight at first calving was significantly related to milk yield in the first lactation (table 1). Highest value for the correlation coefficient was obtained using data from heifers in the age range 24 to 27 months at calving, though coefficients using data from all heifers were highly significant (table 1).

In addition, milk yield in the second and third lactations was related to liveweight at first calving ($P < 0.01$; table 1). The regression coefficient of milk yield on liveweight showed a slight but statistically non-significant decrease with advancing lactations.

Interactions between age, years and liveweight on first lactation yields were not significant.

TABLE 1

RELATIONSHIP OF MILK YIELD OF HEIFERS (kg) TO LIVEWEIGHT AT FIRST CALVING (kg).
LIVEWEIGHT IS THE INDEPENDENT VARIATE

Group	n	a	b ± S.E.	R.S.D.	r	Significance
24 to 27 months at first calving	35	49.1	7.351 ± 2.397	586	0.77	P < 0.01
All heifers:						
1st lactation	78	-780.4	8.705 ± 1.801	718	0.57	P < 0.01
2nd lactation	61	111.8	7.607 ± 1.689	947	0.51	P < 0.01
3rd lactation	41	712.7	6.685 ± 2.072	862	0.46	P < 0.01

IV. DISCUSSION

Our study shows a positive relationship between liveweight at calving and subsequent milk yield in Friesian heifers grazing tropical pastures. Results suggest that animals which are genetically or environmentally capable of reaching a higher liveweight at first calving will produce more milk than animals of lower liveweight. This superiority tends to decrease with subsequent lactations. However, the nature of the data used in our analysis does not allow us to conclude that this is a causative relationship.

Experimental evidence on the relationship between liveweight at first calving and milk yield is conflicting. Bailey and Broster (1954), Swanson (1967), and Swanson *et al.* (1967), working with cows fed a diet of high energy content, concluded that body size at first calving had no influence on subsequent milk yield. From a survey of a large number of predominantly roughage fed cows of three breeds, Hickman *et al.* (1971) concluded that weight at calving had a highly significant effect on first lactation milk yield. This effect decreased with succeeding lactations though the partial regression coefficient for milk yield on liveweight at calving was highly significant in lactation four for Friesian cows. Significant positive relations between liveweight at calving and milk yield were also obtained by Miller *et al.* (1973).

The relationship between liveweight at calving and milk yield may be influenced by the feeding regime after calving. Cows early in lactation supplement their energy intake by drawing on body reserves and the importance of adequate reserves would be expected to increase as energy intake after calving is restricted. Energy intake of cows in early lactation and grazing tropical pastures of digestibility in the range 55 to 60% (Minson and McLeod 1970) may be restricted well below demand by rumen capacity (Freer and Campling 1963). The regressions reported in table 1 may reflect this restriction on energy intake for growing and lactating Friesian heifers grazing tropical pasture. Further controlled studies on this relationship should have value for dairying industries utilizing tropical pasture.

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