SOME EFFECTS OF GENOTYPE ON THE CONVERSION OF PASTURE TO MILK BY FRIESIAN COWS

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by

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ABSTRACT

The New Zealand Dairy Industry has been aiming to bring about genetic improvement of dairy cattle by the use of genetically superior (progeny tested) bulls in the Artificial Breeding Scheme. There is evidence to show that there has been a genetic improvement in the level of milk fat production per cow, but little evidence to show the mechanisms by which the increase has been achieved.

At present the genetic merit of a New Zealand cow for milk or milk fat production is measured by her breeding index (BI). The main objective of the work was to determine the mechanisms whereby cows of high BI produce more milk than cows of low BI.

A total of 40 Friesian cows with high BI (approximately 125) or low BI (approximately 100 which is equivalent to the average cow in 1960) were identified and purchased from New Zealand dairy farmers. Experiments were carried out to determine the performance of high and low BI cows; when grazed as one group; when fed cut pasture individually in stalls at two levels of feeding; and when subjected to complete energy and nitrogen balances whilst lactating and non-lactating.

Over the whole lactation, high BI cows produced more milk fat and gained less liveweight than low BI cows. The difference between BI groups in milk fat production was in close agreement with the expected differences based on BI's. Differences in liveweight changes between genotypes were not measurable in the short term (approximately five weeks) feeding experiments.

One exception was in late lactation when high BI cows partitioned significantly ($P < 0.10$) more metabolisable energy to milk at the expense of body tissue than the low BI cows.

The two genotypes had similar intakes of fresh cut pasture offered ad libitum in stalls. However high BI cows ate, on average, 7% more pasture per unit metabolic liveweight than low BI cows, but the differences between genotypes in intake were significant only in two of the four indoor feeding experiments ($P<0.05$, $P<0.10$).

There were no significant differences between BI groups in their ability to metabolise feed energy and in their efficiency of use of metabolisable energy (as measured by heat production at a given energy intake). There was one anomalous result during restricted feeding in early lactation when high BI cows produced less heat ($P < 0.05$) at a common energy intake than low BI cows. Differences in nitrogen balance between genotypes were small and inconsistent.

The feed required to maintain body condition and to promote a gain of body condition during the dry period was similar for both genotypes.

The statistical methods developed in the course of analysing the experimental data were outlined in detail because it was considered that the analyses were more appropriate than those normally used.

It was concluded that high BI cows produced more milk fat because they ate more and partitioned a higher proportion of their metabolisable energy intake to the synthesis of milk rather than to liveweight gain, than the low BI cows.

The implications of the results were considered by making some preliminary predictions about the likely effect of genetic merit on farm productivity.

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