CAN A NEW COMPONENT OF MILK BE INTRODUCED IN A BREEDING INDEX TO IMPROVE GENETIC PROGRESS?

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Butterfat and protein of milk are conglomerates of many fractions. The possibility of finding one or more of these fractions for use as an additional genetic indicator of economic milk production is of interest to the industry.

The biologically possible genetic and phenotypic combinations of a fraction of milk, butterfat or protein were simulated to give investigators of new components of milk an indication of the possibility of finding a fraction which will economically improve genetic progress. Valid combinations were evaluated and classified according to the percentage increase in dollar return for production realised by their inclusion in linear Selection Indices (Henderson, 1963) with milk, butterfat and protein.

Estimated dollar return for these indices required specification of phenotypic and genetic (co)variances; relative economic values and selection intensity. Two sets of relative economic values v_m for quota milk and v_f for manufacturing milk were considered. From Anderson *et al*, (1978), a selection factor of 0.1273 corresponding to a genetic trend of 45 kg of milk per year when selection is on milk alone, was used. Parameters are specified in Table 1.

TABLE 1: Phenotypic[a], Genetic[a] and Relative Economic[b] Parameters Assumed for Milk, Butterfat and Protein

	Milk	Butterfat	Protein	σ_p	v_m	v_f
Milk	0.25	0.87	0.93	800	0.23	0
Butterfat	0.66	0.25	0.98	30	0	2.5
Protein	0.81	0.75	0.22	25	0	0

[a]Heritability on diagonal, phenotypic correlations r_p above, genetic correlations r_g below diagonal; phenotypic standard deviations σ_p in kilograms.

[b]Units are dollars per kilogram.

The parameters specifying the additional trait for the purpose of simulation were, heritability (h^2) = 0.1, ..., 0.9; phenotypic and genetic correlations = -1.0, ..., 1.0, and proportion component of parent trait = 0.1, ..., 0.9, all in increments of 0.1. Of nearly 7 x 10^9 parameter combinations, only 106,630 were possible after biological and mathematical conditions were satisfied. Although biologically possible, combinations involving high h^2 and high positive r_p with high negative r_g would seem impossible for a part-whole relationship in dairy cattle.

Table 2 contains the percentage of combinations with h^2 = 0.2 and 0.3 and r_p and $r_g \geqslant 0.5$ exceeding given percent increases in dollar return. The relative economic value of the additional trait was assumed to be zero, implying no economic advantage and hence results presented here underestimate economic return if this is not the case.

TABLE 2: Percentage of Combinations with h^2 = 0.2 and 0.3 and r_p, $r_g \geqslant 0.5$ Exceeding Percentage Increases in Dollar Return

Heritability of Fraction	Percentage Increase in Dollar Return				
	> 5	> 10	> 20	> 30	> 40
			v_m		
0.2	23	6	1	0	0
0.3	40	26	6	1	0
Overall	30	14	3	0	0
			v_f		
0.2	25	9	4	0	0
0.3	44	27	10	3	1
Overall	33	17	6	1	0

Results for all biologically possible combinations were substantially greater than those presented in Table 2 and have been reported by Everett *et al* (1981). These results assume no cost of measurement, as well as no investment in finding a new fraction.

ACKNOWLEDGEMENTS

This work was conducted while RWE was partially funded by and JFT was in receipt of a postgraduate studentship from the Australian Dairying Research Committee.

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