Economic Value Of Live Weight In South African Dairy Cattle

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Introduction

A sound breeding objective should, of necessity, incorporate all economically relevant traits. In the past, breeding objectives for dairy cattle in most countries were focussed solely on production traits. Significant changes have, however, taken place in recent years, gradually leading to more balanced breeding objectives comprising a wider range of economically important traits (Miglior, F., Muir, B.L. and Van Doormaal, B.J. (2005)).

Several studies (Groen (1989); Groen and Korver (1990); Visscher, P.M., Bowman, P.J. and Goddard, M.E. (1994); Spelman and Garrick (1997); review by Veerkamp (1998); Pe´rez-Cabal, M.A., González Santillana, R. and Alenda, R. (2006)) support the inclusion of live weight in breeding objectives, to account for increased maintenance costs of heavier cows. A few countries such as New Zealand (Spelman and Garrick (1997)), Finland (Hietanen and Ojala (1995)) and Australia (Hayes, B.J., Bowman, P.J., Chamberlain, A.J. *et al.* (2009)) have, accordingly, incorporated live weight in their dairy breeding objectives. In South Africa, genetic evaluation is routinely carried out and EBVs published on 23 dairy traits; however there are no scientifically developed and clearly defined breeding objectives. Genetic trends show that selection in South African dairy cattle is mainly directed at increased yield and improved type (Theron and Mostert (2004)). The objective of this study was to determine the economic value of live weight in South African dairy cattle, as part of an exercise to develop sound and broader breeding objectives.

Materials and Methods

Economic values were calculated separately for the two major dairy cattle breeds (Holstein and Jersey) in each of the two major dairy production systems in South Africa (intensive concentrate-fed and pasture-based systems). A bio-economic herd model, simulating an average farm (base herd) for each breed in each production system, was developed. Data collected through the National Dairy Animal Improvement Scheme were used to derive base herd parameters (Table 1).

Farm economic data and milk pricing information were provided by the Milk Producersô Organisation of South Africa (MPO (2008); Koos Coetzee (2009), personal communication; Dawie Maree (2009), personal communication) and the milk buyers (Berlo Cotsee (2009), personal communication; Pieter van Zyl (2008), personal communication)). The price of beef was obtained from the South African Meat Industry Company (SAMIC (2008)).

The partial budget approach was used to compute economic values by simulating the marginal change in profit resulting from a unit increase in live weight, while all other traits remained constant. This was done by considering incomes and expenses for the base herd and a higher live weight herd. It was assumed that increased feed (energy) requirements for higher live weight were met by buying in extra feed and that non-feed costs remained constant. In the pasture-based production system, it was assumed that purchased feed is obtained at opportunity cost, defined as average revenue in the base situation, following Garrick (2002).

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Table 1: Base herd parameters for each breed in each production system

Parameter[1]	Concentrate		Pasture	
	Holstein	Jersey	Holstein	Jersey
Milk volume (l/cow)	9 746	6 252	7 049	5 152
Fat yield (kg/cow)	383	303	277	248
Protein yield (kg/cow)	319	237	233	198
Mature live weight	650	500	600	450
Cows culled (%)	34.6	31.9	26.1	26.6

[1]*Yields standardised to 305 day lactation*

Economic value was calculated as the change in profit (income less costs) per unit change in live weight (*i.e*. difference in profit between higher live weight herd and base herd). Profit was expressed per cow in the herd per year. Standardised relative economic values, expressed in genetic standard deviation units relative to the standardised value for protein yield, were calculated to enable comparison of the relative importance of live weight with other traits in the breeding objective.

Results and Discussion

Table 2 presents economic values of live weight for each breed in each production system. An increases in live weight resulted in a decrease in profit. The decrease in profit per kg live weight was larger in the Jersey than in the Holstein. This may be explained by the higher culling rate for the Holstein, which results in a larger increase in beef revenue in the alternative (higher live weight) herd, compared to the Jersey. Economic values were higher in the concentrate-fed production system compared to the pasture-based system, due to the lower cost of feed in the latter system.

Table 2: Economic value of live weight by breed and production system

	Concentrate		Pasture	
	Holstein	Jersey	Holstein	Jersey
Economic value (ZAR/kg)	-6.62	-7.49	-4.00	-4.90

Figure 1 shows the relative economic values of traits in the breeding objective, standardised to protein (the most important trait). Live weight is one of the most important traits and its value is 47 % compared to that of protein.

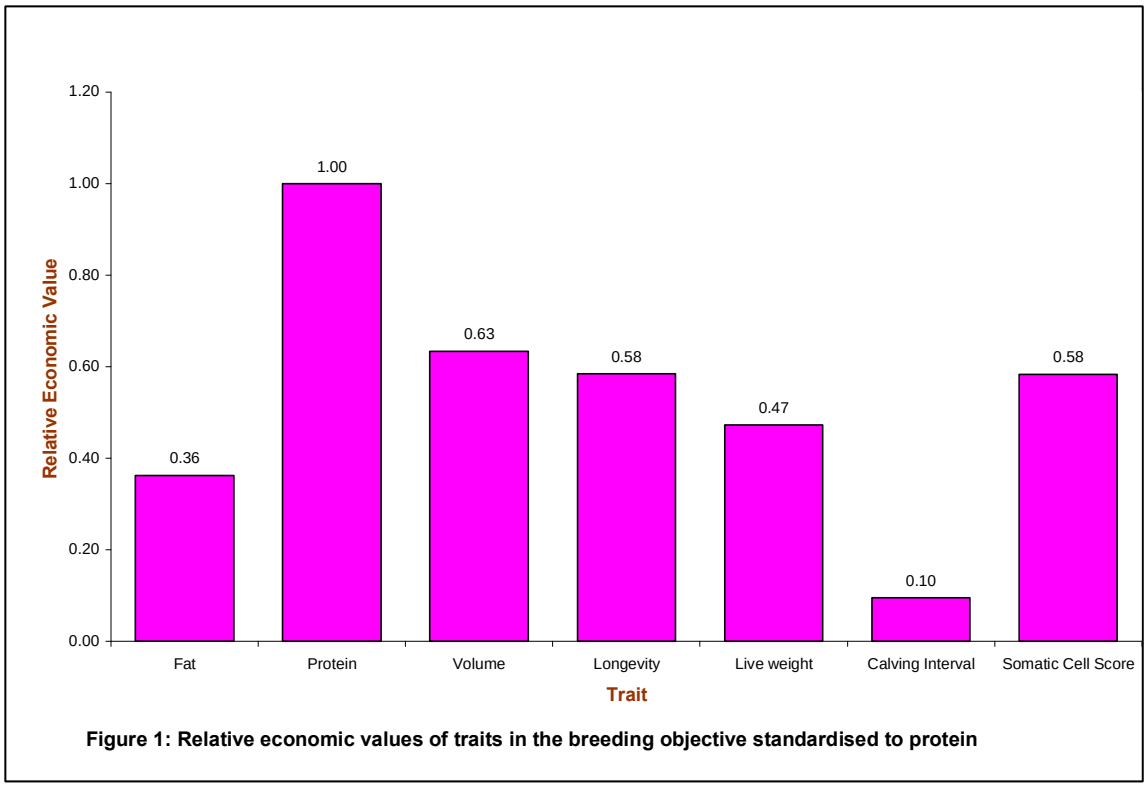

Figure 1: Relative economic values of traits in the breeding objective standardised to protein

The current study highlights the importance of live weight in the breeding objectives for South African dairy cattle, indicating that increased live weight is associated with a significant decrease in profit. This is a widely observed phenomenon (Visscher, P.M., Bowman, P.J. and Goddard, M.E. (1994); Du Plessis and Roux (1998); Koenen, E.P.C., Berentsen, P.B.M. and Groen, A.F. (2000); Nielsen, H.M., Groen, A.F., Pedersen, J. *et al*. (2004); Nielsen, H.M., Groen, A.F., Østergaard, S. *et al*. (2006); Pe´rez-Cabal, M.A., González Santillana, R. and Alenda, R. (2006); Wolfová, M., Wolf, J., Kvapilík, J. and Kica, J. (2007)) and can be explained by the fact that marginal costs associated with increased maintenance energy requirements for heavier cows exceed marginal revenues from increased live weight of disposed stock (Groen (1989)). Contrary to these results, however, Vargas, B., Groen, A.F., Herrero, M. *et al*. (2002) and Kahi and Nitter (2004) reported positive economic values for live weight. Such results may theoretically be possible in a market where the price of beef relative to feed is such that marginal beef revenue from increased live weight is more than marginal costs of maintaining heavier cows.

In South Africa, live weight cannot presently be included in the breeding objective, as it is not routinely evaluated under the national genetic evaluation programme. There is therefore a need to develop means to record and evaluate live weight in order to incorporate it in the breeding objective. The possibility of using indicator traits such as stature or rump height, as surrogate or predictor traits for live weight, also needs to be investigated. These traits are routinely recorded and genetically evaluated in South Africa and have been shown to be good predictors of live weight (Heinrichs, A.J., Rogers, G.W. and Cooper, J.B. (1992); Mantysaari (1996); Veerkamp and Brotherstone (1997); Koenen and Groen (1998)).

Conclusion

Live weight has high economic value in the South African dairy cattle population. Efforts therefore need to be made to incorporate it in the breeding objective.

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