ECONOMIC WEIGHTS FOR PRODUCTION AND FUNCTIONAL TRAITS OF ESTONIAN HOLSTEIN POPULATION

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INTRODUCTION

For establishing a total merit index after Hazel (1943) the relative economic weights of the traits considered in the aggregate genotype have to be known. The economic weight of carrier, fat and protein production for Estonian cattle population was calculated first in 1997 (Pärna and Saveli, 1997 ; Pärna and Saveli, 1998). Annual genetic response in milk carrier, fat and protein yield was estimated to be 57.4 kg, 1.98 and 1.67, respectively (Pärna and Meier, 2001). Since 1997 performance has risen by more than 1 000 kg, but fertility parameters and further functional traits have deteriorated. The population size has decreased by 6 %. Increasing input prices for agricultural enterprises were not balanced by output prices. Preparing the joining of Estonia to EU, we have to consider the impact of quota on economic weights. After Groen *et al.* (1996), under quota conditions and decreasing milk prices, functional traits like reproduction traits (which increase efficiency not by higher output of products but by reduced costs of input) might have a bigger impact on the profit of dairy farmers and should therefore be included in breeding programmes. Apart from economic reasons for including functional traits in the breeding programmes there are several non economical reasons, for example ethical reasons and consumer concern, which are becoming more and more important (Dempfle, 1992 ; Groen *et al.,* 1996 ; Olesen *et al.,* 1999). Including functional traits in breeding programmes will have a major impact on the expected selection response of functional traits and will result in only small losses of the expected selection response of production traits (Fewson and Niebel, 1986).

In this study absolute and relative economic weights estimated with a herd model under assumed quota on milk production with given fat and protein content and non quota conditions will be given for the Estonian Holstein population. The following traits were considered : milk yield, fat and protein content, daily gain in fattening bulls, dressing percentage in bulls, feed conversion in bulls, net daily gain in bulls, calving interval, age at first breeding, interval between the first and last breeding of heifers, cow longevity. The discounted economic weights of above-named traits were calculated to account for time delay influence.

MATERIAL AND METHODS

For the derivation of the economic weights, a bioeconomical model of a closed herd which included the whole integrated production system of dairy breed was used (Wolfová *et al.,* 2001). The total discounted profit for herd was calculated as the difference between all revenues and costs that occurred during the whole life of animals born in the herd in one year and that was discounted to the birth year of these animals.

The situation based on production and economic data of the joint stock companies was defined for the Estonian Holstein population as follows. The 305 - day milk production of the first lactation was 5539 kg, 227 kg fat and 179 kg protein. The age structure of the herd assuming at most 10 lactations per cow. The statistical data were taken from the Results of Animal Recording in Estonia (2000). The average number of inseminations for pregnancy for heifers was 1.5 and for cows 2.0. Interval between the first and last breeding in heifers was 26.8 days and interval between calving and the first breeding in cows 83.3 days. The 90 days non-return rate was 65.9 % for heifers and 49.6 % for cows. The average service period was 129 days, and calving interval was 410 days. Basic price of milk was 3.0 EEK/kg, price for 1 % protein content in milk was 0.3 EEK, and price for 1 % fat in milk was 0.1 EEK (1 EUR = 15.65 EEK).

A computer program developed by Wolfová and Wolf (1996) was used for the calculations of economic values for the various traits. The situations with and without milk quota were investigated. It was assumed that the number of breeding heifers was constant when increasing the length of production life in cows.

RESULTS AND DISCUSSION

Economic weights. Absolute economic weights for all traits considered are given in table 1. Milk quota had not any influence on the economic weights for beef performance traits, on feed conversion in bulls and on daily gain on fattening bulls, but influenced the economic weights of milk yield and cow longevity. There were only minor differences in economic values of functional traits.

Table 1. Economic weights of Estonian Holstein

Trait	Unit	Economic weights (in EEK per unit of given trait and per standard female unit)			
		without quota		with milk quota [A]	
		u [B] = 0.10	u = 0	u = 0.10	u = 0
Milk yield	kg	2.4	3.9	2.0	2.3
Fat content	%	-163.0	-267.4	-163.0	-267.4
Protein content	%	844.1	1384.6	844.1	1384.6
Net daily gain in bulls	g/day	-3.6	-1.8	-3.6	-1.8
Dressing percentage	%	45.1	63.3	45.1	63.3
Feed conversion	MJ NE/kg	-398.1	-565.1	-398.1	-565.1
Daily gain in fattening bulls	g/day	-1.8	-1.8	-1.8	-1.8
Interval between 1st and last successful breeding in heifers	days	-8.3	-6.8	-8.4	-7.1
Calving interval	days	-5.5	-1.7	-6.1	-3.9
Cow longevity	lactations	10.3	624.5	-75.6	302.5
Age at first breeding	days	-3.8	-0.2	-3.9	-0.6

[A] With constant fat and protein content
[B] u = discount rate

In table 2 the relative economic weights per genetic standard deviation and the relative economic weights in relation to the most important trait, milk yield, are given. The results are presented for a discounting rate 0.10 and for the situation without discounting (zero discounting rate). Genetic standard deviations were taken from the literature (Miesenberger, 1998 ; Wolfová *et al*., 2001*)*. In all cases discounted economic weights were lower than economic weights calculated without discounting. The differences in economic weights increased along with the time interval between birth of improved animals and impact of improved traits on revenues or costs. The difference in economic weights between discounted and not discounted economic values was especially high for cow longevity. Selection gain in the first lactation was influenced neither by quota nor by discounting, but discounted total profit per closed herd decreased 59 %.

Table 2. Relative economic weights of Estonian Holstein (no quota)

Trait	Unit	Genetic standard deviation [A]	Economic weights (in EEK) per standard deviation		Economic weights relative to milk yield	
			u = 0	u = 0.10	u = 0	u = 0.10
Milk yield [B]	kg	450	1755	1080	1.00	1.00
Fat content	%	0.207	-55.4	-33.7	-0.03	-0.03
Protein content	%	0.095	131.5	80.2	0.07	0.07
Net daily gain in bulls	g/day	30	-54.0	-54.0	-0.03	-0.05
Dressing percentage	%	1.14	72.2	51.4	0.04	0.05
Feed conversion	MJ NE/kg	1.5	-847.7	-597.2	-0.48	-0.55
Interval between 1st and last successful breeding in heifers	days	10	-68.0	-83.0	-0.04	-0.08
Calving interval	days	10	-17.0	-55.0	-0.01	-0.05
Cow longevity	lactations	180	368.6	6.1	0.22	0.01

[A] Literature values (Meisenberger, 1998 ; Wolfová *et al.*, 2001)
[B] With constant fat and protein content

Economic situation. In 2000, a relative stabilisation of the number of cows was observed. The liquidation of cattle due to the unfavourable production conditions in 1999 has been stopped because stronger and more competitive producers have survived. No considerable decline is expected in the number of cows within the next few years, and some increase is even predicted. The purchase prices of milk increased by 44 % in 2000 compared to the last year (Piirsalu, 2001). The main reasons for the price and the Estonian export quota to have both almost doubled are the successful EU accession negotiations and the elimination of the 29 % customs tariff within the quota, and this should be emphasized. Nevertheless, despite the increase in the price of milk in 2000, most milk producers had no means for current repairs or investments, because the production costs of milk increased considerably due to the increase in the price of several major inputs (e.g. fuel, feedstuff, electricity). The rise of the USD compared to the EURO has been of great influence.

There can be one single trend noted - the higher the milk yield per cow, the more effective the production in the terms of economy. In Estonia milk production is considered profitable when exceeding 4 500 kg production per cow a year and this level has been reached already. The trends of the Estonian milk production policy in 2000 were evaluated by the state's direct aid to dairy cows. Subsidy per cow was 1,065 EEK. In 2000, for the first time, the total of 8.7 million EEK were allocated for the dairy sector and the breeding of dairy cattle out of the 16 million EEK allocated for the joint stock companies from the state subsidies. The system of milk quotas will be of great importance for Estonia in the nearest future.

As beef production is dependent on the number of milk cows, it decreased in 2000, exhibiting the greatest decline among the branches of meat production. Purchase prices have remained low during the recent years, resulting in the decreasing interest of producers to fattening animals. In 2000, the outbursts of foot-and-mouth disease and cases of BSE influenced the world beef market. The influence of BSE in Europe on the production of beef in Estonia will probably become more evident in 2002.

CONCLUSION

The standardised economic weights of the most considered traits made 3 - 8 % of the economic weight for milk yield. Only feed conversion of bulls amounted up to 48 % and cow longevity 22 % of the economic value of milk yield. Discounting had a definite impact on the economic weight of cow longevity. Selection gain in the first lactation was influenced neither by quota nor by discounting, but discounted total profit per closed herd decreased by 59 %. The economic value of production and functional traits are only preliminary, as many changes in Estonian dairy sector should be considered in the nearest future.

REFERENCES

Dempfle, L. (1992) *Züchtungskunde* **64** : 447-457.

Fewson, D. and Niebel, E. (1986) *Züchtungskunde* **58** : 4-20.

Groen, A.F., Steine, T., Colleau, J.J., Pedersen, J., Pribyl, J. and Reinisch, N. (1996*) Report of an EAAP-working group*. EAAP-Meeting 1996.

Hazel, L.N. (1943) *Genetics* **28** : 476-490.

Miesenberger, J., Sölkner, J. and Essl, A. (1998) *Interbull Bulletin* **18** : 78-84.

Olesen, I., Gjerde, B. and Groen, A.F. (1999) *Book of Abstracts of EAAP*, **5**, 33.

Piirsalu, M. (2001) *Proc 7th BABC* : 21-28.

Pärna, E. and Meier, A. (2001*). J. Agric. Sci.* **12** (2) : 100-110.

Pärna, E. and Saveli, O. (1997) *Proc 3rd BABC* : 15-18.

Pärna, E. and Saveli, O. (1998) *Proc 6th WCGALP* **25** : 399-402.

Results of Animal Recording in Estonia (2000).

Wolfová, M., Přibyl, J. and Wolf, J. (2001) *Czech J. Anim. Sci*. **46** : 421-432.

Wolfová, M. and Wolf, J. (1996) *PC-program for estimating economic weights in cattle*. User's manual for the program EW, version 1.1.