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Economic weights of Holstein cattle in Slovak dairy production system

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Summary

This work presented economic weights (EWs) calculated for Holstein cattle raised in Slovak dairy productions using a bio-economic approach. EWs are calculated for alternatives with (A) and without (B) market quota. Both alternatives included three market payment systems of milk (base price per milk value was corrected according to content of fat, protein and somatic cells). Marginal EWs for milk production traits and for some functional traits were influenced by quotas system. Mainly values for fat content got different weight (-103.8 EUR/% per cow and year and -21.9 EUR/% per cow and year in system A and B, respectively). EWs for all growth and carcass traits were in both systems similar. Values for fat and protein content were also influenced by payment system. Standardised EWs for lifetime of cows and daily gain of calves during rearing and feedlot in system A shared 20 %, 20 % and 18 % of the value for milk yield. In system B values reached 18 %, 14 % and 13 % of the standardised milk value. Relative EWs for milk fat content shared about –31 % and –4% for system A and B.

Key words: dairy cattle, economic values, production, functional, growth, carcass traits

Introduction

Economic weights for dairy production systems using bio-economic model were calculated in many papers (Pärna et al., 2002; Vargas et al., 2002; Wolfová et al., 2007) latterly. First economic values for dairy cattle traits under production circumstances of Slovakia (Peškovičová et al., 1997; Huba et al., 2004) were calculated by program constructed Wolfová and Wolf (1996). These values were used for construction of Slovak Production Index. The new bio-economic model written by Wolf et al. (2006) put attention on some new traits (somatic cells count, calving performance, and calf survival).

Milk production in Slovakia is with quota limited, but the quotas limits are not filled up if the whole dairy population is taken into account and deletion of quota from 2015 is considerate. Payment systems of milk production in Slovak conditions are very variable and depend mainly on agreement among producers and manufacturing organizations. The base price for milk volume with standardised fat and protein content and somatic cells content (SCC) is established frequently. The aim of this study was to estimate economic weights for production, function and carcass traits for purebred Holstein breed raised in Slovakia under different quotas and payment systems using bio-economic approach.

Material and Method

The economic weights (EWs) were calculated for purebred Holstein cattle raised in Slovak Republic. The selling of surplus pregnant breeding heifers and intensive indoor feedlot of weaned male calves were used in current (year 2005) production system. The basic characteristics of Holstein breed raised in Slovakia are shown in Table 1.

The EWs were calculated for milk production traits (305-day milk yield, milk fat content and milk protein content), functional traits (calving performance, losses of calves at calving, losses of calves till weaning, conception rate of heifers and cows, lifetime of cows and somatic cell

score), growth traits (birth weight of calves, mature weight of cows, average daily gain till weaning of calves and during the fattening period) and carcass traits (dressing percentage, average class for carcass conformation and for fatness).

Two basic alternatives of production system: A – production system under market milk fat production quota, B – production system without quota; and three additional variants for each of systems: 1 – milk price depends on somatic cell count and fat content, 2 - milk price depends on somatic cell count, fat content and protein content, 3 – same as variant 2 but double value for extra protein content were applied. The base price with standardised fat and protein content was corrected according to increased fat and protein content. For variant 1 base price was 25.39 cent/kg and bonus 0.13 cent per each percent (10 g) of milk fat. In second variant base price 25.39 cent/kg) was corrected with bonus 0.13 cent per each percent (10 g) of milk fat and protein, respectively. Third variant supposed price bonus 0.13 cent and 0.26 cent per each percent (10 g) of milk fat and protein, respectively. These prices were paid for market milk with value 300 000 - 400 000 SC/ml milk only. Bonus 1.16 cent/l milk was paid if SCC is up to value 300 000. The base price decreased by 20% when SCC got over 400 000 cells.

Economic efficiency of the production system was calculated as difference between total revenues and total costs per cow and year at the stationary state of herd structure. Amount of revenues come from realised breeding heifers, fattened bulls, culled cows (price depend on the slaughter weight, dressing percentage and payment for carcass body based on SEUROP grading system) and marked milk (more than 90% of all revenues). Costs for housing, feeding, breeding, veterinary treatment and fixed costs (labour, energy, reparations, insurance, fuels, overhead) were calculated for each category of animals. Some of input variables are shown in Table 2. Total profit (*TP*) was calculated as row vectors of revenues (*rev*) and costs (*cost*) multiplied by column vectors of the number of discounted expressions of revenues ($NDE^{[rev]}$) and costs ($NDE^{[cost]}$). *Subsidies* were not included in the calculations. All revenues and costs were discounted to the date of birth of progeny by using $NDE^{[rev]}$ and $NDE^{[cost]}$.

$$TP = rev * NDE^{[rev]} - cost * NDE^{cost} + Subsidies$$

Marginal economic weights of each trait were defined as partial derivation of the profit function.

EWs were calculated by bio-economic model (PC program ECOWEIGHT, Version 2.0.19 (Wolf et al., 2006) module EWDC). Markov chain was used for calculating of herd dynamics. Feeding ratios for each animal category was calculated in program Feedman (Petrikovič et al., 2003). The input parameters were adapted according to own investigation, personal communication and price trends in Slovakia. The marginal EWs expressed in Euro per cow and year were multiplied by genetic standard deviations of traits to standardised economic weights of traits. All values of genetic standard deviations were not available for the local population; therefore values provided by Wolfová et al. (2007) were used. Relative economic value of each trait is consequently expressed as proportion of standardised trait value of standardised value for 305-day milk (in %).

Results and Discussion

The marginal EWs calculated for 17 traits are presented in Table 3. Economic values for somatic cell score (SCS), losses of calves from 24 hours till weaning, mature weight of cows achieved negative values. Increase of mean values of these traits is linked with depression of revenues (base prise per milk released), increase of costs for replacement and feed costs for cow maintenance, respectively. Negative EWs for mature weight were estimated also by Groen (1989a, b) and Koenen et al. (2000). In case when feed costs for cow maintenance are calculated of the basis of feed availability, EWs for mature weight become positive values (Vargas et al., 2002). Carcass conformation and fatness achieved very low negative and positive economic value (-0.41 EUR, 0.03 EUR), respectively. Wolfová et al. (2007) estimated conformable economic values for these traits for Holstein cattle. Higher negative value for SCS (-309.68 EUR) and flashiness

(-55.57 EUR) presented in their paper is probably caused distinct threshold values for SCC (250 000; 400 000) and base price per milk unit over 400 000 SC (7.14 cent/kg milk). Likewise, higher base price for carcass weight (3.21, 2.79, 2.6 EUR per kg carcass bulls, heifers and cows, respectively), increased mean carcass class (O3 –P3) caused higher negative importance of carcass conformation in their calculations.

Economic values for growth and carcass traits calculated for different payment and quotas system according to our calculations were similar. On the other hand, economic weights for fat content were influenced by these factors. Economic weights for fat content reached higher values in system A (about –104.00 EUR / % per cow and year) than in system B (about –21.08 EUR / % per cow and year), in agreement with finding of Gibson (1989) and Groen (1989a, b). EWs for protein were in both alternatives similar due to no quotas limitations; differences were only among variants. Both traits achieved negative values, because improving of mean values is jointed with inadequate improving of revenues per unit of each trait. Conception rate of cows touched higher positive economic weights in system A, whereas milk yield and lifetime of cows reached positive value in system B. Similarly positive effect of genetic improvement of fertility and health on profitability of Holstein cattle was founded by Vargas et al. (2002). Negative total economic efficiency of fattening probably caused low positive economic value of losses of calves at calving.

Relative economic values allow to comparing relative importance of different traits. Relative values for system A, B and each payment system are shown in Table 4. The highest relative economic importance reached daily gain of calves till weaning, in fattening and production lifetime of cows, ranging between 14-20 %, 13-18 % and 18-20 % for both systems. Conception rate of heifers and dressing percentage achieved weights from 6% to 10 %. Relative values for fat content differed between quotas system (4 - 31 %). Pärna et al. (2002) estimated in system without market quota lower values for milk fat content, dressing percentage and for productive lifetime of cows (-3%, 5% and 1 %). Wolfová et al. (2007) calculated comparable relative values for productive lifetime, dressing percentage and milk fat content (29%, 12 %, 23 %, respectively) in milk quota system.

References

Gibson, J.P. (1989): The effect of pricing system, economic weights, and population parameters on economic response to selection on milk components. . J. Dairy Sci. 72, 3314-3326.

Groen, A.F. (1989a): Economic values in cattle breeding. I. Influence of production circumstances in situation without output limitations. Lives. Prod. Sci. 22, 1-16.

Groen, A.F. (1989b): Economic values in cattle breeding. II. Influence of production circumstances in situation with output limitations. Lives. Prod. Sci. 22, 17-30.

Huba, J., Daňo, J., Kica, J., Peškovičová, D., Krupa, E., Polák, P. (2004): Economic weights of milk efficiency traits in production system of the year 2003. In: Journal of Farm Anim. Sci., 37, p. 119 – 124

Koenen, E.P.C, Berentsen, P.B.M., Groen, A.F. (2000): Economic values of live weight and feed-intake capacity of dairy cattle under Dutch production cicumstances. Livest. Prod. Sci. 66, 235-250.

Pärna, E. Saveli, O., Kaart, T. (2002): Economic weights for production and functional traits of Estonian holstein population. 7th WCGALP, August 19-23, Montpellier, France, Session 01.

Peškovičová, D., Huba, J., Chrenek, J., Kica, J. (1997): Economic weights of milk efficiency parameters in production system in 1996. In: Journal of Farm Anim. Sci., 37, 134 – 137.

Petrikovič, P. - Hrdina, M. - Hosťovecký, M. (2003): Feedman – user manual to program. Nitra, 78 p.

Vargas, B., Groen, F., Herrero, M. and Van Arendonk, J.A.M. (2002): Economic values for production and functional traits in Holstein cattle of Costa Rica. Liv. Prod. Sci. 75, 101-116.

Wolf, J.; Wolfová, M.; Krupa, E. (2006): ECOWEIGHT - user manual to program package. C program for calculation economic weights in livestock, Version 2.0.19, Programs for cattle. Prague - Uhříněves, Research Institute of Animal Production, Czech Republic.

Wolfová, M., Wolf, J. (1996): EW version 1.1 (A PC program for estimating economic weights in cattle). Prague - Uhříněves, Research Institute of Animal Production, Czech Republic.

Wolfová, M., Wolf, J., Kvapilík, J., Kica, J. (2007): Selection for profit in cattle: I. Economic weights for Czech dairy cattle in a purebreeding system. J. Dairy Sci. Accepted.

Table I. Mean values and standard deviations of traits

Trait	Mean	Standard deviation
Average milk yield (kg)	6500	650
Milk fat content (%)	3.90	0.202
Milk protein content (%)	3.20	0.085
Somatic cell score	4.81	0.094
Calving performance	1.31	0.06
Losses of calves at calving (%)	6.80	2.5
Losses of calves till weaning (%)	5.59	2.0
Conception rate of heifers (%)	97.00	1.5
Conception rate of cows (%)	94.08	2.0
Productive lifetime of cows (years)	4.02	0.3
Birth weight of calves[1] (kg)	40	1.6
Mature weight of cows (kg)	600	17.5
Daily gain in rearing of calves[1] (g/day)	800	60
Daily gain in fattening[1] (g/day)	800	47
Dressing percentage[1] (%)	52.00	1.14
Carcass conformation[1] (class)	5.10	0.03
Fatness[1] (class)	3.12	0.02

[1]Average value for female progeny

Table II. Some input variables for calculation of revenues and costs for all variants

Variable	Value
Number of milk quality classes according to SC[1] content	3
Upper limit for SCC in class 2 (Number of SC/ml milk)	300000
Upper limit for SCC in class 3 (Number of SC/ml milk)	400000
Basic price for milk volume (cent[2]/kg)	25.39
Bonus for milk fat content (cent/% fat)	0.13
Bonus for milk protein content (cent/% protein) for variant 1, 2 and 3	0.00 0.13 0.26
Fixed price for milk quality class 3 according to SCC (cent/kg)	20.31
Price for carcass weight in the base class[3] (€/kg)	
Bulls	2.89
Heifers	2.24
Cows	2.16
Price of pregnant breeding heifers (€/kg live weight)	1.52
Price of male breeding calf (€/animal)	1036
Price for dung (€/100 kg)	0.52
Fixed costs[4] (€/animal per day)	
Cows	1.54
Reared calves	0.52
Breeding heifers	0.62
Fattened bulls and heifers	1.02
Price for water (cent/100 l)	12.96
Price for straw for bedding (€/100 kg)	1.30
Annual discount rate	0.04

[1]SC = Somatic cells.

[2] 100 cents = 1 € = 38.593 SKK (average exchange rate for year 2005).

[3] S1 is the base class for carcasses quality.

[4]Fixed costs included labor, energy, fuels, reparations, insurance, interest of investments and overhead costs.

Table III. Marginal economic values of traits (in Euro per unit of the trait and per cow and year)

Trait	Alternative A			Alternative B		
	Variant 1	Variant 2	Variant 3	Variant 1	Variant 2	Variant 3
305d milk production (kg)	0.10	0.10	0.10	0.15	0.15	0.15
Fat content in milk (%)	-103.78	-103.93	-104.10	-21.09	-21.08	-21.09
Protein content in milk (%)	-14.82	-11.07	-7.36	-14.82	-11.07	-7.36
Somatic cell score (0.01 of score)	-3.72	-3.72	-3.72	-3.72	-3.72	-3.72
Calving performance (0.01 of class)	-0.11	-0.11	-0.11	-0.16	-0.16	-0.16
Losses of calves at calving (%)	1.09	1.09	1.09	1.09	1.09	1.09
Losses of calves till weaning (%)	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14
Conception rate of heifers (%)	0.37	0.37	0.37	0.37	0.37	0.37
Conception rate of cows (%)	3.30	3.30	3.30	2.96	2.96	2.97
Lifetime of cows (years)	44.66	44.73	44.53	59.72	59.82	59.65
Birth weight of calves (kg)	0.40	0.40	0.40	0.40	0.40	0.40
Mature weight of cows (kg)	-0.60	-0.60	-0.60	-0.60	-0.60	-0.60
Daily gain of calves in rearing (g/day)	0.22	0.22	0.22	0.22	0.22	0.22
Daily gain in fattening (g/day)	0.26	0.26	0.26	0.26	0.26	0.26
Dressing percentage (%)	6.23	6.24	6.24	6.23	6.24	6.24
Carcass conformation (0.01 of class)	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41
Fatness (0.01 of class)	0.03	0.03	0.03	0.03	0.03	0.03

Table IV. Relative economic values of traits (in percent of standardized economic value of 305-day milk yield)

Trait	Alternative A			Alternative B		
	Variant 1	Variant 2	Variant 3	Variant 1	Variant 2	Variant 3
Average milk yield	100	100	100	100	100	100
Milk fat content	-31.27	-31.32	-31.37	-4.34	-4.33	-4.33
Milk protein content	-1.88	-1.40	-0.93	-1.28	-0.96	-0.64
Somatic cell score	-0.52	-0.52	-0.52	-0.36	-0.36	-0.36
Calving performance	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Losses of calves at calving	4.05	4.07	4.06	2.76	2.78	2.77
Losses of calves till weaning	-0.42	-0.41	-0.42	-0.29	-0.28	-0.29
Conception rate of heifers	0.83	0.83	0.83	0.57	0.57	0.57
Conception rate of cows	9.84	9.84	9.85	6.04	6.04	6.04
Productive lifetime of cows	19.99	20.02	19.93	18.24	18.28	18.22
Birth weight of calves	0.97	0.97	0.97	0.66	0.66	0.66
Mature weight of cows	-15.58	-15.58	-15.58	-10.64	-10.64	-10.64
Daily gain in rearing of calves	20.02	20.02	20.02	13.66	13.66	13.66
Daily gain in fattening	18.33	18.33	18.33	12.51	12.51	12.51
Dressing percentage	10.60	10.60	10.61	7.24	7.24	7.24
Carcass conformation	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01
Fatness	0.00	0.00	0.00	0.00	0.00	0.00