Economic Importance of the Traits for Slovak Pinzgau Breed Reared in Dairy and Cow-calf System

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Summary

The bio-economic approach was used to calculate economic weights for twelve production (dairy and growth), functional and carcass traits of Slovak Pinzgau cattle raised in dairy (A) and cow-calf (B) system. The breeding heifers for own herd replacement with ten reproduction cycles at maximum was produced. The sale of surplus male and female calves was assumed after finishing of weaning period in both systems. Milk production is with quota limited in Slovakia, but the quotas limits aren't filling up if the whole dairy population is taken into account. In the system A, the base price per milk value was corrected according to the fat and protein content and somatic cells count. The marginal economic weights were calculated as the numeric derivation of the profit function. Marginal values were standardized (multiplied by the genetic standard deviation of the appropriate trait) and expressed as relative values (percentage proportion). The marginal economic weight for milk yield (+0.20 €) and for dressing percentage (+0.39 €) were the lowest in both systems. The highest marginal importance was found for production lifetime of cows in system A (+69.26 € per year and cow), and in system B (+52.55 € per year and cow), respectively. Functional traits achieved the highest marginal values in both systems. But the relative economic values for the functional traits complex represent only 37.04% in system A, and 73.52% in system B, respectively. The proportion of functional, production and carcass traits complexes was 37.04 : 62.73 : 0.23 in system A, and 73.52 : 26.07 : 0.41 in system B. The highest relative economic importance was observed for the 305 d milk production (37.70%) in system A and yearling weight (25.35%) in system B, respectively. Subsidies in the calculations were of positive effect on the profitability in the system B but it was not sufficient for positive profitability in the system A. The system A achieves negative profitability irrespective on assigned subsidies. The system B has positive profitability after accounting subsidies.

Key words

economic weights, Pinzgau breed, dairy system, cow-calf system

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Aim

The aim of the present study was to calculate the economic importance of production, functional and carcass traits for Slovak Pinzgau breed kept in dairy and cow-calf system.

Material and methods

The typically breeding area of purebred Slovak Pinzgau cattle is concentrated in the mountainous regions with an altitude frequently exceeding 900 m. Pinzgau breed is registered by the UN FAO as threatened with extinction and it is classified as Animal Genetic Resource – AnGR since 1994 (Kadlečík et al., 2008). Number of purebred cows is less than 2000. Number of breeding cows in herd varied form 35 for cow-calf system to 100 in dairy system.

The economic weights were calculated separately for dairy (system A) and cow-calf population (system B). The indoor system with box housing and complete feed mixture was used in system A. The traditional Central European pasture system with spring calving and autumn weaning was applied in system B. All surplus calves were sold after rearing and weaning period in both systems. Calculations of economic values were based on the production and economic data of Pinzgau breed in the year 2009. The most of economic input parameters represent the values taken from: four dairy and three cow-calf farms co-operated with The Animal Production Research Centre Nitra (unpublished data).

The main input parameters for both production systems are shown in Table 1. The structures of cow herds were calculated using Markov chains as described by Wolf et al. (2010) and Wolfová et al. (2005). The ten reproduction cycles were assumed at the maximum for both systems. The economic weights were calculated for:

Functional traits: conception rate of heifers (%), conception rate of cows (%), mean class for calving difficulty (class), losses of calves at calving (%), losses of calves from 48 hours till weaning (%), lifetime of cows (years);
Carcass traits: dressing percentage (%);
Growth traits: birth weight of calves (kg), mature weight of cows (kg);
Production traits in system A: 305d milk yield (kg), milk fat content (%), milk protein content (%)
Production traits in system B: weight of calves at 120d of age (kg), weaning weight of calves (at 210 d of age, in kg), yearling weight (at 365d of age, in kg)

The revenues came from sale of reared calves, milk and manure (system A), from sale of weaned calves, breeding bulls, pregnant heifers, culled cows and heifers and manure (system B) and from governmental subsidies (both systems).

Costs for housing, feeding, breeding, veterinary treatment and fixed costs (labour, energy, reparations, insurance, fuels, overhead) were calculated for each category of animals. The profit calculated as the difference between revenues and costs per calving in the herd and per year (both revenues and costs discounted to the birth year of progeny by the discount rate of 2%) was used as criterion for the economic efficiency in both systems.

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 with breeders and average market prices in the Slovak Republic. The marginal EW expressed in Euro per standard female unit (SFU) and year were standardised (multiplied by the genetic standard deviations of the trait). All values of standard deviations were not available for the local cattle population, therefore values provided by Wolfová et al. (2007), Miesenberger (1997), Koots and Gibson (1998), Coopman et al. (1999), Amer et al. (2002), Hradecká (2002), Brumatti et al. (2002) and Přibyl et al. (2003) were used in the calculations. Relative economic value for each trait was calculated as percentage proportion of standardized economic value on the total economic importance all of traits evaluated for the given production system. For more details see Krupa et al. (2005) and Krupová et al. (2009). The ECOWEIGHT package, module EWBC version 2.1.2 and EWDC version 2.0.4 (Wolf et al., 2010) was used for calculation of economic weights.

Table 1. Main input characteristics for both systems

Variable (unit)	Dairy system	Cow–calf system
Number of reproduction cycles (sum)	10	10
Cow losses (excluding dystocia) (%)	22	21
Culling rate of cows due to dystocia (%)	2	0
Average conception rate of cows (%)	68	79
Average conception rate of heifers (%)	75	86
Peak of milk yield during milk period (kg/day)	22	10
Fat content in milk (%)	4.0	4.1
Protein content in milk (%)	3.30	3.35

Results and discussion

Results from the calculation of herd structure varied between the systems. The proportion of cows at first reproduction cycle was 30.74% and 22.69% for system A and B, respectively. The 50% of cows was on first and third reproduction cycle in system B but on first and second cycle in system A. Likewise average lifetime of cows in number of calvings differed for dairy (3.25 years) and cow-calves (4.41 years) system.

Marginal economic value expresses the change in the total profit per calving and year generated by increasing the trait level due to breeding. Marginal economic values of traits calculated for system A and B are shown in Table 2 and 3, respectively. For most of evaluated traits the positive economic values were calculated. Mean class of calving difficulty, losses of calves and mature weight of cows were only of negative economic importance in both systems. Negative values of traits assume the reduction in profit. For example increase of calving difficulty by 0.1 of class decrease the total profit of 1.11 € and of 2.07 € per SFU and year in system A and B, respectively mainly due to higher veterinary costs. Contrary, lifetime of cows obtained the highest positive marginal economic importance in system A (+69.26 €) and B (+52.55 €) due to reduction of cost for replacements and increasing of revenues per cow life. Compared to other breed populations (Holstein, Slovak Spotted) raised in Slovak Republic the economic importance of lifetime of cows for Pinzgau breed was a slightly lower (Krupa et al., 2005; Krupová et al., 2009). We supposed that it is particularly caused by a lower milk production of Slovak Pinzgau breed and relatively high value of average lifetime of cows. Therefore increase of longevity of Pinzgau cows led to slightly lower economic change then for Holstein and Spotted cows.

Generally, economic values of traits between dairy and cow-calves system do not differ very significantly. The biggest difference was detected only for lifetime of cows (+16.71 € in system A) followed by losses of calves at calving (+5.11 € in system B) and losses of calves till weaning (+5.01 € in system B). The traits like mature weight of cows, dressing percentage or conception rate of heifers achieved similar importance in both systems. A higher economic importance of the traits was found out in system B, except of mature weight of cows, conception rate of cows and lifetime of cows. These three traits reached a slightly higher importance in system A.

Calculation of marginal economic weights is necessary for expression of economic importance of individual traits. Ranking of animals for selection should be based upon a more selection parameters. As the traits are measured in different units (kg, g, year) and direct comparison of economic importance is not possible, the relative economic values are calculated (expressed in %). The highest relative importance was found for the average milk yield (37.70%) followed by conception rate of cows (16.38%) and lifetime of cows (12.23%) in system A and for live weight at 365 days (25.35%) followed by live weight at 210 days (15.21%) and conception rate of cows (9.02%) in system B. Low economic value of calving performance (0.03% and 0.06% for system A and B, respectively) point out that herd performance is relatively high as showed Albera et al. (2002). Small economic importance was also identified for dressing percentage. The economic importance of this trait is strongly joined with the marketing strategy practised in Slovakia. The economic importance increased if the selling of surplus calves to slaughter house or fattening is assumed in simulated system (Krupa et al., 2005).

Summing-up the proportion of functional, production and carcass traits, the final ratio is follows: 37.04 : 62.73 : 0.23 in system A, and 73.52 : 26.07 : 0.41 for system B. In system A, the complex of economic values for production traits was two times higher than complex of functional traits. Contrary, the complex of functional traits was almost three times higher than production trait in system B. The carcass trait had negligible importance in both systems. From the presented results we can conclude, that the system A is more influenced by lower number of traits included in the evaluation, by practised milk payment system and by milk component content (Wolfová et al., 2007; Krupová et al., 2009). On the other side, in the system B the trait complex is combination of several production and functional traits. Their ratio could vary depending on assumed marketing strategies (Kahi and Nitter, 2004; Krupa et al., 2005). Based on the relative economic values of the traits, the production index can cover the traits: average milk yield, milk fat content and milk protein content in system A and average live weight at 210 days in system B.

The herd economic characteristics for both systems are shown in Table 4. Structure of revenues and cost vary between the systems. Both systems were depending on payment system of main product and marketing strategy. Total revenues reached 1453.92 € and 902.74 € for system A and system B, respectively. The difference in total costs between the systems was significant. The higher costs in system A was caused by higher nutrient requirement of dairy cows. Achieved revenues did not reached level of costs for both systems. This status is due to the bad situation with milk price in system A and lower production of calves per

Table 2. Marginal and standardized economic weights for dairy system

Trait	Marginal EW* (€)	Relative EW* (%)
Mean class of calving difficulty (0.1 class/SFU**)	−1.11	0.03
Losses of calves at calving (%/SFU)	−0.94	1.35
Losses of calves till weaning (%/SFU)	−1.78	2.43
Mature weight of cows (kg/SFU)	−0.65	6.24
Birth weight of calves (kg/SFU)	+0.75	0.70
Dressing percentage (%/SFU)	+0.35	0.22
Conception rate of heifers (%/SFU)	+2.48	2.05
Conception rate of cows (%/SFU)	+14.89	16.38
Average milk yield (kg/SFU)	+0.20	37.70
Milk fat content (%/SFU)	+1.01	9.81
Milk protein content (%/SFU)	+1.65	10.86
Lifetime of cows (year/SFU)	+69.26	12.23

* Economic Weight; ** Standard Female Unit

Table 3. Marginal and standardized economic weights for cow-calf system

Trait	Marginal EW* (€)	Relative EW* (%)
Mean class of calving difficulty (class/SFU**)	−2.07	0.06
Losses of calves at calving (%/SFU)	−6.05	8.42
Losses of calves till weaning (%/SFU)	−6.79	9.01
Mature weight of cows (kg/SFU)	−0.43	4.00
Birth weight of calves (kg/SFU)	+1.09	0.99
Dressing percentage (%/SFU)	+0.39	0.24
Conception rate of heifers (%/SFU)	+2.61	2.09
Conception rate of cows (%/SFU)	+13.36	14.29
Live weight at 120 days (kg/SFU)	+1.74	11.34
Live weight at 210 days(kg/SFU)	+1.62	15.21
Live weight at 365 days (kg/SFU)	+1.80	25.35
Lifetime of cows (year/SFU)	+52.55	9.02

* Economic Weight; ** Standard Female Unit

Table 4. Economic characteristics of both system (in €)

Economic characteristics (€)	Dairy system	Cow–Calf system
Total revenues (cow/year)	1453.92	902.74
Total subsidies (cow/year)	91.05	796.88
Total costs (cow/year)	1736.50	1074.34
Profit (cow/year)	−191.53	+696.87
Profitability ratio A* (%)	−16.27	−9.31
Profitability ratio B** (%)	−11.03	+64.86

*profitability ratio is calculated as the present value of profit per cow per year and given in per cent and not including subsidies; **profitability ratio is calculated as the present value of profit per cow per year and given in per cent and including subsidies cow in system B. The cost effectiveness was expressed as profitability ratio. The only system B reached positive profit after accounting of subsidies. In this system for every 100 Euros of costs the profit of 64.86 Euros was achieved.

Conclusions

The relative high economic importance of average milk yield, fat and protein content is probably caused by relative low milk production of Slovak Pinzgau breed. This breed is classified as AnGR. To address the vulnerability of this breed, it is necessary focus on those traits that relate to the survival of Slovak Pinzgau breed. It is required the breeding objectives to focus on improving of reproduction traits of cows and on increasing of stay ability of calves in both systems. To achieve this objective it will be necessary to use not only traditional way of breeding, but also modern breeding methods.

Referrences

Albera A., Carnier P., Groen A.F. (2002): Economic values for beef traits in Piemontese cattle. In: Proceedings of the 7th WCGALP, Montpellier (CD-ROM), Com. No. 02-22.

Amer P.R., Roughsedge T., Simm G. (2002): Cow herd population dynamics in a model for economic comparison of beef breeds and crossing systems. In: Proceedings of the 7th WCGALP, Montpellier (CD-ROM), Com. No. 23-21.

Brumatti R. C., Ferraz J. B. S., Formigoni I. B., Eler J. P. (2002): Aplication of bioeconomical model to estimate economical weights for traits used in selection index in beef cattle. In: Proceedings of the 7th WCGALP, Montpellier (CD ROM), Com. No. 23-19.

Coopman F., Krafft A., Gengler N. (1999): Definition of a modern breeding goal in Belgian Blue cattle. Interbull Bulletin No. 23: 47-53. Hradecká E. (2002): Odhady plemenné hodnoty pro obtížnost telení. Thesis, ZF JU v Českých Budějovicích, 144 pp.

Kadlečík, O., Kasarda, R., Mészáros, G. (2008) Inbreeding in purebred Slovak Pinzgau dualpurpose cattle population. Archiva Zootechnica, 2008, vol. 11, (2), p. 21-28.

Kahi A.K., Nitter G. (2004): Developing breeding schemes for pasture based dairy production systems in Kenya. I. Derivation of economic values using profit functions. Liv. Prod. Sci. 88: 161–177.

Koots K.R., Gibson J.P., (1998): Economic values for beef production traits from a herd level bioeconomic model. Can. J. Anim. Sci. 78: 29-45.

Krupa, E., Wolfová, M., Peškovičová, D., Huba, J., Krupová, Z. (2005): Economic Values of Traits for Slovakian Pied Cattle Under Different Marketing Strategies. Czech. J. Anim. Sci., 50: 483-492.

Krupová, Z., Huba, J., Daňo, J., Krupa, E., Oravcová, M., Peškovičová, D. (2009): Economic weights of production and functional traits in dairy cattle under a direct subsidy regime. Czech J. Anim. Sci., 54: 249–259.

Miesenberger, J. (1997): Zuchtzieldefinition und Indexselektion für die österreichische Rinderzucht. Dissertation. Universität für Bodenkultur Wien, 186 p.

Petrikovič P., Hrdina, M. Hosťovecký, M. (2003): Feedman – User manual to program. Ver. 09/2003. AGRARIS Nitra, SK, 78 p.

Přibyl J., Misztal I., Přibylová J., Šeba, K. (2003): Multiple-breed, multiple-traits evaluation of beef cattle in the Czech Republic. Czech. J. Anim. Sci., 48: 519–532.

Wolf J., Wolfová M., Krupa E. (2010): Users Manual for the program ECOWEIGHT (C program for calculating economic weights in livestock), Version 5.0.2. Part 1: Program EWBC (Version 2.1.3) and EWDC (Version 2.0.5) for cattle. Research Institute of Animal Production, Prague-Uhříněves.

Wolfová M., Wolf J., Přibyl J., Zahrádková R., Kica J. (2005): Breeding objectives for beef cattle used in different production systems. 1. Model development. Livest. Prod. Sci., 95: 201-215.

Wolfová M., Wolf J., Přibyl J.(2007): Impact of milk pricing system on the economic response to selection on milk components. J. Anim. Breed. Genet., 124: 192-200.

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