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INFLUENCE OF DIFFERENT FEEDLOT TYPES ON ECONOMIC WEIGHTS OF CURRENT AND PREDICTED SYSTEMS FOR CHAROLAIS BREED USING BIOECONOMICAL APPROACH

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Abstract

The economic weights (EW) of 13 production and function traits for Charolais cattle raised in Slovakia were calculated. Two different fattening systems – intensive feedlot in bind (Fed1) and in free technology (Fed2) and three different slaughter weights – 350 kg (A), 550 kg (B), 650 kg (C) were simulated. EWs for current production system (2005) and for the future production system (2010) were calculated. The economic weights were expressed in Slovak crowns (1 Euro = 37.50 Sk). The economic importance of evaluated traits were little bit higher in all feedlots types for production system in 2010 year, except EW for average daily gain during fattening period. The EW for average daily gain during fattening period were +1.56, +4.66 ,+7.61 ,+1.58 ,+4.74 ,+7.68 Sk per 1 g for Fed1A, Fed1B, Fed1C, Fed2A, Fed2B, Fed2C in 2005 year per year and standard female unit, respectively. The highest difference in EW within one trait for different alternatives were found out for EW of conception rate of cows and average daily gain in fattening for 2005 and 2010, respectively. The different influences of feedlot types on EW were observed mainly for functional traits and average daily gain during fattening period.

Introduction

The base objective of genetic improvement of livestock is increasing of economic efficiency of production (Albera a kol., 2004), which is represented by various traits. These traits are included in breeding goals and carried out by breeding programs. Choice of traits, included in program is mainly depended on the proportion of appropriate trait on total production efficiency usually evaluated from economic point of view. Requirements for set up of breeding goal are carrying out in aggregate genotype, which is representation of evaluated breeding values for traits and their relative economic importance. Design of aggregate genotype also should reflect differences between eventual alternatives due to natural conditions or management of herd and marketing strategies. Breeding values accomplished

these requirements, when the environmental effects are considered. The differences due to eventual various conditions are developed little bit less for calculation of economic weights.

Many papers were dedicated to calculation of economic weights (EW) for beef cattle. Phocas et al. (1998) calculated EWs for more than 20 most important traits for Limousine cattle. Wolfová et al. (2005) found out economic weights for functional, growth and carcass traits of Charolais cattle raised in Czech Republic raised in middle European conditions. Krupa et al. (2005) calculated EWs for Slovak Simmental cattle. Studies especially concentrated to fattening systems were also published. Lamb et al. (1992) simulated the feedlot segment of an integrated beef production system. They evaluated different biological and economical efficiency for two various slaughter weights. Hirooka et al. (1998) estimated biological and economic values using by deterministic bio-economical model for feedlot production system under alternative circumstances. According their results, increasing of marbling score was most beneficial in feedlot system. Decreasing slaughter weight resulted in negative economic values of daily gain and weaning weight.

The goal of this study was compare the economic importance of growth, carcass and functional traits for Charolais breed raised in the Slovak Republic in different alternatives of integrated feedlot types and different slaughter weights for current (2005) and predicted (2010) production systems.

Material and Method

The economic weights (EW) of the following 13 traits for Charolais cattle raised in Slovakia were calculated:

- growth traits - average daily gain (ADG) of calves from birth to 120 days, from 120 to 210 days, from 210 to 365 days and during fattening period
- functional traits - mean class for calving performance, losses of calves: at calving, losses of calves: 48 hours till weaning, conception rate of heifers and cows and average lifetime of cows
- carcass traits – dressing percentage, mean class of fleshiness, mean class of fat covering

The traditional middle European calf-cow system with intensive feedlot was assumed (for details of herd management, see Krupa et al., 2005). Two different fattening alternatives – intensive feedlot in bind technology (Fed1) and intensive feedlot in free technology (Fed2), for three various slaughter weights - 350 kg (A), 550 kg (B) and 650 kg (C) were simulated. Growth and feeding parameters for feedlots are displayed in Table I. EW for current production system (2005) and for the future production system (2010) were calculated. The main characteristics of production systems are given in Table II.

Revenues from slaughtered animals depend on the slaughter weight, dressing percentage and payment for carcass body (based on EUROP grading system). 16.4 % growth of costs and prices for predicted system in 2010 was assumed. For the predicted production system in 2010, yearly genetic improvement of average daily gain in fattening (120 g), equal genetic standard deviation was assumed. The economic weights were expressed in Slovak crowns (1 Euro = 37.50 SKK) per unit of appropriate trait and per standard female unit (SFU). Economic weights were calculated using ECOWEIGHT program – module EWBC (Wolf et al., 2003). Differences of marginal economic weights within the traits among feedlot alternatives in 2005 and 2010 respectively were expressed to Fed1B feedlot. This system (bind system fattening to 550 kg) is currently the mostly used in Charolais population in Slovakia.

Results and Discussion

Marginal economic weights for production system in 2005 year are shown in Table III. The highest EW was calculated for average lifetime of cows and for Fed1A alternative (+1820.27 SKK/year and SFU). In our previous study (Krupa et al., 2005) we also found out the highest EW for this trait. Increasing of slaughter weight to 550 or 650 kg resulted in decreasing economic importance for majority of studied traits. The situation was different only for carcass traits and ADG in fattening period. Increasing of slaughter weight caused increasing of EWs for dressing percentage (+164.11 SKK/%, +250.82 SKK/%, +291.10 SKK/% for Fed1A, Fed1B, Fed1C, respectively), and for mean class of fleshiness and fat covering. Neither increasing nor decreasing EWs for ADG from birth to 120 days and EW for ADG from 120 to 210 days were observed with increasing of slaughter weight. The highest EWs, for both traits reached animals in alternative A (+2.16 SKK/g in Fed1, +2.15 SKK/g in Fed2 and identically +1.76 SKK/g for Fed1 and Fed2). The middle EWs was found out for animals with highest slaughter weight and the lowest EWs reached animals with 550 kg slaughter weight. Differences between technologies used in feedlots were low in 2005-year production system. Most of the EWs were higher in bind technology. Breeding technology alternatives did not influence EWs of carcass traits.

Economic weights of traits for predicted production system (year 2010) are shown in Table IV. Similarly to 2005, the highest economic importance was found for average lifetime of cows (from +1851.59 SKK/year for Fed2C to +2123.91 SKK/year for Fed1A). On the other hand the situation was different from current production system when different slaughter weights were token into account. Increasing slaughter weight resulted in decreasing of EWs only for ADG from 210 to 365 days, conception rate of cows and average lifetime of cows.

Increasing importance were observed for the same traits as for current system. Increasing slaughter weight did not uniformly influence the next 6 traits. From A to B alternative EWs increased and then economic importance fell down. Differences between technologies used in feedlot were the same as in 2005 year. The economic importance of traits were stronger in current production system for all traits except for ADG from birth to 120 days and ADG in fattening period. EWs for ADG from 120 to 210 days were stronger in current system except of EW in Fed2B.

Tables V and VI figure differences among feedlot alternatives for the traits studied expressed in % relatively to Fed1B (100%) alternative within each trait. Higher differences among alternatives in the current production system were observed. EW in Fed1B (100%) alternative for conception rate of cows was almost ones time higher than EW in Fed1A (+93.39 %), almost ones time smaller than EW in Fed1C (-97.88 %) and more than ones time smaller as EW in Fed2C (-113.55 %). Relative differences for the same trait in predicted system in 2010 were +14.50 % for EW in Fed1A, -32.18 % for EW in Fed1C and -38.91 % for EW in Fed2C.

Conclusions

Economic weights were sensitive on different feedlot types. Differences due to various alternatives of feedlot were stronger for current production system in the most of the part of traits studied. As there are substantial differences in the economic importance of traits for different alternatives of feedlot, it will be beneficial to construct different production indices for Charolais cattle (in pure-breeding systems) that will allow farmers to choose the best breeding animals according their breeding system and marketing strategy

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Table I. Growth and feeding parameters for different feedlot systems.

Parameter	Year 2005			Year 2010		
	Type A	Type B	Type C	Type A	Type B	Type C
Average daily gain during fattening period – bulls (g)	1300	1400	1300	1400	1500	1400
Average daily gain during fattening period – heifers (g)	1200	1300	1200	1300	1400	1300
Dry matter in feed for bulls in feedlot (%)	46%	48%	47%	50%	49%	48%
Dry matter in feed for heifers in feedlot (%)	43%	37%	37%	43%	34%	34%
Net energy content in dietary for bulls in feedlot (MJ/kg of dry matter)	6.64	6.70	6.83	6.73	6.80	6.94
Net energy content in dietary for heifers in feedlot (MJ/kg of dry matter)	5.95	5.64	5.67	6.14	6.13	6.23
Protein content in dietary for bulls in feedlot (g/kg of dry matter)	87.26	82.25	77.49	87.60	83.31	79.31
Protein content in dietary for heifers in feedlot (g/kg of dry matter)	78.51	69.43	69.30	83.98	76.84	77.01

A = fattening to 350 kg of male (bulls, castrates) live weight and 320 kg of female (heifers) live weight
B = fattening to 550 kg of male (bulls, castrates) live weight and 500 kg of female (heifers) live weight
C = fattening to 650 kg of male (bulls, castrates) live weight and 600 kg of female (heifers) live weight

Table II. Main differences in input parameters between production systems (2005 and 2010-year)

Parameter	Year 2005	Year 2010
Fixed costs (SKK/day): cow and calf in summer	36.00	41.00
breeding bull in herd	36.40	39.60
bull in intensive feedlot	39.40	42.00
heifer in intensive feedlot	39.40	42.00
Veterinary costs (SKK/day): cow and calf in summer	1000.00	1200.00
breeding bull in herd	530	650.00
bull in intensive feedlot	277	318
heifer in intensive feedlot	277	318
Maximum price for carcass bull in carcass weight (SKK/kg)	98.28	112.28
Maximum price for carcass heifer in carcass weight (SKK/kg)	70.00	79.94

1 Euro = 37.50 SKK

Table III. Economic weights (marginal economic values) of traits under different fattening types for current production system (2005 year).

Trait	Bind (1)			Free (2)		
	Type 1A	Type 1B	Type 1C	Type 2A	Type 2B	Type 2C
Mean class for calving performance (SKK/0.01 class)	-14.14	-12.56	-8.95	-14.09	-12.40	-8.57
Losses of calves at calving (SKK/ %)	-83.87	-80.80	-60.69	-83.65	-80.12	-59.20
Losses of calves from 48 hours till weaning (SKK/%)	-76.20	-69.92	-50.42	-75.94	-69.14	-48.60
ADG of calves from birth to 120 days (SKK/1g)	+2.16	+1.84	+2.06	+2.15	+1.81	+2.07
ADG of calves from 120 to 210 days (SKK/1g)	+1.76	+1.52	+1.69	+1.76	+1.45	+1.70
ADG of calves from 210 to 365 days (SKK/1g)	+1.50	+1.45	+1.41	+1.50	+1.45	+1.40
ADG in fattening (SKK/1g)	+1.56	+4.66	+7.61	+1.58	+4.74	+7.68
Dressing percentage (SKK/%)	+164.11	+250.82	+291.10	+164.11	+250.82	+291.10
Conception rate of heifers (SKK/%)	+15.47	+11.71	+7.79	+15.42	+11.45	+7.15
Conception rate of cows (SKK/%)	+58.50	+30.25	+0.64	+58.10	+28.24	-4.10
Mean class of fleshiness (SKK/0.01 class)	+8.61	+11.49	+12.83	+8.61	+11.49	+12.83
Mean class of fat covering (SKK/0.01 class)	+5.59	+7.48	+8.32	+5.59	+7.48	+8.32
Average lifetime of cows (SKK/year)	+1820.27	+1605.79	+1372.83	+1817.05	+1589.72	+1334.27

A = fattening to 350 kg of male (bulls, castrates) live weight and 320 kg of female (heifers) live weight
B = fattening to 550 kg of male (bulls, castrates) live weight and 500 kg of female (heifers) live weight
C = fattening to 650 kg of male (bulls, castrates) live weight and 600 kg of female (heifers) live weight

Table IV. Economic weights (marginal economic values) of traits under different fattening types for predicted production system (2010 year).

Trait	Bind (1)			Free (2)		
	Type 1A	Type 1B	Type 1C	Type 2A	Type 2B	Type 2C
Mean class for calving performance (SKK/0.01 class)	-16.85	-17.10	-14.60	-16.75	-16.93	-14.25
Losses of calves at calving (SKK/ %)	-100.70	-106.27	-92.35	-100.24	-105.56	-90.96
Losses of calves from 48 hours till weaning (SKK/%)	-91.11	-94.01	-80.53	-90.66	-93.16	-78.84
ADG of calves from birth to 120 days (SKK/1g)	+2.12	+1.82	+1.99	+2.12	+1.79	+2.00
ADG of calves from 120 to 210 days (SKK/1g)	+1.74	+1.51	+1.65	+1.74	+1.49	+1.65
ADG of calves from 210 to 365 days (SKK/1g)	+1.76	+1.74	+1.71	+1.76	+1.73	+1.70
ADG in fattening (SKK/1g)	+1.45	+4.26	+6.97	+1.47	+4.31	+7.03
Dressing percentage (SKK/%)	+187.50	+284.16	+332.90	+187.50	+284.16	+332.90
Conception rate of heifers (SKK/%)	+18.46	+17.23	+14.51	+18.32	+16.96	+13.94
Conception rate of cows (SKK/%)	+73.12	+63.86	+43.31	+72.06	+61.76	+39.01
Mean class of fleshiness (SKK/0.01 class)	+9.83	+13.04	+14.66	+9.83	+13.04	+14.66
Mean class of fat covering (SKK/0.01 class)	+6.39	+8.45	+9.51	+6.39	+8.45	+9.51
Average lifetime of cows (SKK/year)	+2123.91	+2050.01	+1885.33	+2117.49	+2033.94	+1851.59

A = fattening to 350 kg of male (bulls, castrates) live weight and 320 kg of female (heifers) live weight
B = fattening to 550 kg of male (bulls, castrates) live weight and 500 kg of female (heifers) live weight
C = fattening to 650 kg of male (bulls, castrates) live weight and 600 kg of female (heifers) live weight

Table V. Relative importance (%) of marginal economic values within traits (lines in table) comparing to FED1B system for current production system (2005-year).

Trait	Bind (1)			Free (2)		
	Type 1A	Type 1B	Type 1C	Type 2A	Type 2B	Type 2C
Mean class for calving performance (SKK/0.01 class)	112.58	100.00	71.26	112.18	98.73	68.23
Losses of calves at calving (SKK/ %)	103.80	100.00	75.11	103.53	99.16	73.27
Losses of calves from 48 hours till weaning (SKK/%)	108.98	100.00	72.11	108.61	98.88	69.51
ADG of calves from birth to 120 days (SKK/1g)	117.39	100.00	111.96	116.85	98.37	112.50
ADG of calves from 120 to 210 days (SKK/1g)	115.79	100.00	111.18	115.79	95.39	111.84
ADG of calves from 210 to 365 days (SKK/1g)	103.45	100.00	97.24	103.45	100.00	96.55
ADG in fattening (SKK/1g)	33.48	100.00	163.30	33.91	101.72	164.81
Dressing percentage (SKK/%)	65.43	100.00	116.06	65.43	100.00	116.06
Conception rate of heifers (SKK/%)	132.11	100.00	66.52	131.68	97.78	61.06
Conception rate of cows (SKK/%)	193.39	100.00	2.12	192.07	93.36	113.55
Mean class of fleshiness (SKK/0.01 class)	74.93	100.00	111.66	74.93	100.00	111.66
Mean class of fat covering (SKK/0.01 class)	74.73	100.00	111.23	74.73	100.00	111.23
Average lifetime of cows (SKK/year)	113.36	100.00	85.49	113.16	99.00	83.09

A = fattening to 350 kg of male (bulls, castrates) live weight and 320 kg of female (heifers) live weight
B = fattening to 550 kg of male (bulls, castrates) live weight and 500 kg of female (heifers) live weight
C = fattening to 650 kg of male (bulls, castrates) live weight and 600 kg of female (heifers) live weight

Table VI. Relative importance (%) of marginal economic values within traits (lines in table) comparing to FED1B system for predicted production system (2010-year).

Trait	Bind (1)			Free (2)		
	Type 1A	Type 1B	Type 1C	Type 2A	Type 2B	Type 2C
Mean class for calving performance (SKK/0.01 class)	98.54	100	85.38	97.95	99.01	83.33
Losses of calves at calving (SKK/ %)	94.76	100	86.9	94.33	99.33	85.59
Losses of calves from 48 hours till weaning (SKK/%)	96.92	100	85.66	96.44	99.1	83.86
ADG of calves from birth to 120 days (SKK/1g)	116.48	100	109.34	116.48	98.35	109.89
ADG of calves from 120 to 210 days (SKK/1g)	115.23	100	109.27	115.23	98.68	109.27
ADG of calves from 210 to 365 days (SKK/1g)	101.15	100	98.28	101.15	99.43	97.7
ADG in fattening (SKK/1g)	34.04	100	163.62	34.51	101.17	165.02
Dressing percentage (SKK/%)	65.98	100	117.15	65.98	100	117.15
Conception rate of heifers (SKK/%)	107.14	100	84.21	106.33	98.43	80.91
Conception rate of cows (SKK/%)	114.5	100	67.82	112.84	96.71	61.09
Mean class of fleshiness (SKK/0.01 class)	75.38	100	112.42	75.38	100	112.42
Mean class of fat covering (SKK/0.01 class)	75.62	100	112.54	75.62	100	112.54
Average lifetime of cows (SKK/year)	103.6	100	91.97	103.29	99.22	90.32

A = fattening to 350 kg of male (bulls, castrates) live weight and 320 kg of female (heifers) live weight
B = fattening to 550 kg of male (bulls, castrates) live weight and 500 kg of female (heifers) live weight
C = fattening to 650 kg of male (bulls, castrates) live weight and 600 kg of female (heifers) live weight