Agricultura 7: 15-22 (2010)

Production efficiency of rearing calves for organic veal "*Pohorje beef*" trade mark

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Growth rate (net daily gain of warm carcass weight) and carcass quality were analysed for suckling calves of trade mark *"Pohorje beef"* (N=634) i.e., older calves (8-12 months old) of Simmental×Limousin crossing reared on organic farms of Pohorje and Kozjak (Slovenia). Data for slaughter age, carcass weight, conformation and fatness grades were collected. *"Pohorje beef"* was compared to older calves of various genotypes and rearing systems (N=2980) and older beef cattle from the same, organic farms (N=271). At slaughter, *"Pohorje beef"* males were 324 days old with 220 kg of warm carcass weight (682 g/day net daily gain), whereas *"Pohorje beef"* females were 332 days old and had 187 kg of carcass weight (567 g/day). *"Pohorje beef"* had better net daily gain and conformation compared to pure bred calves of various rearing systems, while the differences with meat crosses were insignificant. The comparison of *"Pohorje beef"* to older beef cattle category of the same genotype reared on the same farms showed that under the circumstances (no concentrates added) prolonged rearing was not economical due to growth stagnation. At current price, only about a half of total costs of *"Pohorje beef"* veal is covered. Such rearing becomes cost-effective when various subsidies are added. However, even in that case the herd size must be about 20 suckling cows.

Key word: suckling calves, organic rearing, growth rate, carcass quality, costs analysis

INTRODUCTION

Trade-mark *"Pohorje beef"* designates meat of special quality obtained from older suckling calves (8-12 months old), the crossbreeds of Simmental cows with Limousin bulls, reared on organic farms of Pohorje and Kozjak, a hilly region at North-East of Slovenia. According to the literature, organic farming *per se* does not have a major effect on the growth rate and carcass quality of cattle. Studies show that growth rate and carcass quality of animals depends on the intensity of the rearing system and nutrition (Keane et al. 1998, Sami et al. 2004, Cerdeño et al. 2006, Dannenberger et al. 2006). Important differences arise also from the genotype (Marshall 1994, Kögel et al. 2000, Alberti et al. 2005, Dannenberger et al. 2006, Grodzki et a. 2006) and from the differences between males and females within a breed (Kögel et al. 2000, Crews et al. 2001). In 2008, the EU legislation adopted a new regulation (Council regulation 700/2007) for better regulation of beef market and consumer protection in in view of meat production from so called older calves production (8-12 months of age). Meat of older calves is considered of special or better quality, as demonstrated by many products with protected geographical designations in the EU (EU agricultural product quality policy 2008). In Slovenia, a case of such special type of veal was protected more than ten years ago as a trade mark; however there is few data regarding production and economical efficiency of such rearing. The aim of the current study was to analyse growth and carcass quality traits of calves bearing the trade mark *"Pohorje beef"* and to compare them to the results of i) other older calves of different genotypes and rearing conditions and to the results of ii) young beef cattle of the same genotype from the same organic farms. Additionally, the economic efficiency of rearing older calves for *"Pohorje beef"* was evaluated.

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MATERIALS AND METHODS

Animals

Current study consisted from data collection for three groups of beef cattle which were slaughtered in the period of five years (2003-2008) in different commercial abattoirs. The first group comprised 634 older calves reared according to the rules for trademark *"Pohorje beef"* (age category older calves, i.e., 8 to 12 months old, Simmental×Limousin (SIM×LIM) crossbreed, suckling calves, organic farming). *"Pohorje beef"* calves were compared to two different groups of animals for growth rate and carcass quality. The first comparative group comprised older calves (N=2,980) reared in different regions of Slovenia in diverse rearing conditions with heterogeneous nutrition and management. The analysis comprised only sufficiently represented older calves (N>100) according to the breed or crossbreed; thus the analysis included purebred older calves of Simmental (SIM; N=1456), Brown (BR; N=202) and Holstein (HOL; N=774) breed and commercial meat crosses of Simmental (N=351) or Brown (N=197) cow with bulls of meat breeds (×M). The second comparative group comprised beef cattle (N=271) between 12 and 24 months of age (bulls) or between 12 and 30 months of age (heifers), SIM×LIM crosses reared on the same organic farms (EKO beef).

Growth and carcass quality traits

For each animal included in the analysis the origin, rearing location, age and breed/crossing were obtained from the Central Cattle Database located at the Agricultural Institute of Slovenia. Carcass quality data were obtained from the Slovenian official classification body Bureau Veritas. Data on carcass quality comprised warm carcass weight and subjective grades for conformation (P-1 – lowest conformation, O-2, R-3, U-4 or E-5 – highest conformation) and fatness (1– lowest fatness to 5 – highest fatness). On the basis of warm carcass weight and age at slaughter daily gain of warm carcass weight (net daily gain) was calculated as an indicator of growth intensity. Additionally, we analysed the changes in the net daily gains from two aspects, i) overall net daily gain (from birth to slaughter) per age and ii) net daily gain within a two months period.

Statistical analysis for growth and carcass quality traits

Statistical analysis was performed using statistical package SAS (SAS 2002). Procedure *FREQ* with $\chi 2$ test (option CHISQ) was used for frequency distributions according to conformation and fatness. Analysis of variance (*MIXED* procedure) was used to compare *"Pohorje beef"* calves with i) other older calves and ii) with beef cattle from the same organic farms.

i) Comparison of *"Pohorje beef"* calves to other older calves of different genotypes:

$$Y_{ijkl} = \mu + G_i + S_j + (G \times S)_{ij} + b \times CW_{ijk} + e_{ijkl} \quad (1)$$

Where:

Y_{ijk} – studied trait,
μ – mean,
G_i – the effect of genotype,
S_j – the effect of sex,
$(G \times S)_{ij}$ – the effect of interaction between genotype and sex,
b – regression coefficient,
CW – warm carcass weight (only for conformation and fatness),
e_{ijk} – random error.

ii) Comparison of *"Pohorje beef"* calves to organic beef cattle:

$$Y_{ijkl} = \mu + C_i + S_j + (C \times S)_{ij} + b \times CW_{ijk} + e_{ijkl} \quad (2)$$

Where:

Y_{ijk} – studied trait,
μ – mean,
C_i – the effect of category,
S_j – the effect of sex,,
$(C \times S)_{ij}$ – the effect of interaction between category and sex,
b – regression coefficient,
CW – warm carcass weight (only for conformation and fatness),
e_{ijk} – random error.

Significantly different least squares means (LS means) were evaluated using *PDIFF* option, and *Tukey* adjustment.

Economical analysis for *"Pohorje beef"* rearing

Economical analysis for the rearing of *"Pohorje beef"* calves was performed using full costs model calculation method (Modelne kalkulacije 2009, Rednak 1998, Volk 2001) developed at the Agricultural Institute of Slovenia and based on the following methodological assumptions:

1) different number of suckling cows in the herd
2) fattening period from 43 kg (birth weight) to 340 kg (slaughter weight) with average daily gain of 900 g/day.
3) feed ratio for winter and summer. For cows, the winter ration consisted of hay and grass silage with both components in the portion, while the summer ration was based on the pasture supplemented with mineral-vitamin mixture. For calves, the feeding consisted of milk, and pasture (summer), or grass silage (winter). The amount of milk for the calf was estimated on the basis of milk yield of suckling cow which was estimated on 3000 litres in the whole lactation. The amount of grass silage or pasture was estimated by the difference between the energy needs of the calves (Kirchgesner 2008, Jarrige, 1989) and the amount of energy consumed with milk (DLG 1997). Although few farmers may feed animals additionally with some concentrates, due to the lack of information concentrates were not considered in the calculation of costs.
4) herd renewal costs were based on the market price of heifers and longevity of five years. The cost of artificial insemination was taken into account.
5) amortization of the stable and equipment was taken into account based on standing place for cows and the pen for calves.

The results of economical analysis of the rearing of *"Pohorje beef"* calves is presented in a graphical form firstly as a comparison of full production costs in relation to the market price for calves (Figure 4a). On the Figure 4a, full costs for *"Pohorje beef"* calves is reduced for the value of by-products (culled cows, manure) and different subsidies (regional support for grasslands, financial support for organic farming and different payments for the cattle-breeding sector. The comparisons are presented for three parity levels i) production costs taking into account full labour costs for social security - P1, ii) production costs with minimal labour costs for social security - P2 and iii) production costs with net labour costs - P3. The labour value was estimated on the basis of average salary in Slovenia. The price for *"Pohorje beef"* calves was obtained from the trade mark owner. Additionally, the price for organically reared veal (slaughter and transport costs deducted) in case of self-organised sale is presented (personal information). Both prices are calculated on the live weight basis.

RESULTS AND DISCUSSION

Growth rate and carcass quality of *"Pohorje beef"* calves compared to older calves of various genotypes and rearing systems

Figure 1 represents frequency distributions of *"Pohorje beef"* and other older calves from various rearing conditions according to conformation and fatness. The distributions were significantly different among genotypes. There were considerable differences in conformation between *"Pohorje beef"* and the purebred calves (Figure 1a). Approximately 30% of *"Pohorje beef"* calves were categorised in the U class and more then 65% got the R grade which was much better than in case of BR (20% of R grade, 60% of O grade) and HOL breed (10% of R grade 60% of O grade). When *"Pohorje beef"* calves were compared to commercial meat crosses the differences in conformation were smaller (Figure 1c). The majority of animals (70%) were classified in the fatness grades 2 and 3, which are the most desired and equivalent with regard to the payment. *"Pohorje beef"* calves were rather fattier (i.e. more often classified in the class 3) than other older calves especially compared to purebred HOL and BR calves, while the differences to commercial meat crosses were smaller.

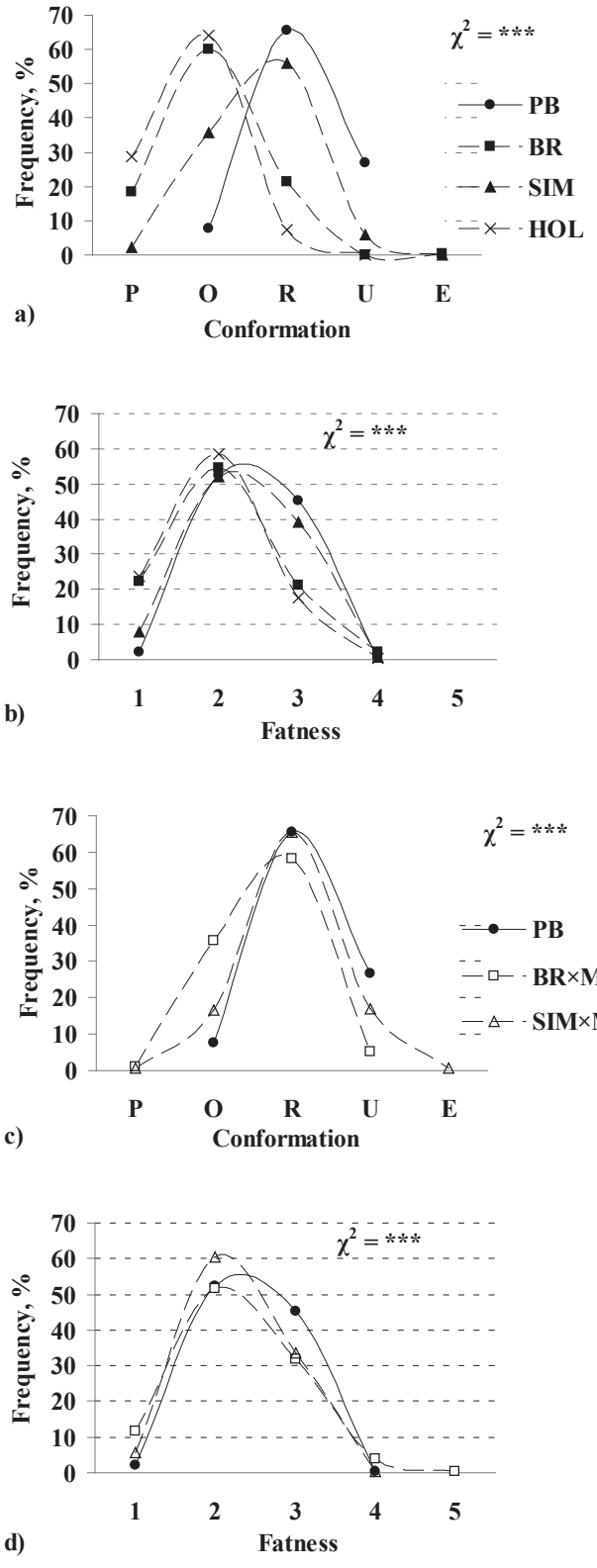
The analysis of variance for the effects of genotype and sex (Table 1) showed a significant interaction between genotype and sex for growth and carcass quality traits, denoting different nature of genotype differences in males and females. Namely, for the studied traits, we can observe the significant genotype effect, but the differences among genotypes varied according to sex, and therefore the results are also presented separately for each sex. In general, the female calves were a bit younger and lighter at slaughter than male calves (Table 2). Also, *"Pohorje beef"* calves were older compared to calves of other genotypes, especially when compared to purebred BR and HOL peers. Regarding carcass weight, *"Pohorje beef"* male calves had significantly heavier (22 to 64 kg) carcasses compared to purebred peers while the differences to commercial meat crosses were insignificant (≈2 kg). Similarly, *"Pohorje beef"* female calves were significantly heavier compared to pure breeds (28 to 65 kg); also in female calves the differences to meat crosses were smaller (11-24 kg), but still significant. As a consequence, the growth intensity (expressed as net daily gain) of the *"Pohorje beef"* male calves was 62-168 g/day bigger than in SIM, BR and HOL peers, but similar compared to commercial meat crosses. *"Pohorje beef"* female calves had significantly higher (40-153 g/day) net daily gain compared to purebred peers or BR×M crosses. It is interesting to observe, that in pure bred calves, males were not superior to females in conformation grade, whereas *"Pohorje beef"* calves had better conformation grades compared to either purebred animals or meat crosses, which was valid in both sexes. In male calves the differences in grade ranged from 0.23 unit compared to SIM×M calves (same genetics), up to 1.27 or 1.50 unit compared to BR and HOL calves. For female calves the difference in conformation grade was 0.12 unit compared to SIM×M calves, up to 1.00 or 1.27 unit compared to BR and HOL females. For fatness grades, the differences between calves of different genotypes were less marked (0.07 to 0.56). As observed in the Table 2 the *"Pohorje beef"* calves had the highest average fat score (2.28 and 2.61 for males and females, respectively). After the correction for warm carcass weight the differences between *"Pohorje beef"* and other older calves were smaller for conformation (0.22 to 1.14 unit for males, 0.06 to 0.90 unit for females) and fatness (up to ±0.1 unit for males and females).

The obtained results on growth rate and carcass quality are in accordance with commonly known characteristics of breeds and crossbreeds (Marshall 1994, Alberti et al. 2005). The advantageous effect of using crossing with meat type breeds on growth intensity and carcass quality agrees with the literature reports (Kögel et al. 2000, Čepin et al. 2001, Grodzki et al. 2006, Prevolnik et al. 2007). The relationships among the pure breeds and meat crosses are mostly in accordance with the results obtained in a study on Slovenian population of young bulls under 24 months (Prevolnik et al. 2007). However, considering the nature of the current research it is difficult to discuss in detail the differences observed, since we can not neglect the co-effect of the rearing technology and feeding on the observed differences. Many studies (Čepin et al. 1994, Sami et al. 2004, Dannenberger et al. 2006, Prevolnik et al. 2007) showed that animals under intensive feeding system attain greater daily gain and better carcass quality. In our study the production system of *"Pohorje beef"* was exactly defined (late weaning, predominant feeding with milk with supplement of grass silage or hay), while for other older calves we only know that they were reared in heterogeneous rearing and feeding conditions.

Growth rate and carcass quality of *"Pohorje beef"* calves compared to EKO beef cattle from the same organic farms

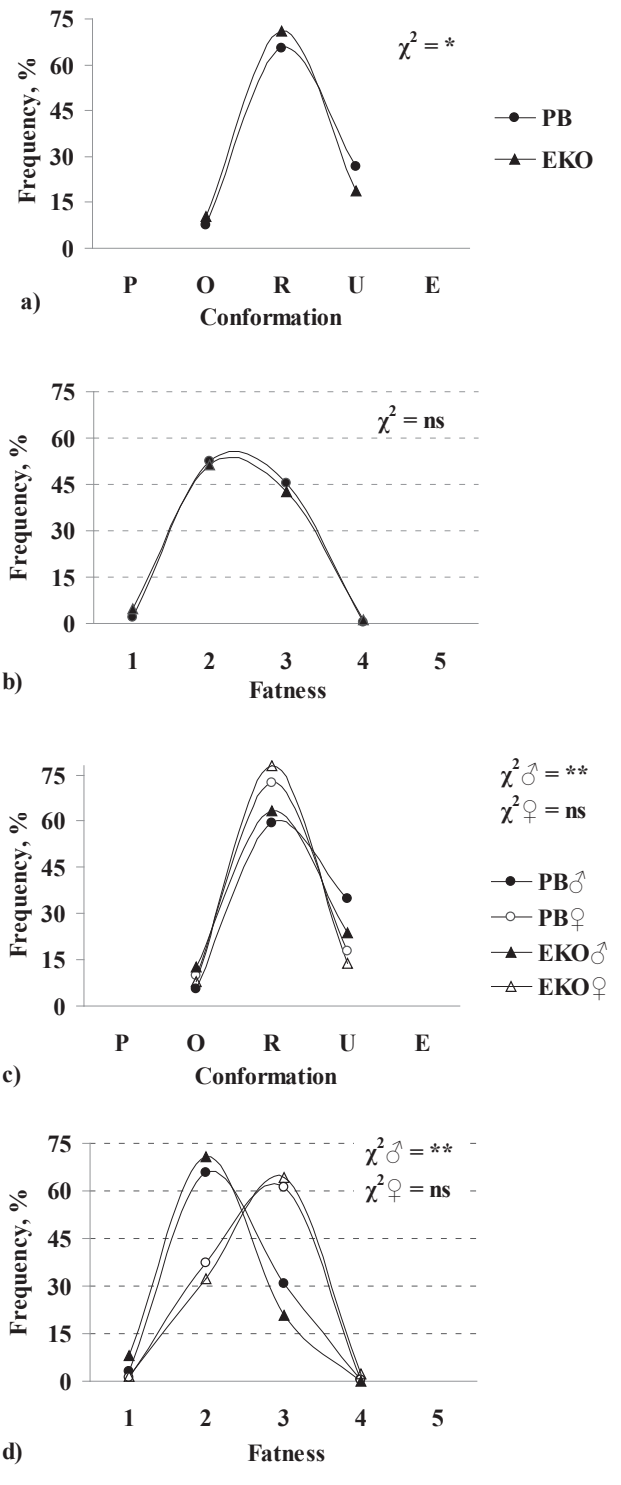
The comparison of *"Pohorje beef"* calves with older EKO beef cattle of the same genotype (SIM×LIM) and from the same organic farms was performed to evaluate the efficiency of prolonged rearing of suckling calves. Figure 2 represents frequency distributions of *"Pohorje beef"* calves and EKO beef cattle according to conformation and fatness. We could observe considerable differences between males and females but quite small between the age categories (yet significant for bulls). We anticipated better EUROP scores for EKO beef cattle, but in fact *"Pohorje beef"* calves were more often classified in the U grade (Figure 2a, χ^2=*). The difference in fatness between categories was insignificant (Figure 2b, χ^2=*ns*). The comparison of sexes showed the expected differences (Figure 2c, d) i.e. better conformation and lower fatness scores in bulls than in heifers.

The analysis of variance for growth rate and carcass quality of *"Pohorje beef"* calves and EKO beef cattle is presented in Table 3. EKO beef cattle was in average almost four months older at slaughter (113 and 106 days for bulls and heifers, respectively), but only 19 kg heavier (16 and 23 kg for bulls and heifers, respectively), while there was no difference in age at slaughter between males and females within age categories (insignificant category×sex interaction). EKO beef cattle had higher carcass weight compared to *"Pohorje beef"* calves, but



PB – *"Pohorje beef"*, SIM – Simmental, BR – Brown, HOL – Holstein, BR×M – crosses of Brown and meat breed, SIM×M – crosses of Simmental and meat breed; χ^2 Pearson chi-square *** P<0.001.

Figure 1: Frequency distribution for conformation (a and c) and fatness (b and d) of "Pohorje beef" and other older calves of most common breeds and crossbreeds from various rearing systems



PB –*"Pohorje beef"*; EKO – beef cattle; χ^2 Pearson chi-square ** P<0.01; * P<0.05; *ns* P>0.05.

Figure 2. Frequency distributions of "Pohorje beef" calves and EKO beef cattle from same organic farms according to conformation (a and c) and fatness (b and d)

the increase in warm carcass weight was very low (16 to 23 kg) in regard to the prolongation of the fattening. Significant interaction between the category and sex denotes that the differences in growth intensity between *"Pohorje beef"* calves and EKO bulls and heifers were not the same for both sexes. Thus the decrease in net daily gain was less expressed in heifers than in bulls (78 *vs.* 131 g/day). The comparison of carcass traits between *"Pohorje beef"* calves and EKO beef cattle also showed significant interaction between age category and sex (only a tendency P=0.09 for conformation corrected for carcass weight). In average male calves *"Pohorje beef"* were more muscular (0.18 unit) and fatter (0.15 unit) compared to EKO bulls, while there was no differences between females of two age categories. After the correction for carcass weight the differences in conformation and fatness increased and became significant also in females. The comparison of sexes within category showed that *"Pohorje beef"* males were more muscular (0.21 unit) than females, while there was no difference in conformation between EKO bulls and heifers. As expected, in both categories (older calves and EKO beef cattle) females were fatter than males (0.33 and 0.54, respectively). After the correction for warm carcass weight the differences in conformation between males and females became insignificant, while the differences in fatness increased (0.55 and 0.73 for *"Pohorje beef"* and EKO beef cattle, respectively).

Regarding growth rate, we could observe that EKO beef cattle stagnated or even regressed in growth during the final fattening period (Figure 3). The consequence of the growth stagnation was about 17% lower net daily gain of EKO beef cattle compared to *"Pohorje beef"* calves. Due to this observation, it was our interest to analyse this more deeply. Figure 3 presents the changes in the net daily gains from two aspects, a) overall net daily gain per age and b) net daily gain within a two months period. Overall net daily gain linearly decreased with age, while periodical differences in net daily gain were more important. We could note a drastic decline in net daily gain between 8-10 months which coincides with lower milk yield of suckling cow and/or weaning. Net daily gain within a period improves only after a few months, but does not attain more than 300 g/day.

Organically reared bulls and heifers were on average slaughtered at 14 months, which is considerably below the age limit for the category of young beef (below 24 months for bulls and below 30 months for heifers). Decrease in growth rate of EKO beef cattle seems the reason that farmers decided to slaughter them so early. The other explanation is that these animals could not be sold at the right time and remained in the herd. Lower growth intensity of EKO beef cattle can be explained with insufficient coverage of nutritional needs of these animals in the period of intensive growth due to lower milk production and/or weaning and insufficiently developed digestive organs to consume enough roughage. According to the literature (Cerdeño et al. 2006) the addition of concentrates could to some extent reduce the negative impact of weaning on growth rate. Our results demonstrate, that if older suckling calves (like *"Pohorje beef"*) are not sold soon after the weaning

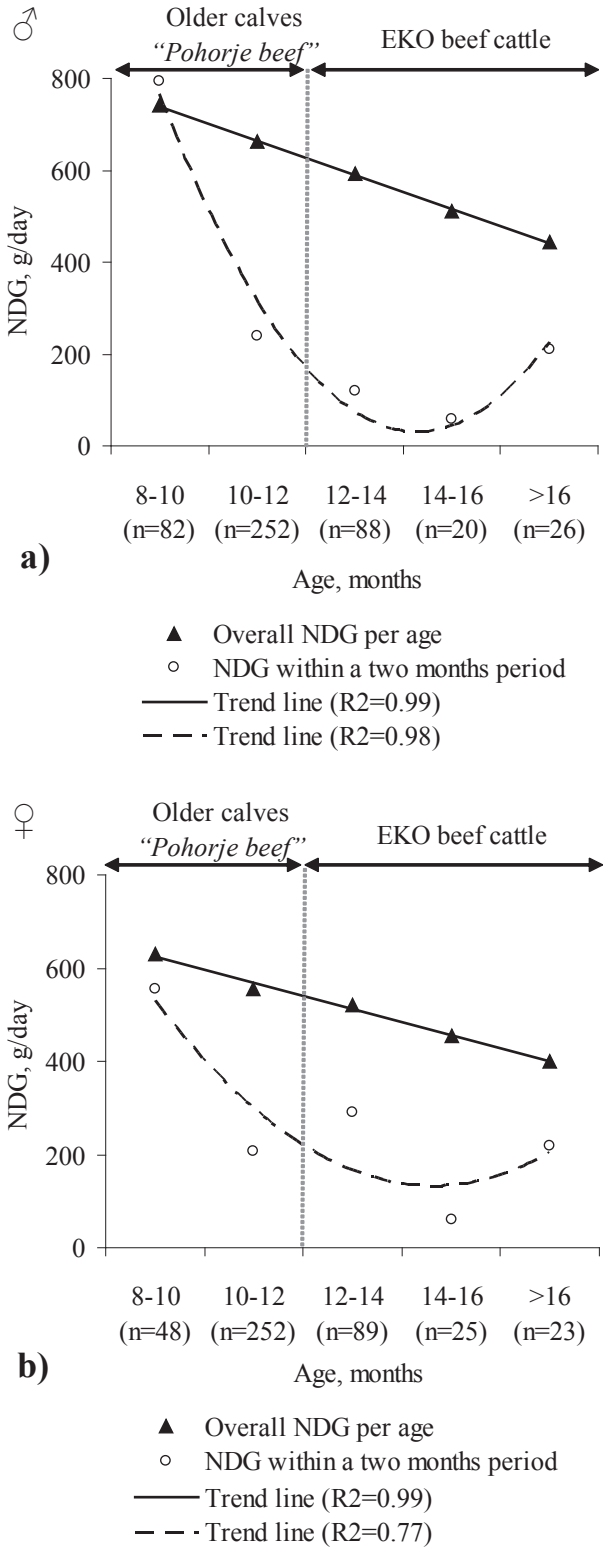


Figure 3. Decline of net daily gain (NDG) for beef cattle from organic farms a) in bulls and b) in heifers

Table 1. Analysis of variance for the effect of genotype and sex on growth rate and carcass quality for older suckling calves

Trait	P				
	G	S	G×S	[2]Slicing of G×S interaction	
				♂	♀
Age at slaughter, days	***	**	***	***	***
Warm carcass weight, kg	***	***	*	***	***
Net daily gain, g/day	***	***	**	***	***
Conformation (P=1-E=5)	***	ns	***	***	***
Fatness (1-5)	***	***	ns		
[1]Conformation (P=1- E=5)	***	***	***	***	***
[1]Fatness (1-5)	***	***	*	***	***

G – effect of breed or crossbreed, S – effect of sex; G×S – interaction between genotype and sex;

ns – P > 0.05; * – P < 0.05; ** – P < 0.01; *** – P < 0.001;

[1]correction on warm carcass weight, significant effect of warm carcass weight (***);

[2]when G×S interaction was significant it was sliced on the main effects (option slicing of SAS, 2002).

Table 2. Growth rate and carcass quality of "Pohorje beef" calves as compared to older calves of most common breeds and crossbreeds from various rearing systems

Trait	Sex	*LS* means (±standard errors)					
		PB	BR	SIM	HOL	BR×M	SIM×M
		N=634	N=202	N=1456	N=774	N=197	N=351
Age at slaughter, days	♂	$324^{c,1}$ (±2)	$304^{a,1}$ (±3)	$318^{b,2}$ (±1)	$303^{a,1}$ (±1)	$315^{b,1}$ (±4)	$317^{bc,1}$ (±3)
	♀	$332^{d,2}$ (±2)	$304^{ab,1}$ (±4)	$303^{ab,1}$ (±1)	$297^{a,1}$ (±3)	$309^{bc,1}$ (±3)	$313^{c,1}$ (±3)
Warm carcass weight, kg	♂	$220^{d,2}$ (±3)	$177^{b,2}$ (±4)	$198^{c,2}$ (±2)	$156^{a,2}$ (±2)	$219^{d,2}$ (±6)	$218^{d,2}$ (±4)
	♀	$187^{e,1}$ (±3)	$134^{b,1}$ (±5)	$159^{c,1}$ (±2)	$122^{a,1}$ (±4)	$163^{c,1}$ (±4)	$176^{d,1}$ (±3)
Net daily gain, g/day	♂	$682^{d,2}$ (±8)	$584^{b,2}$ (±12)	$620^{c,2}$ (±5)	$514^{a,2}$ (±6)	$702^{d,2}$ (±12)	$689^{d,2}$ (±11)
	♀	$567^{d,1}$ (±8)	$445^{b,1}$ (±16)	$527^{c,1}$ (±5)	$414^{a,1}$ (±11)	$529^{c,1}$ (±12)	$564^{d,1}$ (±9)
Conformation (P=1-E=5)	♂	$3,29^{e,2}$ (±0,03)	$2,02^{b,1}$ (±0,05)	$2,60^{c,1}$ (±0,02)	$1,79^{a,1}$ (±0,02)	$2,71^{c,1}$ (±0,07)	$3,06^{d,1}$ (±0,05)
	♀	$3,08^{e,1}$ (±0,03)	$2,08^{b,1}$ (±0,07)	$2,70^{c,2}$ (±0,02)	$1,81^{a,1}$ (±0,05)	$2,65^{c,1}$ (±0,05)	$2,96^{d,1}$ (±0,04)
Fatness (1-5)	♂	$2,28^{c,1}$ (±0,03)	$1,94^{a,1}$ (±0,05)	$2,18^{b,1}$ (±0,02)	$1,92^{a,1}$ (±0,02)	$2,21^{bc,1}$ (±0,07)	$2,12^{b,1}$ (±0,05)
	♀	$2,61^{c,2}$ (±0,04)	$2,29^{a,2}$ (±0,09)	$2,45^{b,2}$ (±0,02)	$2,05^{a,2}$ (±0,05)	$2,35^{ab,1}$ (±0,05)	$2,41^{b,2}$ (±0,04)
[3]Conformation (P=1-E=5)	♂	$3,05^{e,1}$ (±0,03)	$2,02^{b,1}$ (±0,05)	$2,47^{c,1}$ (±0,02)	$1,91^{a,1}$ (±0,02)	$2,47^{c,1}$ (±0,06)	$2,83^{d,1}$ (±0,04)
	♀	$3,02^{e,1}$ (±0,03)	$2,32^{b,2}$ (±0,06)	$2,81^{c,2}$ (±0,02)	$2,12^{a,2}$ (±0,05)	$2,73^{c,2}$ (±0,05)	$2,96^{d,2}$ (±0,04)
[3]Fatness (1-5)	♂	$1,99^{bc,1}$ (±0,03)	$1,94^{b,1}$ (±0,05)	$2,04^{bc,1}$ (±0,02)	$2,06^{c,1}$ (±0,02)	$1,92^{ab,1}$ (±0,06)	$1,84^{a,1}$ (±0,04)
	♀	$2,54^{b,2}$ (±0,03)	$2,46^{ab,2}$ (±0,0)	$2,58^{b,2}$ (±0,02)	$2,42^{a,2}$ (±0,04)	$2,44^{a,2}$ (±0,05)	$2,42^{a,2}$ (±0,04)

PB – *"Pohorje beef"*, SIM – Simmental, BR – Brown, HOL – Holstein, BR×M – crosses of Brown and meat breed, SIM×M – crosses of Simmental and meat breed

[ab,12]different letters within a row indicate significantly (P<0.05) different least square means for genotypes, while different numbers within a column significantly different a least square means for sexes within particular trait;

[3]correction on warm carcass weight, significant effect of warm carcass weight (***).

Table 3. Analysis of variance for growth rate and carcass quality of "Pohorje beef" calves as compared to EKO beef cattle (same crossing, same farms)

Trait	*LS* means (±standard errors)				C	S	C×S	[2]Slicing of C×S interaction	
	PB♂ N= 334	EKO♂ N=134	PB♀ N =300	EKO♀ N =137				♂	♀
Age at slaughter, days	324^{a} (±3)	437^{b} (±5)	332^{a} (±3)	438^{b} (±5)	***	*ns*	*ns*		
Warm carcass weight, kg	220^{c} (±2)	236^{d} (±3)	187^{a} (±2)	210^{b} (±3)	***	***	*ns*		
Net daily gain, g/day	682^{c} (±5)	551^{b} (±9)	567^{b} (±6)	489^{a} (±9)	***	***	***	***	***
Conformation (P=1-E=5)	$3,29^{b}$ (±0,03)	$3,11^{a}$ (±0,05)	$3,08^{a}$ (±0,03)	$3,06^{a}$ (±0,05)	*	***	*	**	*ns*
Fatness (1-5)	$2,28^{b}$ (±0,03)	$2,13^{a}$ (±0,05)	$2,61^{c}$ (±0,03)	$2,67^{c}$ (±0,04)	*ns*	***	**	**	*ns*
[1]Conformation (P=1-E=5)	$3,23^{b}$ (±0,03)	$2,94^{a}$ (±0,04)	$3,22^{b}$ (±0,03)	$3,06^{a}$ (±0,04)	***	*ns*	*ns*		
[1]Fatness (1-5)	$2,22^{b}$ (±0,03)	$1,94^{a}$ (±0,04)	$2,77^{c}$ (±0,03)	$2,67^{d}$ (±0,04)	***	***	**	***	*

PB – *"Pohorje beef"*, EKO – beef cattle from organic farms; *** P < 0.001; ** P < 0.01; * P < 0.05; ns – P > 0.05; K – effect of category, S – effect of sex; C×S – interaction between category and sex;

[1]correction on warm carcass weight, significant effect of warm carcass weight (***);

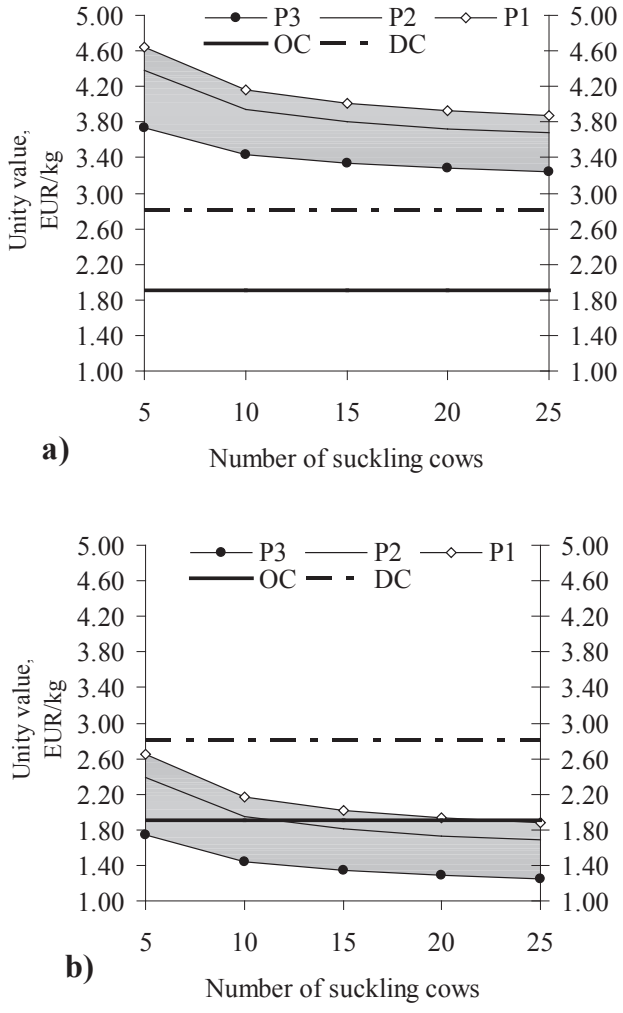
[2]when C×S interaction was significant it was sliced on the main effects (option slicing of SAS, 2002),

[a,b]least square means within a row followed by a different letter are significantly (P<0.05) different.

or if the farmers would want to prolong the fattening, it would be recommended to add concentrates in the ration. However, such option could be problematic for organic farms of Pohorje and Kozjak which are situated in a hilly region with little arable land. Buying ecological concentrates on the other hand would be economically questionable. Besides lower growth rate, EKO beef cattle also demonstrated lower carcass classification grades. Studies (Cartier et al. 2007, Cerdeño et al. 2006, Sami et al. 2004) show that for the same technology and genotype the conformation and fatness scores increase with age (and carcass weight). In our study EKO beef cattle was much older than *"Pohorje beef"* calves, but these animals grew poorly after 8 months of age which resulted in lower carcass conformation. Such relationship between growth intensity and conformation was observed also in our previous study on the population of young bulls (Prevolnik et al. 2007). The literature data (Cartier et al. 2007) also show that under the same rearing system and at the same age the bulls are better conformed and less fatty than heifers. As expected, heifers were fatter than bulls. Contrary to the expectations, there were no differences in conformation between EKO bulls and heifers, which could indicate, that negative impact of prolonged fattening was more expressed in bulls than in heifers.

Economical analysis

The results of the economical analysis for rearing of organic veal *"Pohorje beef"* are presented in Figure 4. The market price for "*Pohorje beef"* calves paid by the trade mark owner does not cover the production costs (Figure 4a). The rearing of "*Pohorje beef"* calves becomes economically interesting only when various subsidies according to the common EU agricultural policy (Figure 3b) are added. In relation to total production value (carcass value, manure value, value of by-products and subsidies) the subsidies cover about a half of total costs. When subsidies are included in the calculation, the costs of production are covered with herd size of 20 suckling cows. It should be mentioned that the average organic farm of Pohorje and Kozjak region has only about 10 suckling cows, while there are also some farms with less than five cows (Jurič 2009). When the average herd size of suckling cows of the organic farms of Pohorje and Kozjak is taken into account, the actual selling price covers only labour costs with minimal payments for social security. For very small herds (less than five suckling cows) the selling price covers only the net labour costs. On small farms labour costs might be covered on the account of amortisation, which means that no worth mentioning investments are made. According to these results it is thus not surprising that many farmers decide for a self-organised sale at home (Jurič 2009). This enables them to get a higher selling price, which covers full production costs even in small herds (Figure 3b).



P1 – Full production costs with full labour cost
P2 – Production costs with minimal labour cost
P3 – Production costs with net labour cost
OC –Price of calf (on live weight basis; May 2009)
DC – Price of calf for self-organised sales (on live weight basis; May 2009)

Figure 4. Economical analysis according to the income parity (P1, P2, P3) and number of suckling cows in herd; a) no subsidies and b) with subsidies added

CONCLUSIONS

The analysis comprised 634 older calves reared according to *"Pohorje beef"* technology in a five-year period (2003-2008). At slaughter, *"Pohorje beef"* males were 324 days old and had 220 kg of warm carcass weight, giving 682 g/day net daily gain, whereas *"Pohorje beef"* females were slaughtered on average at 332 days and 187 kg of weight, giving net daily gain of 567 g/day. Compared to older calves of various rearing systems, *"Pohorje beef"* calves exhibited better net daily gain, but the differences were more important compared to purebred calves than meat crosses. *"Pohorje beef"* calves were superior in conformation and fatness compared to other calves from various genotypes and rearing systems, the differences being more pronounced in relation to purebred calves. The comparison of *"Pohorje beef"* to older cattle category of the same genotype

reared on the same farms showed that prolonged rearing is not economically interesting. Although 110 days older, organically reared animals were only 19 kg heavier than *"Pohorje beef"* calves, demonstrating growth stagnation, reflected in lower net daily gain and lower conformation. The analysis of costs shows, that the current price for suckling calves *"Pohorje beef"* covers about a half of total costs and that such rearing becomes economically interesting only with various subsidies added. However, even in that case the minimum herd size must be 20 suckling cows. In practice, many farmers are self-organised for the sale of their meat, which enables them to get a higher price, which covers the costs even in smaller herds.

ACKNOWLEDGEMENTS

Authors greatly acknowledge help of Mrs. Nežka Jurič in data analysis, classification body *Bureau Veritas* for carcass classification data, organic farmers of Pohorje and Kozjak and Zveza zadrug Maribor, the owner of trade mark *"Pohorje beef"* for the information provided. The authors acknowledge the financial support from the state budget by the Slovenian Research Agency (Project J4-9532, Program P4-0072).

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Received: August 14, 2009
Accepted in final form: November 25, 2009