The impact of sex on the economics of pig fattening

Vliv pohlaví na ekonomiku výkrmu prasat

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Abstract: The test was focussed on the influence of sex on the production traits of the (LW×L) × OLW combination of hybrids. In the system of ad-libitum feeding, 72 pigs were divided into two identical groups of gilts and barrows and the fattening performance, i.e. the growth intensity, daily feed intake and the quantitative aspect of the carcass value were monitored. On the basis of the profit function, it was found out that in the ad-libitum feeding with the separate fattening of barrows and gilts with respect to the given genotype, it is possible to achieve with the same slaughter weight the difference in the profit per 1 fattened pig 111.06 CZK, i.e. 5.86%.

Key words: pig, sex, production traits, testing, economics, profit functions

Abstrakt: V testu byl sledován vliv pohlaví na produkční užitkovost hybridní kombinace prasat (BU×L) × OLW. V systému ad-libitního krmení byla u 72 kusů prasat, rozdělených do dvou stejných skupin prasniček a vepříků, sledována výkrmnost, tedy růstová intenzita, denní příjem krmiva a kvantitativní stránka jatečné hodnoty. Na podkladě ziskové funkce bylo zjištěno, že v systému ad-libitního krmení při odděleném výkrmu vepříků a prasniček, lze s ohledem na daný genotyp dosáhnout při stejné porážkové hmotnosti rozdílu zisku na 1 vykrmené prase 111,06 Kč, resp. rentability 5,86 %.

Klíčová slova: prase, pohlaví, užitkovost, testace, ekonomika, ziskové funkce

INTRODUCTION

By its standard of pig rearing, the Czech Republic ranks among advanced countries in this field. Hybridisation of pigs was introduced here at the beginning of the seventies. With respect to the current globalisation of agriculture and, consequently, also in the production of pig meat, it is important for the pig breeders to be able to use as efficiently as possible not only their own experience and the long-term experience of the preceding generations but also to apply new scientific and specialized knowledge promoting the competitiveness of our pig rearing as one of the few branches of agriculture that shows profit. In spite of this, pig breeders should spare no effort to keep maintaining the profitability and competitiveness of this sector with regard to the EU producers. Therefore, it is necessary to address expeditiously the problems mainly with a focus on the priorities of the European pig breeding at the beginning of the third millennium, i.e. the quality, environment, health condition and particularly economics. The economics may be substantially influenced by breeders in the way of the reduction of costs, i.e. by a higher standard of production traits being achieved through optimisation of the welfare, application of the results of tests of individuals or populations as well as through the implementation of measures using the knowledge and differences in the growth intensity with regard to the sex of pigs. Although these issues are in general well known, a number of enterprises still neglect these factors which may markedly influence the economy in feed consumption in the period of fattening as it accounts for one of the most significant shares in the cost of production per a slaughter pig.

REVIEW OF LITERATURE

The fattening performance and the slaughter value are, similarly as all physiological qualities of live organisms, influenced by a number of endogenous and exogenous factors which may have either positive or negative impact on the given qualities (Hovorka 1983).

Of the endogenous factors it is sex or castration, as the case may be, that have been proven to have a significant impact on the use and conversion of the feed proteins into meat (Kopecký 1972; Lenis, Jongbloed 1994). It is the internal factor the significance of which with regard to the intensity of deposition is well known.

Bučko et al. (2001) have found out that gilts as compared to barrows achieve a lower average daily weight gain, a higher feed consumption per kg of the gain, a higher share of the main meat parts and a higher share of

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ham in the carcass weight. Adamec (1991) states that the findings relating to a higher growth intensity of barrows are associated with a higher feed consumption and a higher share of separable fat while the findings relating to the growth intensity of gilts with the ability to use the feed more efficiently and a higher share of the main meat parts.

As concerns the slaughter value, Hanson (1974), Stupka et al. (1995), Šprysl et al. (2002) state that gilts show in the given weight a higher share of lean meat as compared to barrows, they deposit a lower quantity of fat which is associated with the hormonal differentiation, a different metabolism and a lower feed intake in the ad-libitum technique of feeding. The influence of sex on the composition of carcass of thoroughbred pigs was proved by Pulkrábek et al. (1993, 1994), Pulkrábek (1995) Andersson et al. (1995). They proved the fact that gilts show a better standard of the carcass value, i.e. a higher meatiness than barrows. This fact was logically manifested in the share of fat that was lower in gilts than in barrows.

The differences ensuing from sex are reflected also in the classification according to the basic quality grades. The E and U classes include the better-valued gilt carcasses, in the R class the sex ratio is almost identical and in the O and P classes the representation of sex is changing, i.e. barrow carcasses have a higher share (Pulkrábek 1995).

Koucký et al. (1993) have found out that when classifying barrows and gilts according to the share of lean meat into the S and E classes of the SEUROP system, the total percentage of classified gilts was evidently higher (above 50%) as compared to the classification of barrows into these classes, reaching the value of 30%.

METHODS

The aim of the test was to examine the impact of the production traits characterized by the fattening performance and carcass value on the total economics of pig production with regard to sex.

The test consisted in the comparison of two groups of hybrid pigs of the (LW×L) × OLW genotype penned in compliance with the methodology for the tests of thoroughbred and hybrid pigs, observing the principle of penning the animals by couples. The animals included in the test were fed according to the standards of nutrient supply ad-libitum in three phases with a continuous transition by means of the Duräumat self-feeders. Complex feeding mixtures (CFM) used in the tests were three-component mixtures using wheat, barley, soyameal and a feeding supplement (Table 1).

Table 1. Feeding sheme

Nutrients in FCM (%)		Feeding phase		
		up to 35 kg	35–65 kg	above 65 kg
NL	(g/kg)	195.77	178.41	147.79
Mep	(MJ/kg)	13.24	13.12	12.91
Lysine	(g/kg)	10.89	9.51	7.69
Threonine	(g/kg)	4.01	3.86	4.10
Methionine	(g/kg)	5.78	4.96	3.48
Ca	(g/kg)	7.09	6.21	5.91
P	(g/kg)	7.27	6.83	6.56

The total number of 72 pigs at the average age of 84 days after the birth at the total average live weight of 27.94 kg were divided in the test according to sex into two groups as follows:
Group 1: 36 barrows at the average live weight of 28.00 kg,
Group 2: 36 gilts at the average live weight of 27.88 kg.

In order to evaluate the fattening and growth performance, the pigs were regularly weighed at 7 day intervals and the following traits were observed:
– average live weight during the fattening period (kg),
– feed conversion ratio (consumption of CFM (kg) per 1 kg of live weight gain),
– daily feed consumption (consumption of CFM (kg) per day),
– average daily weight gain (g).

After achieving the total average live weight of approx. 110 kg, the pigs were slaughtered and realized in the slaughterhouse using the SEUROP system, the ZP method (Pulkrábek 2001, etc.).

The evaluation of the carcass value in each animal was based on:
– carcass weight of pig (kg),
– weight of the right half (kg),
– carcass length (cm),
– back fat thickness at the last sternal vertebra (mm),
– average height of the back fat thickness (mm),
– lean meat share (%) (by the ZP method).

The obtained data was processed by mathematical-statistical methods using the SAS program, the differences between the examined traits were tested by the means of the variance analysis.

The following part of the work focussed on the evaluation of the economics of the test with regard to the tested group of pigs by means of the profit function after Poděbradský (1980) Župka (1992):

$$Zc = \{c_1 y_1 - [n_1 x_1 + n_2 x_2 + (n_3 : x_3) + A]\} \times r$$

where:

$$r = 365 : (x_2 + k)$$

$$x_2 = (y'_1 - y'_0) : x'_2$$

$$Zc = Z \times r$$

where:
Zc = profit per a capacity unit per year,
Z = profit per a slaughter pig,
r = turnover rate of pigs per year,
c_1 = average market price per a unit of production of carcass halves,

n_1 = purchase cost per CFM unit,
n_2 = fixed costs per 1 day in feed of a pig in fattening,
n_3 = costs per a sow and litter without costs of treatment and feeding of piglets,
A = costs of the treatment and feeding of piglets,
y_1 = weight of carcass halves,
y'_1 = live weight of the slaughter pig,
y'_0 = live weight of a hog in fattening,
x_1 = volume of consumed CFM,
x_2 = period of fattening,
x'_2 = average daily weight gain from the beginning of fattening until achieving the market weight,
x_3 = number of reared piglets per a sow and litter,
k = number of days between two fattening cycles.

RESULTS AND DISCUSSION

The evaluation of the basic fattening performance, i.e. the growth characterized by average daily gain during individual one-week periods and feed ratio conversion or CFM consumption per 1 kg of the gain (CFM/1 kg) in individual groups is shown in Table 2. This Table also shows that better growth results, i.e. average daily gain, were achieved by barrows whose average gain in the test reached 925 g as compared to gilts with the gain of 850 g which represents above average values within commercial breeding in the Czech Republic. The achieved values may be assessed as very satisfactory despite the fact that the animals upon their inclusion in the test were in terms of weight under the optimal level in relation to age, on average by 2–3 kg of live weight (Guyokrma 1994; Stupka et al. 1996). A similar trend was confirmed by Bučko et al. (2001) who found out in hybrid barrows during the period of testing an average daily gain of 886.5 g with the consumption of feeding mixtures of 2.99 kg per kg of the gain of live weight. Gilts as compared to barrows achieved a lower average daily gain of 832.3 g with a higher consumption of feed per kg of gain (3.13 kg).

A more detailed analysis of the course and standard of the achieved gains shows evidently that the highest gain was achieved by barrows in the live weight range of 50–90 kg, and gilts in the live weight range of 70–90 kg. In general, starting from the weight of approximately 100 kg there occurred a relative decrease in gains, which corresponds with the characteristics of the given genotype. This corresponds also to the work by Hovorka (1989) who states that the impact of sex is evident mainly after the achievement of sexual maturity, i.e. approximately starting from 50–70 kg of live weight.

As concerns the feed conversion, it is obvious that a statistically significant difference of 0.31 kg ($P \leq 0.01$) was achieved within the comparison of barrows and gilts in favour of gilts. The achieved values may be assessed as very satisfactory, mainly because of ad-libitum feeding that is characterized by a higher consumption of feed. A significant increase of conversion in relation to the gain was recorded in pigs starting from 100 kg of live weight. On the basis of the achieved results, it is necessary to consider the recommendation

Table 2. Evaluation of the feeding performance of tested pigs by sex (n = 72)

Barrows (n = 36)						Gilts (n = 36)					
Age	average live weight (kg)		feed conversion ratio (kg CFM/kg of gain)		gain (g/day)	Age	average live weight (kg)		feed conversion ratio (kg CFM/kg of gain)		gain (g/day)
	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x}$		$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x}$
84	28.00 ± 1.29	4.47	.	.	.	83	27.88 ± 1.22	4.23	.	.	.
91	34.46 ± 1.59	5.92	2.35 ± 0.44	1.51	807	90	33.79 ± 1.53	5.30	1.83 ± 0.12	0.42	740
98	39.88 ± 1.85	6.41	3.51 ± 1.27	4.39	774	97	39.00 ± 1.75	6.06	2.43 ± 0.28	0.97	744
105	47.54 ± 2.12	7.36	2.37 ± 0.17	0.58	1 095	104	45.00 ± 2.11	7.32	1.94 ± 0.08	0.28	857
112	55.17 ± 2.08	7.22	2.45 ± 0.10	0.34	1 089	111	51.13 ± 2.35	8.14	2.48 ± 0.24	0.83	875
119	61.42 ± 2.03	7.04	3.10 ± 0.24	0.82	893	118	57.38 ± 2.53	8.78	2.49 ± 0.17	0.59	893
126	67.21 ± 1.95	6.74	3.51 ± 0.19	0.65	827	125	62.25 ± 2.47	8.57	3.31 ± 0.25	0.86	696
133	74.75 ± 2.26	7.83	2.78 ± 0.18	0.64	1 077	132	68.58 ± 2.76	9.55	2.86 ± 0.27	0.93	905
140	81.42 ± 2.43	8.41	3.37 ± 0.19	0.67	952	139	74.46 ± 2.65	9.16	2.93 ± 0.17	0.60	839
147	89.33 ± 2.43	8.41	2.82 ± 0.15	0.53	1 131	146	81.58 ± 2.88	9.97	2.80 ± 0.17	0.59	1 018
154	95.42 ± 2.51	8.71	3.95 ± 0.28	0.97	869	153	88.00 ± 2.71	9.39	3.23 ± 0.29	1.01	917
161	100.96 ± 2.56	8.86	4.33 ± 0.35	1.21	792	160	93.08 ± 2.89	10.01	3.87 ± 0.23	0.79	726
168	107.88 ± 2.44	8.46	3.51 ± 0.17	0.57	988	167	99.27 ± 3.08	10.67	3.58 ± 0.34	1.16	887
175	112.21 ± 2.53	8.77	4.90 ± 1.10	3.82	619	174	105.25 ± 2.85	9.86	3.67 ± 0.24	0.83	851
Σ	$112.21^{a} \pm 2.53$	8.77	$3.05^{A} \pm 0.08$	0.29	925^{a}	Σ	$105.25^{a} \pm 2.85$	9.86	$2.74^{A} \pm 0.09$	0.31	850^{a}

The differences of values marked by the same letters are statistically significant.
Letter A was used for $P \leq 0.01$, letter a for $P \leq 0.05$.

Table 3. General evaluation of indicators of CFM consumption by sex (n = 72)

Group	n	CFM consumption for the period (kg)	Number of days in feed per period	Gain for the period, total	Average daily gain (g)	Conversion in kg/kg of gain	FM consumption in kg/days in feed
Barrows	36	9196.8^{A}	3 276	3031.5	925.0	3.05^{A}	2.81^{A}
Gilts	36	7605.6^{A}	3 276	2785.5	850.0	2.74^{A}	2.32^{A}

The differences of values marked by the same letters are statistically significant
Letter A was used for $P \leq 0.01$

Table 4. Overview of indicators of slaughter value of tested pigs at the time of slaughter in relation to sex (n = 72)

Group	Barrows (n = 36)		Gilts (n = 36)	
Indicator	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s
Weight of pig carcasses in warm state (kg)	95.92 ± 2.098	7.27	90.33 ± 2.583	8.95
Weight of the right half (kg)	47.58 ± 1.158	4.01	44.42 ± 1.240	4.29
Carcass length (cm)	87.83 ± 0.815	2.82	87.42 ± 0.830	2.87
Height of the back fat (mm)	21.58 ± 0.570	1.98	16.50 ± 1.026	3.55
Average height of the back fat (mm)	28.50 ± 0.557	1.93	25.25 ± 0.871	3.02
Share of meat of ZP (%)	54.38^{a} ± 0.714	2.47	57.38^{a} ± 0.996	3.45

The differences of values marked by the same letters are statistically significant
Letter a was used for $P \leq 0.05$

to set the slaughter weight of the tested genotype at the value of 105–107 kg.

The summary results included in Table 2 that characterize the general indicators of the growth of pigs in the test prove a higher growth intensity and an evidently ($P \leq 0{,}01$) higher feed intake of barrows as compared to gilts which corresponds with the achieved total feed conversion. In case of the average feed conversion and feed consumption per a day in feed, statistically highly significant differences were found out between barrows and gilts complying with the conclusions of Adamec (1991), Bučko et al. (2001).

Table 4 shows an overview of basic indicators of the slaughter value of the tested pigs at the time of slaughter with regard to sex. Based on the achieved results it may be stated that no indicator recorded a statistically significant difference, except for the share of meat. The trend was confirmed of a lower average height of the back fat in gilts as compared to barrows by 3.25 mm. Koucký et al. (1993) found out in gilts a lower average height of the back fat by 5.3 mm, Poltársky and Palanská (1991) by 3.1 mm, Adamec (1991) and Šprysl et al. (1995) by 8 mm. In addition, a statistically significantly higher percentage of meat in pig carcasses was found out in gilts (57.38%) than in barrows (54.38%). The difference represented 3%. The same conclusions were arrived at by Pulkrábek et al. (1994, 1995), Stupka et al. (1995).

Table 5. Realization of slaughter pigs by means of the SEUROP – ZP system (n = 72)

Class	Barrows			Gilts		
	pig carcasses (kg)			pig carcasses (kg)		
	n	$\bar{x}$	%	n	$\bar{x}$	%
S	.	.	.	6	91	16.67
E	9	95.0	25.00	24	89	66.67
U	24	98.0	66.67	6	94	16.66
R	3	84.0	8.33	.	.	.
Total	36	.	100.00	36	.	100.0

The Table 5 shows the evaluation of pigs from the viewpoint of their realization and classification into individual classes of the SEUROP system. It is obvious that gilts were classified better, namely in the S class where in total 16.67% of the animals were realized and in the E class that included 66.67% of gilts and only 25% of barrows. By contrast, in barrows the highest share of pigs, namely 66.67%, was included in the U class and even 8.33% of the animals were included in class R.

Pulkrábek et al. (1995) have found out that gilts are more favourably evaluated in the E and U classes, in the R class the sex ratio is almost identical and in the O and P classes the representation of sex is changing, i.e. they include a higher share of barrow carcasses. Koucký et al. (1993) state that when classifying barrows and gilts according to the share of lean meat into the S and E classes of the SEUROP system, the total percentage of included gilts was evidently higher (over 50%) as compared to the inclusion of barrows in these classes reaching the value of 30%. The achieved results have significantly influenced the resulting sales.

Table 6. Economic evaluation of the tested groups of pigs

Indicator	Barrows	Gilts
Number of pigs in group	36	36
Cost of: (CZK)		
– price of 1 hog	1 680.00	1 723.20[X]
– feed/1 pig in the test	1 326.23	1 095.14
– cost. total/1pc	3 006.23	2 818.34
– 1 day in feed	15.75	12.03
– 1 kg in the test	14.57	14.15
Sales per 1 pig (CZK)	3 870.00	3 793.17
Market price of 1kg of dead weight (CZK)	40.35	41.99
Profit per 1 pig (CZK)	863.77	974.83
Profitability per 1 pig (%)	28.73	34.59

Production costs = include only the price of a hog and the price of feed /1pig in the test

Note: The economics of the tested groups of pigs is based only on the input prices of CFM components set in advance and the market price of slaughter pigs. The price of a hog-gilt marked by [x] is related to its price at the age of 84 days.

For the purpose of a general evaluation of the impact of sex on the economy of production, it is necessary to determine the profit per a production unit by means of the average market price and own costs in the test that in this case consist only of the purchase price of a hog and cost of the feed, as shown by Table 6 where the cost per a hog in gilts was corrected to the common age of 84 days.

The achieved economic indicators included in Table 6 show that from the viewpoint of profitability, gilts recorded better indicators than barrows which in terms of profit per 1 pig, or profitability amounts to the difference of 111.06 CZK or 5.86%. Ensuing from the total economics is the fact that the identified differences with regard to sex are significant due to a more advantageous realization of gilts in the S, E classes. By contrast, barrows achieved a higher growth intensity and, consequently, also a higher slaughter weight and a lower share of meat in the pig carcass. The findings confirm the necessity of a separate fattening in the production pig rearing with the introduction of controlled feeding of barrows and ad-libitum feeding of gilts. The conclusions correspond with the work by Stupka et al. (2003).

CONCLUSION

The test was made in the test centre in Ploskov near Lány. It included 72 hybrid pigs of the (LW×L) × OLW genotype, divided into two identical groups of barrows and gilts, and examined the impact of sex on the production traits and economy of production. These groups of pigs were tested based on the respective methodology from the viewpoint of the fattening performance and slaughter value. At the end of the test, the results were evaluated by means of the profit function. The conclusion is that in the ad-libitum system of feeding with separate fattening of barrows and gilts, a difference in the profit may be achieved with regard to the given genotype per 1 fattened pig amounting to 111.06 CZK, i.e. 5.86%.

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