EVALUATION OF SELECTED QUANTITATIVE AND QUALITATIVE TRAITS OF THE CARCASS VALUE OF DIFFERENT PIG GENOTYPES

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The objective of this work was to assess the fattening capacity, growth performance and carcass value of four crossbred combinations in relation to apparative realization in pigs using a test in the Independent Testation Station of Pigs in Ploskov. The genotypes used were F16 x (LW x L); H x (LW x L); SL-88 x (LW x L) and CVM x (LW x L). The bedding and feeding of all animals were realized according to the method of testation of pure and hybrid pig combinations in the Czech Republic. During the test weekly were observed: average live weight (kg), daily weight gain (DWG in g), feed conversion (kg) and lean meat percentage (from approximately 60 kg live weight by the help of ultrasonic apparatus Pigmatic 103). The total of 180 crossbred pigs of four combinations were finished in the test and the following indicators were assessed after they were slaughtered : carcass weight in warm state (kg), backfat thickness according to the Czech National Standard No. 466160 (mm), average backfat thickness, lean meat share (%) using the ZP (Zwei-Punkte-Verfahren) method and pH_1 (45 minutes *post mortem*) for MLT (*musculus longissimus thoracis*) at the last thoracic vertebra using a portable WTW pH-meter and ORION 201 probe. All the traits were analysed by common statistical method and the basic statistical values have been calculated for the entire sample. As far as the results are concerned, from the point of fattening indicators, the (LW x L) x F16 pigs had the best growth capacity (DWG 935 g) compared to other combinations (DWG 781 g or 681 g, resp.). On the other hand, the SL-88 x (LW x L) genotype had the best results, concerned the carcass value assessment, especially as regards lean meat share (above 55% approximately at the 100 kg live weight) and meat quality.

pig; genotype; fattening capacity; carcass value; lean meat share

INTRODUCTION

Large-scale introduction of apparative realisation of slaughter pigs together with foreign competitors will force the primary producers to use in their rearings those pig genotypes that fulfil requirements of the consumer as in view of assortment of meat, as according to its quality.

Tests of pure-bred and hybrid populations, whose basic principle is to select genetically better populations (Jakubec et al., 1998), are a guide of agricultural practice to determine a suitable genotype. It consists in realisation of differences in genetic effects of populations that are obtained by their testation in different media using different crossing systems. In this respect it is necessary, as reported by Smith (1977), Jakubec (1988, 1990), to determine the targets and plans including conditions for their materialisation.

Nowadays, tests of pig populations in the Czech Republic are conducted in:

- unified conditions of the Station of Fattening Control – testation of genotypes of breeding and reproduction sphere for maximum elimination of the share of medium variance on the total variability,
- concrete conditions of utility rearings
- classical field testation of genotypes of utility sphere tending to full manifestation of mutual of mutual action of genotypes with conditions of concrete environment while the reached utility is not guaranteed for other environments (Bichard, 1985).

In relation to the above possibilities of testation, it is evident that station tests whose results are a guide for primary production for materialisation of the genotype in utility sphere, it is necessary to verify by field tests directly on farms (Šprysl, Stupka, 1991 1998).

Though economy at the beginning of 90s in pig rearing allowed to producers to gather the results of testation from research, breeding as well as from production sphere, many producers did not make use of this situation, and now they are faced the task of selection of suitable genotype for their rearing conditions.

If the question of reproduction is not taken into account, where strict requirement in relation to competitiveness of the farm is 21 reared piglets per sow and year, without respect to the used genotype, while a lot of farms have serious problems in this sphere (Čeřovský, 1997). Then in the production sphere the choice of genotype id a decisive factor that affects production qualities or fattening capacity in view of growth intensity and carcass quality in view of course and production of lean meat in relation to slaughter weight (Russi, 1998; Hovorka, 1989).

MATERIAL AND METHOD

The aim of the testation of hybrid pigs was to test and to compare indicators of fattening capacity and carcass value with concentration on the production of the percentage of muscles in four different genotypes. Pig genotypes were tested in four tests in whose sow line were the crosses of White Pork (BU) and Landrace (L), in the sire line – synthetic boars and the Hampshire breed (H) of the following frequencies:

- 36 animals (BU x L) x F16 (product of the company PIC),
- 36 animals (BU x L) x H,
- 36 animals (BU x L) x SL-88,
- 72 animals (BU x L) x SL-97.

Housing of pigs was done at above-standard Testation Station of Pigs at Ploskov near Lány according to the methodology of testation of pure-bred and hybrid pigs in order to keep the principle of pair housing of animals in pen (1 boar piglet + 1 gilt).

Pigs were fed ad-libitum using the feeders manufactured by Duräumat in two phases with continuous transition from one phase to another by feeding mixtures with the following composition and the content of nutrients:

Nutrient content per 1 kg of mixture		Phase of feeding	
		I (1st to 21st week)	II (22nd week)
MEp	(MJ)	12.9	12.8
Crude protein	(g)	205	158
Fibre	(g)	42	52
LYZ	(g)	11.4	8.1
MET + CYS	(g)	6.3	4.4
TRE	(g)	7.5	5.1
TRY	(g)	2.1	1.5
Ca	(g)	7.2	6.0
P	(g)	5.5	6.0
Formulation		Phase of feeding	
Components	(%)	I (1st to 21st week)	II (22nd week)
Soya extracted meal		20	13
Barley		37	39
Wheat		32.5	38.5
Maize		–	5
Premix Tekro		2.5	2.5
MKM		8	2

To assess the fattening capacity and growth ability, the pigs of the studied genotypes were weighed at the beginning of the trials, and then they were weighed regularly in week intervals from about 60 kg of live weight to determine:

- average weight in the test (kg),
- feed conversion (kg),
- average daily weight gain (kg).

Percentage of lean muscles was also determined in the carcass in the given intervals by ultrasonic apparatus Pigmatic 103.

After reaching the slaughter weight of about 110 kg pigs were slaughtered and realised in the slaughterhouse firmly in meat and by the system EUROP and the method ZP (Vrchlabský, Palásek, 1992; Czech Standard ČN 46 6160, 1993), the following indicators were determined:

- live weight (kg),
- weight of the carcass (kg),
- backfat thickness (Czech Standard ČN 1993),
- electric conductivity (EV 50) 50 minutes *post mortem* (μS) at frequency 10.61 kHz in muscles (*musculus longissimus lumborum et thoracis*) and MS (*musculus semimemranosus*).

All partial data were processed by routine mathematical and statistical methods and expressed in tables and graphs. For more accurate comparison of the effect of genotype and factors influencing the studied production indicators, the computation using regression analysis by polynomial of the 3rd order was done to eliminate the variability of the values found, together with the statistical significance of the effect of genotype and filling weight.

RESULTS AND DISCUSSION

Evaluation of pig fattening capacity of different genotypes with respect to age and production of lean cuts is presented in Tables I to IV.

As presented in the above tables, it is evident that though statistically significant differences in different studied genotypes were found in the studied qualities, they cannot be compared with each other completely for the reasons of significant differences in filling weights and age of pigs, particularly in the group of animals of the genotype (BU x L) x H. For better lucidity of the trend of the course of assessment of traits of fattening capacity and production of lean cuts of the studied pig genotypes, the regression analysis eliminating variability of the values found in view of plus and minus variants was used. The results of this comparison of the studied production indicators of the different genotypes are presented in Table V.

I. Evaluation of fattening capacity of pigs of the genotype (BU x L) x F16

Age at filling (days): 82^{A}					
Filling weight (kg): 31.6^{Aa}					
Age (days)	weight (kg)		percentage of muscles (%)		weight gain (g/day)
	$x \pm s_x$	s	$x \pm s_x$	s	x
124	67.00 ± 0.84	5.07	55.80 ± 0.32	1.92	
131	74.22 ± 0.85	5.07	55.39 ± 0.32	1.95	1 032
138	80.72 ± 1.12	6.69	55.38 ± 0.42	2.52	929
148	89.11 ± 1.20	7.21	54.78 ± 0.41	2.44	839
152	93.42 ± 1.26	7.54	54.04 ± 0.42	2.50	1 076
159	98.72 ± 1.32	7.94	52.84 ± 0.51	2.72	758
166	105.22 ± 1.35	8.09	52.32 ± 0.48	2.75	929
173	112.14 ± 1.48	8.90	51.03 ± 0.51	3.08	988
Total	**112.14^{A} ± 1.48**	**8.90**			**921^{AB}**

$P < 0.01$ – A, B, C, D; $P < 0.05$ – a, c

II. Evaluation of fattening capacity of pigs of the genotype (BU x L) x H

Age at filling (days): 66^{ABC}					
Filling weight (kg): 17.8^{ABC}					
Age (days)	weight (kg)		percentage of muscles (%)		weight gain (g/day)
	$x \pm s_x$	s	$x \pm s_x$	s	x
143	58.18 ± 1.98	11.52	58.10 ± 0.36	1.64	
150	62.74 ± 2.06	12.00	57.62 ± 0.34	1.72	651
157	68.97 ± 2.23	13.01	57.22 ± 0.39	2.03	891
164	74.65 ± 2.24	13.06	57.34 ± 0.38	2.02	811
171	81.29 ± 2.31	13.46	56.40 ± 0.38	2.16	950
178	86.29 ± 2.46	14.37	56.69 ± 0.43	2.46	714
185	90.65 ± 2.42	14.08	55.56 ± 0.46	2.66	622
192	95.41 ± 2.49	14.51	55.13 ± 0.54	3.14	681
Total	**95.41^{ABC} ± 2.49**	**14.51**			**760^{aAC}**

$P < 0.01$ – A, B, C, D; $P < 0.05$ – a, c

III. Evaluation of fattening capacity of pigs of the genotype (BU x L) x SL-88

Age at filling (days): 82^{B}					
Filling weight (kg): 34.2^{aBc}					
Age (days)	weight (kg)		percentage of muscles (%)		weight gain (g/day)
	$x \pm s_x$	s	$x \pm s_x$	s	x
124	64.35 ± 1.85	11.10	58.62 ± 0.47	2.16	
131	70.33 ± 1.71	10.26	59.06 ± 0.36	2.00	855
138	75.89 ± 1.87	11.22	59.07 ± 0.46	2.71	794
148	80.67 ± 1.88	11.30	58.55 ± 0.45	2.68	478
152	86.38 ± 1.85	11.13	58.04 ± 0.40	2.40	1 427
159	90.74 ± 1.87	11.23	57.72 ± 0.43	2.57	624
166	95.04 ± 2.02	12.14	57.09 ± 0.46	2.76	614
173	101.28 ± 2.09	12.53	56.70 ± 0.45	2.72	891
180	106.34 ± 2.07	12.22	56.13 ± 0.48	2.86	724
187	110.03 ± 2.11	12.50	55.08 ± 0.53	3.21	527
194	114.60 ± 2.28	13.48	53.63 ± 0.51	3.09	653
Total	**114.60^{B} ± 2.28**	**13.48**			**718^{aBD}**

$P < 0.01$ – A, B, C, D; $P < 0.05$ – a, c

IV. Evaluation of fattening capacity of pigs of the genotype (BU x L) x SL-97

Age at filling (days): 82^{C}					
Filling weight (kg): 32.1^{cC}					
Age (days)	weight (kg)		percentage of muscles (%)		weight gain (g/day)
	$x \pm s_x$	s	$x \pm s_x$	s	x
140	75.96 ± 0.99	8.31	55.65 ± 0.39	3.26	
147	80.04 ± 1.05	8.83	56.01 ± 0.52	4.39	584
154	84.79 ± 1.10	9.27	54.95 ± 0.36	3.07	678
161	93.28 ± 1.14	9.57	53.65 ± 0.38	3.17	1 213
168	98.87 ± 1.39	11.72	53.06 ± 0.46	3.40	799
175	107.58 ± 1.26	10.58	52.74 ± 0.40	3.35	1 243
182	113.30 ± 1.27	10.71	52.07 ± 0.41	3.45	817
Total	**113.30^{C} ± 1.27**	**10.71**			**889^{CD}**

V. Comparison of fattening capacity and percentage of lean muscles of pig genotypes (transformed by polynomial regression of the 3rd order)

Genotype	(BU x L) x F16 (n = 36)		(BU x L) x H (n = 36)		(BU x L) x SL-88 (n = 36)		(BU x L) x SL-97 (n = 72)	
Weight (kg)	percentage of muscles^{AB}	daily weight gain^{AB}	percentage of muscles^{ACa}	daily weight gain^{aAC}	percentage of muscles^{CD}	daily weight gain^{aBD}	percentage of muscles^{aE}	daily weight gain^{CD}
	(%)	(g/day)	(%)	(g/day)	(%)	(g/day)	(%)	(g/day)
	x	x	x	x	x	x	x	x
60			58.89	779			59.06	
65	56.29	946	58.25	766	60.45	846	58.02	
70	56.23	956	57.75	747	59.87	827	57.09	
75	55.93	953	57.34	721	59.29	806	56.25	394
80	55.45	943	56.98	686	58.73	784	55.49	528
85	54.83	929	56.61	642	58.16	761	54.81	682
90	54.12	917	56.19	587	57.58	739	54.19	834
95	53.36	909	55.68	520	56.99	717	53.62	957
100	52.61	911	55.01		56.37	697	53.10	1 027
105	51.89	926			55.72	679	52.61	1 020
110	51.27	959			55.03	663	52.15	911
115	50.78				54.29	651	51.70	674
120					53.50	643	51.25	

$P < 0.01$ – A, B, C, D, E; $P < 0.05$ – a, b, c

It follows from the table that with respect to the order of profitableness of growth intensity expressed by average daily weight gain of the studied genotypes, the genotype (BU x L) x F16 seems to be the best, and the pigs of three-breed combination (BU x L) x H were the worst. Significances in differences among combinations in the studied quality can be used in further special breeding and production of slaughter pigs.

As far as the evaluation of the percentage of lean cuts is concerned with respect to the genotype, the combination (BU x L) x SL-88 seems to be the best, while the combination using SL-97 boars in C-position seems to be the worst.

Evaluation of the course of production of the percentage of lean cuts with respect to the genotype used was done using the regression analysis of com-

putation of the studied qualities to unified weight and statistical significance of differences of the studied effects was determined (Table VI).

This table has confirmed the above order of suitability of the studied genotypes and further it has confirmed that at immediate large-scale introduction of the apparative system of realisation of slaughter pigs with respect to the requirements of this system into different quality classes, it will be necessary to decrease to about 100–105 kg of live weight. The fact, that genotype, slaughter weight and age of slaughter pigs significantly affect studied production qualities, has been also confirmed.

With increasing percentage of lean cuts, it will be necessary to take into account also the existence of negative relationships between percentage of meat and its quality (P o u r , 1986). This evaluation with respect to the genotype is presented in Table VII.

Significant dependencies and mutual significances of different genotypes with respect to the indicators of the carcass value and meat quality of the studied pigs were found. As to the evaluation of meat quality, except the combination (BU x L) x F16 in that required indicators of meat quality could not be obtained for technical reasons, evidently meat quality is affected by the genotype. It seems to be that better quality can be reached by crossbreeds using the C-position of synthetic boars of the genotype (H x PN) or SL-88, respectively.

VI. Evaluation of the course of production of lean muscles in different genotypes

Genotype^{AA}	(BU x L) x F16^{BC}	(BU x L) x H^{DE}	(BU x L) x SL-88^{BDF}	(BU x L) x SL-97^{CEF}
Weight (kg)^{AA}	percentage of muscles (%)			
60	56.35	58.89	60.30	59.06
65	56.35	58.25	59.74	58.02
70	56.18	57.75	59.18	57.09
75	55.84	57.34	58.61	56.25
80	55.35	56.98	58.04	55.49
85	54.76	56.61	57.47	54.81
90	54.10	56.19	56.89	54.19
95	53.39	55.68	56.30	53.62
100	52.65	55.01	55.70	53.10
105	51.93	54.15	55.10	52.61
110	51.24	53.04	54.50	52.15
115	50.63	51.64	53.88	51.70

$P < 0.001$ – AA; $P < 0.01$ – A, B, C, D, E, F

VII. Survey of indicators of slaughter value and meat quality with respect to the genotype

Group	(BU x L) x F16 ($n = 36$)		(BU x L) x H ($n = 36$)		(BU x L) x SL-88 ($n = 36$)		(BU x L) x SL-97 ($n = 72$)	
Indicator	$x \pm s_x$	s	$x \pm s_x$	s	$x \pm s_x$	s	$x \pm s_x$	s
Live weight (kg)	$112.14^{A} \pm 1.48$	8.90	$95.41^{ABC} \pm 2.49$	14.51	$114.60^{B} \pm 2.28$	13.48	$113.30^{C} \pm 1.27$	10.71
Dead weight (kg)	$89.81^{A} \pm 1.95$	8.96	$80.97^{ABC} \pm 1.31$	10.91	$91.29^{B} \pm 1.89$	11.33	$89.70^{C} \pm 0.68$	3.60
Backfat thickness according to the Czech National Standard ČSN (mm)	$26.00^{aA} \pm 1.22$	5.58	$20.78^{AB} \pm 0.75$	6.26	$22.03^{aC} \pm 0.79$	4.72	$27.18^{BC} \pm 1.11$	5.88
Average backfat thickness (mm)			$26.88^{aA} \pm 0.62$	5.16	$29.49^{aB} \pm 0.79$	4.72	$37.19^{AB} \pm 1.08$	5.53
Percentage of lean cuts (%)			$55.92^{A} \pm 0.43$	3.58	$53.03^{A} \pm 0.57$	3.41		
EV50 MLT (µS)			$5.28^{AB} \pm 0.27$	2.26	$4.03^{AC} \pm 0.21$	1.23	$6.79^{BC} \pm 0.40$	2.13
EV50 MS (µS)			$4.05^{aA} \pm 0.25$	2.10	$3.31^{aB} \pm 0.14$	0.82	$5.57^{AB} \pm 0.37$	1.95

$P < 0.01$ – A, B, C; $P < 0.05$ – a

For the reasons of highly statistical significances found, with respect to the pig weight of the studied combinations, relationships among genotypes can be considered as generally valid, except the three-breed combination (BU x L) x H, whose studied qualitative indicators of the carcass value may be influenced by lower slaughter weight.

CONCLUSION

Based on the results obtained, it can be said that with respect to the growth intensity, the pigs of the genotype (BU x L) x F16 seems to be the best, showing throughout the testation fattening daily weight gain about 935 g and the pigs (BU x L) x SL-88 by their weight gain about 677 g, seem to be the worst ones. The genotype (BU x L) x SL-97 or (BU x L) x H about 781 g or 681 g, resp.), was on the second or third place, resp.

As far as the ability of the production of muscles and meat quality is concerned with respect to the genotype, the combination (BU x L x SL-88 (55.4 %) seems to be the best at the reached slaughter weight 100–105 kg, and (BU x L) x F16 was the worst.

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Zhodnocení vybraných kvantitativních a kvalitativních znaků jatečné hodnoty u různých genotypů prasat.

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Aparativní zpeněžování prasat přinutí prvovýrobce uplatnit ve svých chovech výrazně masné genotypy. Vodítkem jim v tomto ohledu jsou staniční a polní testy.

Cílem provedených testací hybridních prasat, uskutečněných v NTPS v Ploskově, bylo prověření a porovnání ukazatelů výkrmnosti a jatečné hodnoty se zaměřením na tvorbu libové svaloviny u genotypů (BU x L) x F16, (BU x L) x H, (BU x L) x SL-88 a (BU x L) x SL-97.

Ustájení a krmení prasat bylo realizováno podle metodiky pro testaci čistokrevných a hybridních prasat.

Pro zhodnocení výkrmnosti a růstové schopnosti byla prasata sledovaných genotypů po zjištění naskladňovací hmotnosti pravidelně vážena v sedmidenních intervalech cca od 60 kg živé hmotnosti. Byla stanovena průměrná hmotnost v testu (kg), konverze krmiva (kg) a průměrný denní přírůstek (g).

V uvedených intervalech byl rovněž zjišťován podíl libového masa v jatečném těle ultrazvukovým přístrojem Pigmatic 103.

Při dosažení porážkové hmotnosti cca 110 kg byla všechna prasata poražena a zpeněžena na jatkách napevno v mase a systémem EUROP a byly stanoveny ukazatele jatečné hodnoty, resp. čistá hmotnost (kg), mrtvá hmotnost (kg), výška hřbetního tuku (ČN 1993) a elektrická vodivost (EV50) 50 min p. m. (μS) při frekvenci 10,61 kHz ve svalech MLT a MS.

Veškeré dílčí údaje byly zpracovány běžnými matematicko-statistickými metodami a vyjádřeny tabulkově.

Z výsledků testů lze konstatovat, že s ohledem na růstovou intenzitu se jako nejlepší pro užitkové chovy ukazuje genotyp (BU x L) x F16, který v testu vykázal průměrný přírůstek 935 g. Pokud jde o tvorbu libového masa a jeho kvalitu, pak lze doporučit prasata kombinace křížení (BU x L) x SL-88, dosahující v hmotnosti cca 100 kg zmasilosti přes 55 %.

prase; genotyp; výkrmnost; jatečná hodnota; podíl libové svaloviny

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