Genotype impact on the economy of production performance in pigs

Vliv genotypu na ekonomiku výkrmu prasat

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Abstract: The test focussed on the evaluation of production traits, i.e. fattening performance and quantitative aspect of the carcass value in 4 genotypes of pigs by means of station tests. The tests included 288 hybrid pigs of the VEPIG and (LW_d ×L) genotypes mated by hybrid-boars of (PN×D), (PN×H), (LW_s×BL). The outcomes have proved the existence of marked genotype differences in the production traits and, consequently, also in the economics which means for the pig breeders in the current period a significant measure conducing to the improvement of the economics of pig breeding. As the best, there has been proved the VEPIG genotype of pigs, which has shown the best results in all qualities of the fattening performance and carcass value. This genotype has also reflected best its highest growth intensity in the formation of meat which has been manifested positively in the classification of slaughter pigs, i.e. the profit per a slaughter pig in the amount of 625 CZK. In contrast, the other combinations have shown a loss which in the (LW_d×L) × (LW_s×BL) genotypes amounted to 324.50 CZK, in (LW_d×L) × (PN×D) 228 CZK and in (LW_d×L) × (PN×H) 279 CZK. Therefore it has to be stated that a deliberate selection of a suitable genotype is of a vital importance in order to be able to face the current considerably unfavourable situation in pig breeding.

Key words: pig, genotype, production performance, testation, economy, profit formula

Abstrakt: Účelem pokusu bylo zhodnocení produkční užitkovosti, tedy výkrmnosti a kvantitativní stránky jatečné hodnoty 4 genotypů prasat pomocí staničních testů. Testy se uskutečnily u 288 ks hybridních prasat genotypů VEPIG a (LW×L) zapuštěných kanci plemen (PN×D), (PN×H), (BO×BL). Dosažené výsledky prokázaly existenci výrazných genotypových diferencí v produkční užitkovosti a tedy i v ekonomice, což pro chovatele v současném období znamená významné opatření vedoucí ke zlepšení ekonomiky chovů prasat. Prokázalo se, že se jako nejlepší jeví genotyp prasat VEPIG, který ve všech vlastnostech výkrmnosti a jatečné hodnotě prokázal nejlepší výsledky. Tento genotyp svou nejvyšší růstovou intenzitu rovněž nejlépe promítl do tvorby masa, což se pozitivně projevilo v zatřídění jatečných prasat, resp. v zisku na jatečné prase ve výši 625 Kč. Ostatní kombinace naopak vykázaly ztrátu. Ta u genotypů (LW×L) × (BO×BL) činila 324,50 Kč, (LW×L) × (PN×D) 228 Kč a (LW×L) × (PN×H) 279 Kč. Je tedy nutné konstatovat, že uváženým výběrem vhodného genotypu lze s úspěchem čelit současné značně nepříznivé situaci v chovu prasat.

Klíčová slova: prase, genotyp, produkční užitkovost, testace, ekonomika, zisková funkce

INTRODUCTION

The main objective of the production of slaughter pigs is undoubtedly profit which is a function of the whole complex of characters, i.e. qualities characterizing reproduction and production traits. As production traits of farm animals are the resultant of an additive effect of the genes, it is the quantitative qualities the manifestation and scope of which is influenced by the genotype and environment. As a result, production traits may be improved both by genetic and non-genetic measures. As concerns the genetic measures, we are able, thanks to new scientific disciplines such as genomics, biometrics, biotechnology etc., to concentrate desirable genes in DNA and subsequently by dissection, if need be, to determine the loci containing the genes participating in the management and scope of production traits. This is the way how

to purposefully immigrate valuable genes from one population into another and thus directly influence the gene manifestation. However, these measures cannot be successfully implemented without the use of the current methods evaluating production traits indirectly on the basis of biometric evaluation where information about the effects of genotypes is acquired from their average effects in populations and production traits are defined by them.

Both domestic and foreign hybridization programs offer a number of genotypes the production traits of which are associated with non-genetic factors. It depends on breeders and their knowledge what genotype they will choose in the given breeding, in order to achieve the required profitability. Guidance in their choice is provided by the tests of populations that are necessary both for the sphere of breeding and commercial rearing.

REVIEW OF LITERATURE

The choice of a suitable genotype for the particular conditions of commercial breeding is a decisive step for pig breeders. Performance and suitability of various genotypes are verified by tests of populations (Jakubec 1990), the aim of which is according to Moskal (1984,1986), Rao, Mc Cracken (1990, 1992) the acquisition of the biggest possible volume of objective information about the tested populations of pigs on the basis of
– comparison of the chosen combination of breeds/hybrids with other combinations of breeds/hybrids in all relevant indicators of production traits,
– verification of the relative efficiency of individual hybridization programs, thus initiating competition among pig breeders in terms of maximization of the breeding progress while observing the principle of mutual comparability of production traits which may be ensured by the application of definable conditions together with the choice of suitable biometric methods (Jakubec 1990).

The above given tests also provide pig breeders with the information about the influence of the selected line (Stupka, Šprysl 2003), sex (Stupka et al. 2004) and technique of feeding (Šprysl, Stupka 2003).

With regard to the fact that station tests of pig populations providing the breeding and scientific sphere with the findings for selection programs and hybridization are currently being cancelled, breeders may at present test their genotypes only in the standard conditions of test centres of the Czech University of Agriculture and the Central Control and Test Institute of Agriculture. With minimization of environmental effects, they allow to determine the order of benefits of individual genotypes as well as maximum of production traits of the tested combinations of hybrids. This information is useful for breeders in the choice of the respective measures aimed at minimization of differences between the production traits of the given breeding and the production traits manifested by the selected genotype in the station test (Mc Phee et al. 1991; Cameron 1991). With regard to economics, it is the case of the determination of the scope of the genotype x environment interaction that is well known in pig breeding (Merks 1989; De Hear 1990; De Hear, De Vries 1993; Šprysl, Stupka 1990, 1991, 1992).

In order to ensure mutual comparability of internal factors influencing production traits, it is necessary to eliminate different environmental factors (Jakubec 1988; Cameron 1991; Mc Phee et al. 1991).

METHODS

Comparison of the production performance, i.e. fattening capacity and carcass value on the pig profitability with respect to the used genotype was the objective of the carried out test.

In the trial, the genotype VEPIG was tested (Danish service program based on LW_d, L and D breeding and its´crossing) with recomended final hybrid pigs realized in the Czech Republic according to the Association of Pig Breeders in the Czech Republic
– $(LW_d \times L) \times (PN \times D)$
– $(LW_d \times L) \times (PN \times H)$
– $(LW_d \times L) \times (BO \times BL)$

All pigs were penned in pairs (barrow/gilt) according to the testing-methodology of pure and hybridbred pigs.

The feeding was carried out ad-libitum according the Šimeček et al (2000) norm by the help of Duräumat self-feeders in three smooth-conversion phases where the feeding-mixtures (CFM) were fattened according to the followed receptures and figures (Table 1).

288 hybrid pigs were brought in the test-station at the average age of 83 ± 3 days (since their birth) and the average live weight 29.9 kg. The tested animals were sorted out into the following 4 groups (mother-father):

Group 1: 72 barrows and gilts of $(LW_d \times L) \times (PN \times D)$ genotype at the average live weight 31.1 kg.
Group 2: 72 barrows and gilts of VEPIG genotype at the average live weight 25.1 kg.
Group 3: 72 barrows and gilts of $(LW_d \times L) \times (PN \times H)$ genotype at the average live weight 30.0 kg.
Group 4: 72 barrows and gilts of $(LW_d \times L) \times (LW_s \times BL)$ genotype at the average live weight 31.3 kg.

Table 1. Composition of feeding-mixtures (CFM)

	Feeding period		
	less 35 kg	35–65 kg	over 65kg
Component (%)			
Wheat	45.0	38.8	36.2
Barley	26.8	38.4	50.0
Soya meal	25.0	20.0	11.0
Premix	3.2	2.8	2.8
Total	100.0	100.0	100
Nutrient content			
Crude protein (g/kg)	196.70	184.00	156.30
MEp (MJ/kg)	13.30	13.20	12.90
Fibre (g/kg)	39.84	38.76	40.75
LYZ (g/kg)	11.40	10.20	8.30
THRE (g/kg)	7.20	6.50	5.40
MET (g/kg)	3.20	2.90	2.40
Ca (g/kg)	7.20	6.80	6.10
P (g/kg)	5.50	5.40	4.60

where:

Z_c = annual profit per capacity unit
Z = profit per head
r = annual speed of turnover
c_1 = average sales price per unit of production
n_1 = unit cost of compound feed
n_2 = fixed costs per feeding day (in growing and finishing phase)
n_3 = costs per sow and litter
A = costs of piglet treatment and feeding
y_1 = carcass weight
y_1' = live weight of slaughter pig
y_0' = initial live weight of fattened pig
x_1 = quantity of consumed compound feed
x_2 = duration of fattening
x_2' = ADG from live weight y_0 to live weight y_1 of the slaughter pig
x_3 = number of reared piglets per sow and litter
k = number of days between two rounds of fattening.

Legend: LW_d = Large White dam-breed (LW), L = Landrace breed, LW_s Large White sire-breed (BO), BL = Belgian Landrace breed, D = Duroc breed, PN = Pietrain breed, H = Hampshire breed

For evaluation of fattening and growing performance, all pigs were weighted regularly weekly where the following traits were monitored:
– average live weight (ALW) in kg
– feeding conversion ratio (FCR) in kg
– daily feed intake (DFI) in kg
– average daily weight gain (ADG) in g

When achieving the average live weight of approximately 106 kg, pigs were slaughtered and realized within the SEUROP system by the ZP method (Vrchlabský, Palásek 1992; Pulkrábek 2001, etc.).

For carcass value determination, the following traits were monitored in each animal
– live weight (kg)
– carcass weight (kg)
– lean meat share according ZP method (%)

All obtained data were processed by common mathematical and statistic methods and expressed in tables and figures. By the conclusion, the profitability of the test was evaluated with respect to group by the help of profit-formula (Poděbradský 1980; Župka 1992)

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

while

$$r = 365 : (x_2 + k) \qquad x_2 = (y_1' - y_0') : x_2' \qquad Z_c = Z \times r$$

RESULTS AND DISCUSSION

The analysis of the fattening performance characters with regard to the genotype on the basis of the actually achieved values within the tests is presented in Table 2a–d and Figures 1a–d including the initial and/or final weight and age of pigs.

They show evidently that the VEPIG and $(LW_d \times L) \times (PN \times H)$ pigs did not reach at the beginning of the test the recommended growth level (Guyokrma 1994). This fact has proved that there exist problems and reserves in the field of the respective commercial breeding of hogs. Figure 1a and Table 2a document that during 3–4 week, the tested animals of these genotypes got over the recommended lower limit and their weight in relation to age was ranging within the recommended scope until the end of the test. Other genotypes thanks to their initial weight copied the $[(LW_d \times L) \times (PN \times H)]$ or got over the upper recommended growth intensity of $[(LW_d \times L) \times (LW_s \times BL)]$. As concerns the progress of live weight in the course of the test, it may be stated that although age differences between combinations were minimal (7-day cycle), the tested genotypes manifested significant weight differences between each other, namely approximately until the age of 144 days or the weight of approximately 80 kg.

If we evaluate the average daily weight gain (Table 2b and Figure 1b), the achieved values and the progress of weight gains show evidently that the growth intensity

Table 2a. Fattening capacity with respect to genotype ALW (kg)

Age (days)	(LW$_d$×L) × (PN×D)		Age (days)	VEPIG	
	$\overline{x} \pm s_{\overline{x}}$	s		$\overline{x} \pm s_{\overline{x}}$	s
81	33.1 [BDE] ± 2.66	0.33	86	25.1 [ABC] ± 4.27	0.51
88	39.6 [BDE] ± 2.73	0.33	93	30.3 [ABC] ± 5.01	0.59
95	46.4 [BDE] ± 2.97	0.36	100	36.1 [ABC] ± 5.82	0.69
102	53.8 [BDE] ± 3.79	0.46	107	43.4 [AB] ± 6.47	0.77
109	60.3 [BDE] ± 4.23	0.52	114	49.7 [AB] ± 6.83	0.81
116	66.2 [BDE] ± 4.58	0.56	121	55.8 [AB] ± 7.48	0.89
123	72.1 [BEa] ± 4.86	0.59	128	63.8 [AB] ± 7.79	0.92
130	77.8 [BE] ± 5.19	0.63	135	71.0 [AB] ± 8.27	0.98
137	82.8 [BE] ± 5.34	0.65	142	78.1 [AB] ± 8.44	1.00
144	88.5 [ac] ± 5.56	0.68	149	85.1 [Aa] ± 8.61	1.02
151	93.3 ± 6.04	0.74	156	92.5 ± 8.88	1.05
158	99.3 ± 6.35	0.78	163	99.3 ± 9.24	1.10
165	104.9 ± 6.74	0.83	170	106.0 ± 9.28	1.10

Age (days)	(LW$_d$×L) × (PN×H)		Age (days)	(LW$_d$×L) × (LW$_s$×BL)	
	$\overline{x} \pm s_{\overline{x}}$	s		$\overline{x} \pm s_{\overline{x}}$	s
85	30.0 [CE] ± 4.34	0.73	80	31.3 [AD] ± 2.48	0.29
92	34.4 [CEF] ± 5.12	0.87	87	37.3 [ADF] ± 2.91	0.34
99	39.6 [CEF] ± 6.04	1.02	94	44.3 [ADF] ± 3.53	0.42
106	45.1 [EF] ± 6.65	1.12	101	50.8 [ADF] ± 4.23	0.50
113	50.9 [EF] ± 7.28	1.23	108	57.1 [ADF] ± 4.45	0.53
120	58.2 [EF] ± 8.04	1.36	115	63.7 [ADF] ± 4.99	0.59
127	65.6 [EF] ± 8.03	1.36	122	69.8 [AFa] ± 5.71	0.68
134	72.1 [EF] ± 8.46	1.43	129	76.6 [AF] ± 6.47	0.77
141	77.8 [EF] ± 8.99	1.52	136	82.9 [AF] ± 6.80	0.81
148	84.9 [bc] ± 9.37	1.58	143	88.8 [Ab] ± 7.39	0.88
155	92.2 ± 9.86	1.67	150	94.2 ± 7.89	0.94
162	97.9 ± 10.44	1.77	157	100.2 ± 8.25	0.98
169	103.8 ± 11.14	1.88	164	105.9 ± 8.65	1.03

Differences indicate by same type are statistically significant

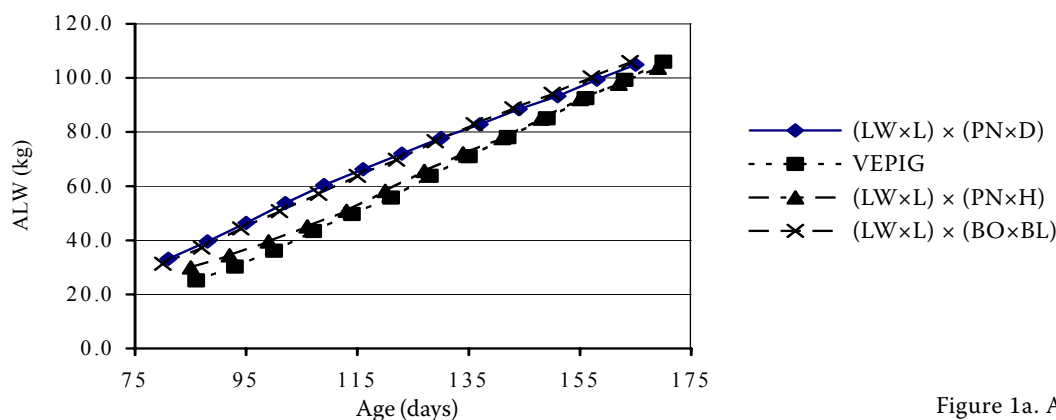For $P \leq 0.01$ are used A, B, C, D, E , for $P \leq 0.05$ then a, b, c

Figure 1a. Average live weight

Table 2b. Fattening capacity with respect to genotype ADG (g)

Interval age (days)	$(LW_d \times L) \times (PN \times D)$		Interval age (days)	VEPIG	
	$\overline{x} \pm s_{\overline{x}}$	s		$\overline{x} \pm s_{\overline{x}}$	s
81–87	925 BDb ± 153	19		736 ABa ± 245	29
88–94	972 BD ± 136	17	93–99	826 ABa ± 179	21
95–101	1 060 CE ± 227	28	100–106	1 042 AB ± 206	24
102–108	934 A ± 168	21	107–113	898 a ± 168	20
109–115	844 BC ± 187	23	114–120	875 A ± 188	22
116–122	832 BD ± 164	20	121–127	1 143 ABa ± 171	20
123–129	823 ACD ± 176	22	128–134	1 036 ABa ± 126	15
130–136	709 BDE ± 155	19	135–141	1 016 ABC ± 153	18
137–143	821 BD ± 201	25	142–148	994 AB ± 165	20
144–150	686 BDa ± 168	21	149–155	1 058 AB ± 165	20
151–157	860 B ± 161	20	156–162	967 ABC ± 174	21
158–164	776 B ± 247	30	163–169	963 ABa ± 204	24

Interval age (days)	$(LW_d \times L) \times (PN \times H)$		Interval age (days)	$(LW_d \times L) \times (LW_s \times BL)$	
	$\overline{x} \pm s_{\overline{x}}$	s		$\overline{x} \pm s_{\overline{x}}$	s
85–91	637 CDa ± 220	37	80–86	857 ACb ± 163	19
92–98	739 CDa ± 227	38	87–93	1 009 AC ± 217	26
99–105	790 BDE ± 224	38	94–100	922 ACD ± 175	21
106–112	824 Aab ± 227	38	101–107	908 b ± 167	20
113–119	1045 ABa ± 308	52	108–114	945 Ca ± 182	22
120–126	1053 CDa ± 263	45	115–121	865 AC ± 213	25
127–132	937 BD ± 186	31	122–128	978 Ca ± 200	24
133–140	806 CEa ± 179	30	129–135	892 ADa ± 199	24
141–147	1024 CD ± 247	42	136–142	849 AC ± 265	31
148–154	1033 CD ± 236	40	143–149	761 ACa ± 228	27
155–161	812 C ± 216	36	150–156	869 A ± 258	31
162–168	845 a ± 255	43	157–163	804 A ± 231	27

Differences indicate by same type are statistically significant
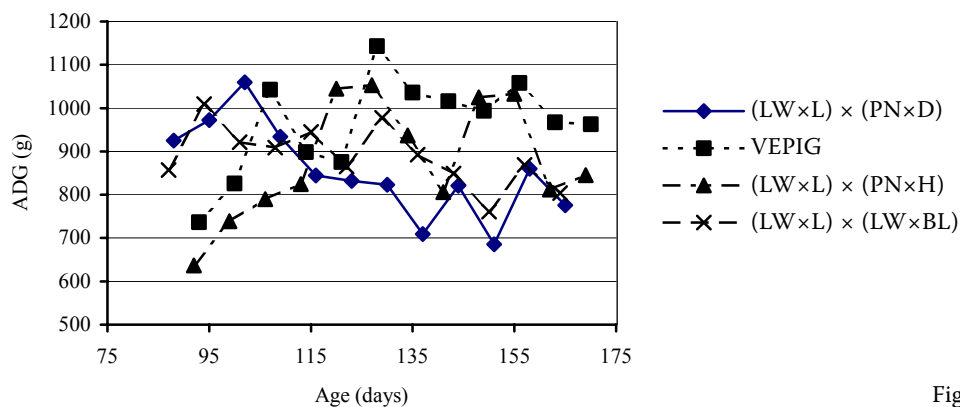For $P \leq 0.01$ are used A, B, C, D, for $P \leq 0.05$ then a, b

Figure 1b. Average daily gain

differs in the examined genotypes which is proved by the presented highly conclusive differences. It may be stated that the $(LW_d \times L) \times (PN \times D)$ or $(LW_d \times L) \times (LW_s \times BL)$ genotype reaches its maximum at the beginning of the fattening period approximately until the age of 100 or 130 days and subsequently the growth intensity decreases. On the other hand, the $(LW_d \times L) \times (PN \times H)$ genotype shows until the age of 110 days the lowest growth intensity. Subsequently until the age of 155 days, it ranges between the standardized values for the meaty/super-meaty type (Šimeček et al. 2000) and then sharply falls. The genotype with the most intensive growth seems to be the commercial VEPIG product which despite its lowest initial weight exceeds by its growth intensity approximately from the age of 100 days the upper limit of the recommended norm. The achieved results prove the fact that most current hybrid combinations of pigs realized in the production sphere manifest their growth potential differently. This fact proves the necessity of regular tests of populations in the field of pig breeding (Moskal 1986, Hovorka 1989).

As concerns the intake ability of the animals, i.e. the average daily feed consumption, the Table and Graph 1c document that it ranges above the upper recommended limit which documents that the examined genotypes do not show a lower intake ability as is currently presented (Dalby 1998). With regard to individual genotypes, it may be also stated that in the system of ad-libitum feeding the $(LW_d \times L) \times (LW_s \times BL)$ and $(LW_d \times L) \times (PN \times D)$ genotypes record until the age of approximately 115 days the highest feed intake which is later surpassed by the $(LW_d \times L) \times (PN \times H)$ pigs. The lowest intake ability in the monitored system of feeding is manifested by the VEPIG pigs whose feed intake ranges slightly above the upper recommended limit for the super-meaty type (Šimeček et al. 2000).

The evaluation in Table 2d and Figure 1d of feed conversion ratio in terms of the economics of fattening constituting a significant cost item shows that in the course of the growth, significant differences were manifested in the monitored character in the tested genotypes. It is evident that with the exception of the commercial VEPIG genotype, the feed conversion ratio ranges markedly above the limit recommended by the norm (Šimeček et al. 2000). The given graph further shows that the highest conversion in this respect was achieved by the $(LW_d \times L) \times (PN \times D)$ genotype. The remaining genotypes range by their feed conversion ratio between the above given genotypes.

The total evaluation of the fattening performance characters of individual genotypes during the test is included in the following Table 3.

The evaluation of the examined combinations throughout the whole period of testing (Table 3) has proved within individual characters of the fattening performance statistically highly significant differences ($P \leq 0.001$ or $P \leq 0.05$), practically in all genotypes, with the exception of the daily feed consumption. It is evident that as concerns the order of advantageousness, the best in terms of the achieved daily weight gain (984 g) and feed conversion ratio (2.7 kg) is the commercial VEPIG product. The worst values were recorded in the $(LW_d \times L) \times (PN \times D)$ genotype (3.20 kg, 850 g).

Table 4 evaluates the achieved standard of the qualities of the carcass value.

Table 4 shows that the highest meat share (57.05%) with the highest slaughter weight (106.2 kg) was achieved by the pigs of the VEPIG genotype. It is therefore obvious that as compared to other genotypes, this genotype manifested together with high growth intensity also an excellent formation of meat in the carcass. As concerns other genotypes $(LW_d \times L) \times (PN \times D)$ and $(LW_d \times L) \times (PN \times H)$, they achieve with a lower slaughter weight the meat share the average lower by 2%. Therefore it may be stated that they reflect their growth intensity to a lesser extent in the meat formation. The lowest values were recorded in the $(LW \times L) \times (BO \times BL)$ genotype which with an approximately same final weight of 106 kg (as VEPIG) had the meat share in the amount of 55.21%.

Table 5 documents classification of pigs of the examined genotypes into the quality grades.

The above mentioned table shows that the highest realization in the S quality grades was achieved by the VEPIG pigs (26.8%), even with a markedly higher slaughter weight in this category. The second highest realization (23.6%) in the given S grade was reached by the $(LW_d \times L) \times (LW_s \times BL)$ genotype, however, with an average carcass weight lower by 6.5 kg. This fact was proved similarly in E class in which the mentioned combinations again rank the highest. The evaluation of the frequency of the representation of slaughter pigs in U, R classes with regard to the genotype shows that the highest representation was achieved in these classes by the $(LW_d \times L) \times (PN \times D)$ and $(LW_d \times L) \times (PN \times H)$ genotypes. This fact has significantly influenced the market prices per 1 kg of meat in the individual tested genotypes.

Determination of profit was based on the market and purchase prices of the year 2003 (Pavlů, Vondráček 2003). They included only the cost of purchase of hogs and the cost of feed without including the fixed costs of the test that vary in different companies. The final Table 6 summarizes the economic evaluation of the examined groups of pigs with regard to the genotype.

Table2c. Fattening capacity with respect to genotype DFI (kg)

Interval age (days)	$(LW_d \times L) \times (PN \times D)$		Interval age (days)	VEPIG	
	$\bar{x} \pm s_{\bar{x}}$	S		$\bar{x} \pm s_{\bar{x}}$	s
81–87	1.9 ^{BEa} ± 0.21	0.03	86–92	1.2 ^{ABC} ± 0.28	0.03
88–94	2.2 ^{BDF} ± 0.22	0.03	93–99	1.7 ^{ABa} ± 0.32	0.04
95–101	2.3 ^{BF} ± 0.22	0.03	100–106	2.1 ^{ABC} ± 0.31	0.04
102–108	2.6 ^{BF} ± 0.22	0.03	107–113	2.3 ^{AB} ± 0.32	0.04
109–115	2.6 ^{C} ± 0.26	0.03	114–120	2.5 ^{AB} ± 0.41	0.05
116–122	2.6 ^{C} ± 0.31	0.04	121–127	2.5 ^{AD} ± 0.36	0.04
123–129	2.6 ^{ACD} ± 0.24	0.03	128–134	2.8 ^{AB} ± 0.36	0.04
130–136	3.0 ^{Ca} ± 0.26	0.03	135–141	2.9 ^{A} ± 0.31	0.04
137–143	3.0 ^{a} ± 0.23	0.03	142–148	3.1 ^{A} ± 0.36	0.04
144–150	3.0 ^{Ba} ± 0.27	0.03	149–155	3.3 ^{AB} ± 0.36	0.04
151–157	2.9 ^{BF} ± 0.33	0.04	156–162	3.2 ^{AB} ± 0.39	0.05
158–164	3.0 ^{Ba} ± 0.41	0.05	163–169	3.4 ^{ABC} ± 0.37	0.04

Interval age (days)	$(LW_d \times L) \times (PN \times H)$		Interval age (days)	$(LW_d \times L) \times (LW_s \times BL)$	
	$\bar{x} \pm s_{\bar{x}}$	S		$\bar{x} \pm s_{\bar{x}}$	s
85–91	1.6 ^{CDE} ± 0.30	0.05	80–86	1.8 ^{ADa} ± 0.19	0.02
92–98	1.8 ^{EFa} ± 0.31	0.05	87–93	2.0 ^{ADE} ± 0.24	0.03
99–105	1.9 ^{EFC} ± 0.33	0.06	94–100	2.4 ^{AE} ± 0.26	0.03
106–112	2.2 ^{EF} ± 0.35	0.06	101–107	2.5 ^{AE} ± 0.25	0.03
113–119	2.7 ^{B} ± 0.36	0.06	108–114	2.7 ^{AC} ± 0.31	0.04
120–126	3.0 ^{ABCa} ± 0.44	0.07	115–121	2.7 ^{BDa} ± 0.34	0.04
127–132	3.1 ^{BDa} ± 0.45	0.08	122–128	2.9 ^{Ca} ± 0.37	0.04
133–140	3.2 ^{ABC} ± 0.47	0.08	129–135	2.9 ^{Ba} ± 0.30	0.04
141–147	3.1 ^{b} ± 0.46	0.08	136–142	2.9 ^{Aab} ± 0.28	0.03
148–154	3.2 ^{Ca} ± 0.37	0.06	143–149	2.9 ^{AC} ± 0.29	0.04
155–161	3.2 ^{EF} ± 0.39	0.07	150–156	2.8 ^{AE} ± 0.31	0.04
162–168	3.1 ^{CDa} ± 0.36	0.06	157–163	2.9 ^{AD} ± 0.27	0.03

Differences indicated by same type are statistically significant

For $P \leq 0.01$ are used A, B, C, D, E, F, for $P \leq 0.05$ then a, b
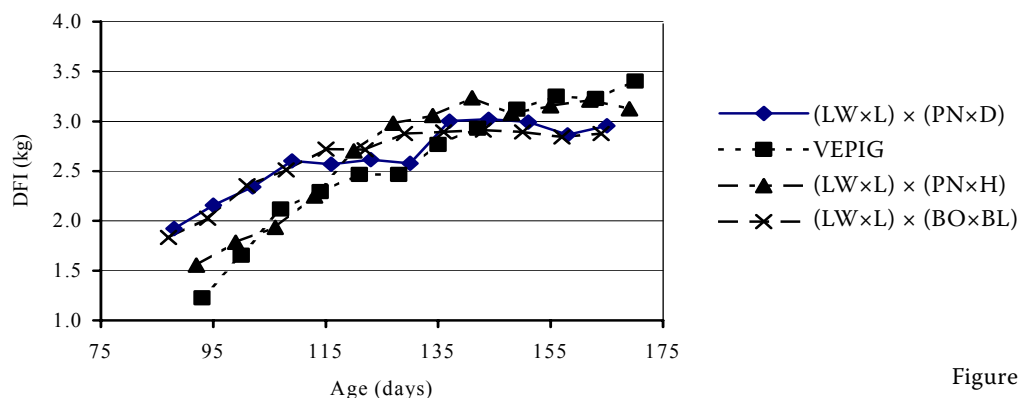

Figure 1c. Daily feed intake

Table 2d. Fattening capacity with respect to genotype FCR (kg)

Interval age (days)	$(LW_d \times L) \times (PN \times D)$		Interval age (days)	VEPIG	
	$\bar{x} \pm s_{\bar{x}}$	S		$\bar{x} \pm s_{\bar{x}}$	s
81–87	2.1 ^{Ca} ± 0.44	0.05	86–92	1.9 ^{ADa} ± 0.83	0.10
88–94	2.3 ^{Ca} ± 0.35	0.04	93–99	2.0 ^{Aa} ± 0.37	0.04
95–101	2.3 ^{CDa} ± 0.49	0.06	100–106	2.1 ^{ABa} ± 0.44	0.05
102–108	2.9 ^{A} ± 0.58	0.07	107–113	2.6 ^{abA} ± 0.50	0.06
109–115	3.3 ^{ab} ± 1.21	0.15	114–120	2.9 ^{a} ± 0.52	0.06
116–122	3.2 ^{Bb} ± 0.63	0.08	121–127	2.2 ^{ABC} ± 0.35	0.04
123–129	3.3 ^{B} ± 0.77	0.09	128–134	2.7 ^{ABC} ± 0.33	0.04
130–136	4.5 ^{BD} ± 1.18	0.14	135–141	2.9 ^{ABC} ± 0.47	0.06
137–143	4.4 ^{b} ± 4.46	0.55	142–148	3.2 ^{ab} ± 0.55	0.06
144–150	4.8 ^{BDa} ± 2.22	0.27	149–155	3.1 ^{AB} ± 0.45	0.05
151–157	3.5 ^{B} ± 0.81	0.10	156–162	3.4 ^{A} ± 0.56	0.07
158–164	4.1 ± 1.13	0.14	163–169	3.7 ± 0.86	0.10

Interval age (days)	$(LW_d \times L) \times (PN \times H)$		Interval age (days)	$(LW_d \times L) \times (LW_s \times BL)$	
	$\bar{x} \pm s_{\bar{x}}$	S		$\bar{x} \pm s_{\bar{x}}$	s
85–91	2.8 ^{ABC} ± 1.11	0.19	80–86	2.2 ^{BD} ± 0.38	0.05
92–98	2.7 ^{ABC} ± 1.12	0.19	87–93	2.1 ^{B} ± 0.44	0.05
99–105	2.6 ^{BD} ± 0.65	0.11	94–100	2.6 ^{AC} ± 0.50	0.06
106–112	2.9 ^{b} ± 0.81	0.14	101–107	2.8 ^{a} ± 0.55	0.07
113–119	2.8 ^{b} ± 0.76	0.13	108–114	3.0 ± 0.69	0.08
120–126	3.0 ^{Cab} ± 0.71	0.12	115–121	3.3 ^{Aa} ± 0.81	0.10
127–132	3.4 ^{Ca} ± 0.77	0.13	122–128	3.1 ^{Aa} ± 0.72	0.09
133–140	4.2 ^{CE} ± 0.89	0.15	129–135	3.4 ^{ADE} ± 0.77	0.09
141–147	3.2 ± 0.88	0.15	136–142	3.9 ^{a} ± 1.68	0.20
148–154	3.2 ^{CD} ± 0.70	0.12	143–149	4.2 ^{ACa} ± 1.73	0.21
155–161	4.2 ^{AB} ± 0.92	0.16	150–156	3.7 ± 2.08	0.25
162–168	4.1 ± 1.35	0.23	157–163	3.9 ± 1.70	0.20

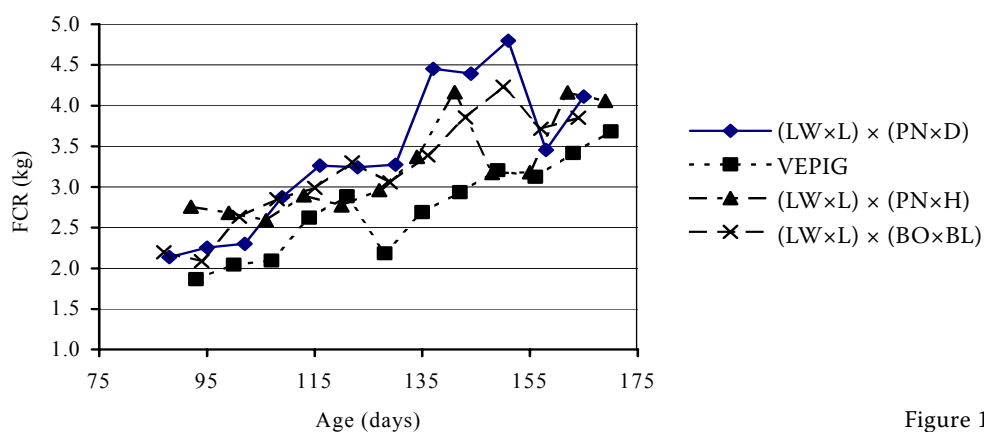Differences indicated by same type are statistically significant

For $P \leq 0.01$ are used A, B, C, D, for $P \leq 0.05$ then a, b

Figure 1d. Feed conversion ratio

The economic indicators included in Table 6 document a significant difference between the tested genotypes. The best in terms of the amount of profit per 1 pig was the genotype of the VEPIG pigs. This genotype also manifested best its growth intensity with the lowest feed conversion into meat formation, which had a positive influence on the classification of the pigs into S, E classes. Other combinations showed loss in terms of profit per one pig which amounted in the $(LW_d \times L) \times (LW_s \times BL)$ genotypes to 324.50 CZK, in $(LW_d \times L) \times (PN \times D)$ to 228 CZK and in $(LW_d \times L) \times (PN \times H)$ to 279 CZK. With regard to the proved standard of the fattening performance characters and the carcass value, it is evident that the OL-38 (PN×D) a 68 (PN×H) hybrid combinations with hogs record a lower growth intensity with a high feed intake and feed conversion ratio. At the same time, they achieve a lower carcass lean meat share, which had a negative impact on both the classification and the profit generated per 1 pig. As concerns the $(LW_d \times L) \times (LW_s \times BL)$ genotype, not even a relatively better classification of pigs into S, E classes had a positive effect and due to a lower average weight of the carcass it recorded the highest loss.

Table 3. Evaluation of the average values of the qualities of the fattening performance with regard to the test length (13 weeks)

Genotype	FCR (kg)		DFI (kg)		ADG (g)	
	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s
$(LW_d \times L) \times (PN \times D)$	3.20 [BD] ± 0.30	0.04	2.7 ± 0.18	0.02	850 [AD] ± 73.49	9.05
VEPIG	2.75 [ABC] ± 0.21	0.02	2.7 ± 0.29	0.03	984 [ABC] ± 88.40	10.49
$(LW_d \times L) \times (PN \times H)$	3.10 [C] ± 0.35	0.06	2.8 ± 0.29	0.05	901 [CD] ± 107.02	18.09
$(LW_d \times L) \times (LW_s \times BL)$	3.04 [AD] ± 0.26	0.03	2.7 ± 0.23	0.03	890 [B] ± 97.04	11.52

Differences indicated by same type are statistically significant; for $P \leq 0.01$ are used A, B, C

Table 4. Overview of the qualities of the carcass value with regard to genotype

Genotype	ALW (kg)		Carcass weight (kg)		Lean meat share (%)	
	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s	$\bar{x} \pm s_{\bar{x}}$	s
$(LW_d \times L) \times (PN \times D)$	104.9 ± 6.74	0.83	88.9 ± 6.92	0.85	55.16 [A] ± 3.76	0.46
VEPIG	106.0 [A] ± 9.28	1.10	89.1 [A] ± 8.39	1.00	57.05 [A] ± 3.17	0.38
$(LW_d \times L) \times (PN \times H)$	103.9 [AB] ± 11.14	1.88	85.8 [B] ± 8.87	1.50	55.48 ± 4.84	0.82
$(LW_d \times L) \times (LW_s \times BL)$	106.0 [B] ± 9.47	1.12	84.1 [AB] ± 7.97	0.95	55.21 ± 4.39	0.52

Differences indicated by same type are statistically significant; for $P \leq 0.01$ are used A, B

Table 5. SEUROP (ZP) realization with resprect to genotype in tested pigs

Třída	$(LW_d \times L) \times (PN \times D)$			VEPIG			$(LW_d \times L) \times (PN \times H)$			$(LW_d \times L) \times (LW_s \times BL)$		
	n	JUT (kg) $\bar{x}$	%	n	JUT (kg) $\bar{x}$	%	n	JUT (kg) $\bar{x}$	%	nN	JUT (kg) $\bar{x}$	%
S	9	85.5	12.7	19	84.6	26.8	12	80.3	17.1	17	80.3	23.6
E	19	89.2	26.7	30	89.2	42.3	25	83.8	35.7	36	85.0	50.0
U	39	89.1	54.9	21	92.3	29.6	28	87.9	40.0	15	84.4	20.8
R	4	92.8	5.7	1	101.8	1.3	5	96.4	7.2	4	90.1	5.6
Celkem	71		100.0	71		100.0	70		100.0	72	.	100.0

Table 6. Economic evaluation of the examined groups of pigs with regard to the genotype

Indicator/Genotype	$(LW_d×L) × (PN×D)$	VEPIG	$(LW_d×L) × (PN×H)$	$(LW_d×L) × (LW_s×BL)$
Number of pigs/group	71	71	70	72
Costs in CZK				
– per 1 weaner	2 052.20	1 556.20	1 860.00	1 940.60
– for feed/1 pig in test	1 684.70	1 354.76	1 745.07	1 716.28
– overall costs/1pig	3 736.90	2 910.96	3 605.07	3 656.88
– 1 feeding day	41.06	31.99	39.61	40.18
– 1 kg of weight gain in test	52.04	35.98	48.85	49.02
Sales in CZK per 1 pig	3 508.70	3 536.51	3 326.07	3 332.38
Realized carcass-price	38.39	39.69	40.60	39.64
Profit/lost per 1 pig	−228.20	625.55	−279.00	−324.50

The economy of the tested groups of pigs is based only on the price of a hog (62 CZK/1kg) and the inputs prices of CFM components set in advance (wheat 4.50 CZK, barley 4.20 CZK, soyameal 10.50 CZK, premix 27.00 CZK) and the market price of slaughter pigs (S − 42.86 CZK, E − 39.87 CZK, U − 37.09 CZK, R − 34.50 CZK).

It may be summarized that by a deliberate selection of a suitable genotype on the basis of tests of populations, it is possible to influence considerably the results achieved within production breeding. Using suitable genotypes will represent for breeders at present but also in the future a significant tool conducing to the improvement of the economy of breeding.

CONCLUSION

The tests were performed in the Test and Experimental Centre of the Czech University of Agriculture in Prague. They focussed on the impact of the genotype in 288 hybrid pigs of the $(LW_d×L) × (PN×D)$, $(LW_d×L) × (PN×H)$, $(LW_d×L) × (LW_s×BL)$ and VEPIG genotypes. A uniform methodology was used in testing these pigs in order to determine the production traits, i.e. the qualities of the fattening performance and carcass value. In the conclusion, the results were evaluated by means of the profit function. The results show clearly that the proper selection of the genotype in the production of final pig hybrids for fattening is essential for the economics of pig fattening.

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