Study On Selecting Growth Traits And Carcass Quality Of Shanxi White Pig

Guo Xiaohong, Li Bugao, Cao Guoqing, Zhou Zhongxiao

Introduction

Mashen pig and Taihu pig are two native Chinese breeds noted for the outstanding reproductive ability, maternal quality and strong hardiness ability. The native pigs with high-yielding genes were used to breed the specialized dam line. Shanxi White pig is a specialized lean-meat dam line, which was newly established by systematic breeding program with the basic population produced by complex crossbreeding among Shanxi local breed Mashen pig, Taihu pig and imported Landrace boars. The purpose of this study was to investigate the selecting proceedings on growth traits, finishing performance and carcass quality of Shanxi White pig.

Material and methods

Selecting and traits recorded: The specialized dam line with high farrowing rate was bred by Mashen pig, Taihu pig and Landrace through six generations selection using complex crossbreeding，then ideal individuals from last crossbred population were selected to cross birth. Excellent individuals were selected from the cross-birth offsprings to form the base population, with 81.25% Landrace blood, 12.5% Mashen pig blood and 6.25% Taihu pig blood. At Datong Pig Breeding Station in Shanxi, China, selecting of Shanxi White pig was conducted from base population to the sixth generation. Base population and every generation population keep the scale of 20 sires and 100 dams. During selection breeding, according to the National Standards on Breeding Pig Performance Testing Technology, reproductive performance of sows, growth traits of replacement pigs, finishing performance and carcass quality were recorded. Polymorphisms and genetic effects of *IGF*, *H-FABP* and *MyoG* genes were analyzed, then were applied to selection.

Statistical analysis: The assumed model for the data of body weight traits was as following: $y_{ijklm} = u + G_i + S_j + M_k + F_l + D_m + e_{ijklm}$, Where Y_{ijklm} = analysed trait vector, u = overall mean, G_i = generation effects, S_j = two sex effects, M_k = *IGF* genotype effects，F_l = paternal effect, D_m= maternal effect，e_{ijklm} = residual vector. The assumed model for the data of finishing performance and carcass quality was as following: $y_{ijkl} = u + G_i + S_j + M_k + e_{ijkl}$ Where Y_{ijklm} = analyzed trait vector, u = overall mean, G_i = generation effects, S_j = two sex effects, M_k = *MyoG* or *H-FABP* genotype effects, e_{ijklm} = residual vector. Statistic analysis was performed using the General Linear Model(GLM) procedure of the Statistical Analysis

College of Animal Sience, Shanxi Agricultural University, Taigu, 030801,Shaixi, China

Systems (SAS 6.12) . Significance of difference of least square solutions was calculated using T test.

Results and discussion

The least square means for growth traits of different generation are shown in table 1. The body weight and average daily gain(ADG) of gilts and boars were improved as well with the systematic breeding for generations, while in the body weight and ADG of boars higher than gilts. Shanxi White pig significantly improved growth traits by using *IGF-1* gene, which have positive genetic effect on body weight of 180 days of age(Xue et al., 2006). Boars and gilts of the sixth generation were 91.16kg and 89.89kg of the body weight at 180 days of age, and 15.52kg, 15.70kg heavier in weight at 180 days of age over the base population, respectively. It is also observed that boars and gilts of the sixth generation had significantly higher($P<0.01$) weaning weight, body weight at 70, 180 days of age and average daily gain from 70 to 180 days of age than the base population, respectively.

Table 1. Least square means and standard errors of the body weights of gilts and boars

Sex	Generation	No.	Birth weight （kg）	Weaning weight （kg）	Weight 70 days （kg）	Weight 180 days （kg）	ADG at 70-180 days (g/d)
Male	0	48	1.35 ± 0.023^{B}	6.02 ± 0.13^{C}	17.57 ± 0.25^{C}	75.64 ± 2.18^{D}	527.91 ± 7.54^{D}
	1	49	1.35 ± 0.024^{B}	6.00 ± 0.11^{C}	18.25 ± 0.25^{C}	77.25 ± 2.18^{D}	536.36 ± 8.34^{D}
	2	45	1.50 ± 0.03^{A}	6.74 ± 0.12^{B}	21.02 ± 0.92^{A}	84.43 ± 1.77^{C}	576.45 ± 10.68^{C}
	3	48	1.46 ± 0.02^{A}	8.32 ± 0.12^{A}	20.23 ± 0.07^{B}	81.82 ± 1.81^{C}	559.91 ± 6.78^{C}
	4	50	1.46 ± 0.02^{A}	9.00 ± 0.19^{A}	20.52 ± 0.40^{B}	84.82 ± 1.81^{C}	584.55 ± 9.23^{C}
	5	48	1.48 ± 0.03^{A}	7.12 ± 0.16^{B}	21.43 ± 0.93^{A}	88.50 ± 2.43^{B}	609.73 ± 10.54^{B}
	6	49	1.28 ± 0.02^{B}	6.67 ± 0.07^{B}	21.26 ± 0.07^{A}	91.16 ± 1.99^{A}	635.45 ± 9.70^{A}
Female	0	142	1.29 ± 0.01^{C}	6.04 ± 0.07^{D}	16.51 ± 0.65^{C}	74.19 ± 1.20^{D}	524.38 ± 6.54^{D}
	1	143	1.29 ± 0.01^{C}	6.03 ± 0.07^{D}	17.28 ± 0.67^{C}	76.08 ± 1.20^{D}	534.53 ± 8.43^{D}
	2	150	1.41 ± 0.01^{AB}	6.59 ± 0.07^{C}	18.90 ± 0.64^{B}	81.82 ± 1.21^{C}	571.96 ± 6.71^{C}
	3	150	1.38 ± 0.01^{B}	7.80 ± 0.08^{A}	17.74 ± 0.11^{BC}	75.80 ± 1.12^{D}	527.54 ± 9.32^{D}
	4	148	1.39 ± 0.01^{B}	8.46 ± 0.08^{A}	18.57 ± 0.37^{B}	80.32 ± 1.12^{C}	561.44 ± 8.54^{C}
	5	141	1.44 ± 0.01^{A}	7.01 ± 0.08^{B}	20.73 ± 0.50^{A}	86.32 ± 1.37^{B}	596.20 ± 4.70^{B}
	6	146	1.27 ± 0.01^{C}	6.47 ± 0.05^{C}	20.18 ± 0.11^{A}	89.89 ± 1.11^{A}	633.75 ± 5.18^{A}

^{ABCD} means within a column followed by different superscripts are significantly different ($P<0.01$).

The finishing performance of the fifth and the sixth generation in Shanxi White pig is shown in table 2. The results from the analysis showed that the sixth generation had highly significant (P<0.01) higher feed conversion rate and ADG than the fifth generation, respectively. Shanxi White pig significantly was heavier 46.35g ADG over Qingping pig(Guo et al., 2005). The backfat thickness of the fifth and the sixth generation were 11.20mm and 11.10mm, respectively. Moreover, there was statistically detectable (p<0.01) difference in backfat thickness between the fifth and the sixth generation. Shanxi White pig significantly improved finishing performance by using *MyoG* gene, which have positive genetic effect on backfat thickness(Xue et al., 2006). Compared with Sichuan White pig, Backfat thickness of Shanxi White pig was decreased by 0.3mm(He et al., 2006).

Table 2. Finishing performance of the fifth and the sixth generation in Shanxi White pig

Generation	No.	Initial weight （kg）	Final weight (kg)	Average daily gain （g）	Backfat thickness (mm)	Feed conversion rate
5	32	30.48 ± 1.78^{A}	90.63 ± 1.11^{A}	614.60 ± 5.00^{A}	11.20 ± 0.03^{A}	3.28 ± 0.03^{A}
6	32	31.05 ± 1.04^{A}	98.50 ± 0.91^{B}	708.35 ± 10.20^{B}	11.10 ± 0.01^{B}	3.14 ± 0.02^{B}

^{ABCD} means within a column followed by different superscripts are significantly different (P<0.01).

The carcass quality of the fifth and sixth generation is shown in table 3. The dressing percentage of the sixth generation was 77.00%, eye muscle area 32.20cm^2, ham percentage 28.44%, lean percentage 59.25% and intramuscular fat content (IMF) 7.86%. The sixth generation had significantly higher(P<0.01) dressing percentage, eye muscle area, ham percentage and lean percentage than the base population. It is also observed that IMF of the sixth generation heavier over the fifth population. However, there was no statistically detectable (P>0.05) IMF difference between the sixth and the fifth generation. Shanxi White pig significantly improved meat quality by using *H-FABP* gene ,which have positive genetic effect on IMF (Yang et al., 2007). Comparing to Qingping pig, Shanxi White pig significantly improved IMF 4.65 percentage points (Guo et al., 2005). Lean percentage of Shanxi White pig was closed to Sichuan White pig and SD-Ⅱ strain(He et al., 2006; Li, et al., 2002).

Table 3. Carcass quality of the fifth and the sixth generation in Shanxi White pig

Generation	No.	Dressing percentage（%）	Eye muscle area(cm^2)	Ham percentage （%）	Lean percentage(%)	Intramuscular fat content(%)
5	32	71.32 ± 1.31^{A}	29.42 ± 1.74^{A}	26.92 ± 0.36^{A}	57.93 ± 0.32^{A}	7.84 ± 0.19^{A}
6	32	77.00 ± 0.42^{B}	32.20 ± 0.05^{B}	28.44 ± 1.72^{B}	59.25 ± 1.43^{B}	7.86 ± 0.02^{A}

^{ABCD} means within a column followed by different superscripts are significantly different (P<0.01).

Conclusion

The growth traits, including weaning weight, body weight at 70 days and 180 days of age and average daily gain, finishing performance and carcass quality were improved as well with the systematic breeding for generation. Through selecting of seven years, Shanxi White pig significantly improved meat quality, while the main selecting traits of Shanxi White pig achieved breeding objects and a specialized dam line of high-quality pig was bred successfully.

Acknowledgments

The work was supported by the grants from Shanxi Science and Technology Committee (021043 and 20080311031) and China Science and Technology Ministry (2008GB2A300032).

References

Guo, W., Huang, J. (2005). Swi. Pro., 2:20-22.

He, Z., Lv, X., Duan, C. (2006). J. Anim. Sci. China., 4:31-33.

Li, H., Zhou, Z. (2002). J. Hu. Agr. Col. , 4:135-137.

Mei, S., Xu, Z., Li, G. (2002). J. Anim. Sci. China., 2:29-30.

Xue, H., Zhou, Z. (2006). Acta Genetica Sinica. 33；992-997.

Xue, H., Zhou, Z. (2006). J. Chin., Bioch. Mol. Bio. 22:876-879.

Yang, W., Cao, G., Liu, J., Li, B.(2007). Acta Bio. Laser Sinica. 16:599-602.