

THE FATTENING AND CARCASS TRAITS OF CHINESE NATIVE BREED PIGS AND THEIR IMPROVEMENT

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SUMMARY

China is rich in local pig breed resources. This paper studies the fattening and carcass traits of eight Chinese local pig breeds, and their improvement. They are Min Pigs (M.); Taihu Pigs (TH.); Jinhua Pigs (JH.); Ningxiang Pigs (NX.); Rong-chang Pigs (RC.); Neijiang Pigs (NJ.); Guanling Pigs (GL.) and small-ear pigs of South Yunan (SE.). Under given ecological conditions, and through a long period of artificial selection, the fattening and carcass traits of these eight pig breeds have developed the characteristics of early maturity, strong fat deposition ability, thick skin, rather low lean meat percentage, tender and juicy texture, good taste and no PSE meat. There are rather high heritability and genetic correlation in the fattening and carcass traits of these pigs. Therefore, the purebred herd should be improved through selection. In the commercial herd, they can be crossed with modern breeds so as to speed up the growth and increase lean meat percentage.

INTRODUCTION

It has been well known to many countries in the world that Chinese pigs have high reproductive rates. However, there are few researches and reports on the fattening property and carcass traits of Chinese pigs in the past. In recent years as the market demand changes the research work in this field has been carried out extensively in many places. This paper is to introduce the fattening and carcass traits of eight Chinese pig breeds in the light of the results of the author's research work. The eight pig breeds are the Northeast Min Pigs (M.), Taihu Pigs (TH.), Jinhua Pigs (JH.), Ningxiang Pigs (NX.), Rong-chang Pigs (RC.), Neijiang Pigs (NJ.), Guanling Pigs (GL.) and the South Yunan Small-ear Pigs (SE.).

The location of these eight native breeds is shown in Figure 1. Taihu pigs consist of different local types such as RS Meishan, Fengjing and Erhualian. Landrace (L) is used as the control under similar conditions.

I. FATTENING AND CARCASS TRAITS

The experiment of the fattening of the weaning pigs is made referring to the Chinese pig feeding standard, i.e. each Kg of mixed feed containing 2800-3000 kilo-calorie of digestible energy and about 120 gram of crude protein. The slaughter test is made when the pigs are fattened to 60-90 kg respectively according to the size of different breeds. The results are illustrated in Table 1.

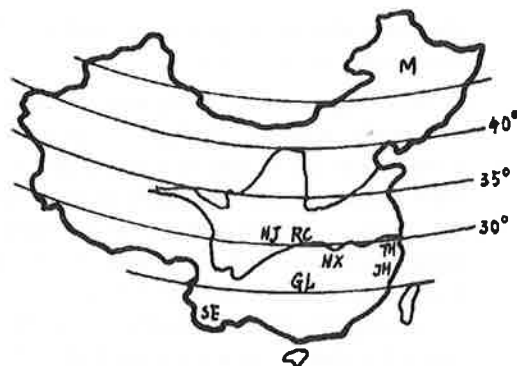


Fig. 1. Location of eight native Chinese breeds.

Produced in the cold north regions, the Min Pig is a large, late maturing breed with fast daily gain, thick skin, and high percentage in lean meat, ham and eye muscle area. The Small-ear pig is produced in the tropical, semitropical rainy and forest areas in the south of Yunan Province. It is a small lard type breed featuring early maturity, easy fattening, high dressing percentage, thick back fat, thin skin, small and short carcass, low lean meat percentage (LMP) and high fat content. Production of TH, JH, NX, RC, NJ and GL is scattered in the areas of the middle and lower reaches of the Yangtze River, and the mountain areas of southwest China. In these areas, the climate is mild, natural resources abundant and feed resources plentiful. All the fattening and carcass traits indices of these pig breeds are between those of the M. and the SE breeds. Their characteristics are: middle-size, high abdominal fat percentage and medium early maturity. Except for the RC pigs, which have rather high LMP, these pigs have low LMPs, about the same as the fat percentages. This reflects the character of most Chinese native breeds which fatten while growing. The formation of the Chinese pig breed fattening and carcass traits is the result of long-term consecutive selection adapting to the local ecological conditions as well as the

Table 1. Fattening and carcass traits of Chinese native pigs

	M	TH	JH	NX	RC	NJ	GL	SE	L(control)
No. pigs	22	48	47	75	201	95	5	140	15
Average daily gain (g)	422	338	410	350	391	410	394	300	464
Life weight before slaughter (kg)	90	72	68.2	76.1	79.2	95.4	78.4	60	92.5
Dressing percentage	72.5	65.8	72.3	68.4	69.4	70.4	68.8	72.4	73.5
Abdominal fat (%)	5.88	-	9.9	8.7	8.6	8.9	-	8.8	6.2
Backfat thickness between 6-7 ribs (cm)	3.4	2.4	3.9	4.5	3.5	4.4	5.9	4.3	2.8
Skin thickness (cm)	.61	.56	.41	.48	.45	.60	.42	.23	.29
Eye-muscle area (cm ²)	23.2	20.2	18.9	17.5	17.2	18.7	20.1	14.6	28.6
Carcass length (cm)	-	83.8	69.3	75.6	78.5	73.3	67.2	59.3	86.0
Ham percentage	29.6	28.6	30.8	23.8	27.5	24.5	25.3	27.0	30.5
Lean	47.6	39.8	43.1	39.5	45.9	37.0	42.1	37.5	57.6
Fat (%)	30.9	26.7	37.2	35.4	32.3	39.3	32.5	52.8	25.6
Source	(1)	(5)	(21)	(15)	(9)	(10)	(20)	(6)	(21, 13)

Table 2. Meat quality criteria of Chinese native pigs

	M	TH	JH	NX	RC	NJ	L (control)
No. pigs	12	6	10	10	23	42	16
pH	6.69	6.55	6.37	6.30	6.11	6.74	5.62
Water holding capacity (%)	79.58	88.96	95.96	92.25	76.33	91.04	-
Muscle colour	3.00	4.75	3.00	3.44	3.48	3.25	2.06
Muscle marbling	3.75	-	3.00	4.81	3.33	3.27	2.50
Cooking shrinkage (%)	-	65.33	-	67.72	69.03	62.65	62.95
DM of lean (%)	30.54	27.70	27.26	27.26	26.62	25.14	24.69
Crude fat of lean (%)	5.87	4.48	3.93	3.97	3.82	3.70	2.38
Crude protein of lean (%)	21.31	20.77	-	21.73	20.92	22.10	20.77
Source	(19)	(19)	(21)	(14)	(8)	(17)	(8)

Table 3 Heritability estimates for fattening and carcass traits in Chinese native breeds of pigs

	TH	NX	RC	NJ	GL	SE	Average
ADG	.58	.60	.58	-	.63	-	.59
Liveweight before slaughter	.80	.14	.35	.70	.73	-	.54
Dressing percentage	.19	.05	.41	.80	-	.78	.45
Abdominal fat %	-	.58	-	.50	-	-	.54
Backfat thickness between 6-7 ribs	.82	.05	.54	.44	.93	.76	.59
Skin thickness	.52	-	-	.79	.34	.14	.43
Eye-muscle area	.39	.81	.38	.46	.38	.62	.51
Carcass length	.66	.79	.45	.32	.76	.22	.54
Ham percentage	.63	.78	.42	.56	.27	.51	.53
Lean %	.34	.47	.51	-	-	.38	.43
Fat %	-	.22	.49	-	-	-	.36
Method of estimate	F	H	M	F	F	U	-
Source	(5)	(15)	(9)	(10)	(5)	(7)	

small-scale production mode. They are obviously different from the control Landrace breed.

II. MEAT QUALITY

Testing method:

pH: Test the longissimus muscle with a pH-meter 45 minutes after slaughter.

Water holding capacity: Take 10 cm² of the longissimus muscle sample within two hours of slaughter and press it with a weight of 35 kg for 5 minutes to test the drip loss percentage and the water holding capacity.

Muscle colour: Take a cross section of fresh longissimus muscle and compare it with a muscle colour evaluation standard card. Evaluation is made according to live grades.

Muscle marbling: Take a cross section of fresh or frozen longissimus muscle and compare it with a marbling evaluation standard card. Evaluation is made according to five grades.

Cooking shrinkage percentage: Take 500 gram musculus biceps femoris sample and test it after cooking for 40 minutes.

Chemical composition: Take a sample from the centre of the eye muscle in the 7-14 thoracic vertebrae and test the

dry matter (DM), crude fat and crude protein content with a routine method of nutrition composition analysis.

The meat quality indices of the six Chinese pig breeds are listed in Table 2.

Table 2 shows that the acidity of all native pig breeds is over 6.11 which is normal. The water holding capacity of the longissimus muscles are all within a normal range, except for the M and RC breeds, the water holding capacity of which are lower. This is related to the higher LMP of these two breeds. The muscle colour and the marbling of most breeds are with in an ideal range (3-4 grade), and the cooking loss is only 31-37.4%. The chemical composition content is rather high. All the indices mentioned above are superior to the control breed landrace and there is no PSE meat. It is should be pointed out that the fat content in the muscle of the Chinese pigs is generally high (3.7-5.87%) and the diameter of muscle fibre is 16% smaller as compared with the modern breeds. This kind meat - tender, juicy, tasty and delicious after cooking, is favorably received by the people.

III. THE HEREDITY OF THE FATTENING AND CARCASS TRAITS AND THEIR IMPROVEMENT

The Chinese pigs have known for their fine meat quality, but the disadvantages are slower growing, lower LMP, and thicker skin. Estimation on the hereditary parameter and tests on the crossing improvement have been made as means of research in the improvement of the character of Chinese pigs.

1. The hereditary parameter of the fattening and carcass traits and the effect of selection:

The heritability of fattening and carcass traits of six breeds have been estimated with the following methods: full-sib correlation (F), half-sib correlation (H), full-half sib mixed family correlation (M) and half-sib correlation in unit (U) (Table 3). The genetic correlations between some traits and the main selection traits, LMP, have been estimated in four breeds (Table 4),

Tables 3 and 4 indicate that the fattening and carcass traits of the Chinese pigs have rather high heritability (mean 0.36-0.59), and the genetic correlations between the LMP and backfat thickness, as well as between the LMP and ham percentage are significant too. All these are favourable for direct or indirect selection for the fattening and carcass traits improvement as well. For example, according to the theory of $R = i \times s \times h^2$, the percent of population saved in RC Pigs remains 30% ($i = 1.16$), $S = 3.3$, then the LMP of every generation increases 1.95% under direct selection for LMP. If an indirect selection method is adapted, every generation can increase 0.88% of the LMP indirectly by reducing the backfat thickness through selection. Selection is a chief method of speeding up the growth rate and improving the carcass quality on the basis of maintaining the intrinsic advantages of the local breeds.

Table 4 genetic correlations between some traits and LMP

	NX	TH	RC	SE	Average
Backfat thickness : lean %	-.58	-	-.44	-.33	-.45
Carcass length : lean %	.73	-	.23	-.07	.30
Ham % : lean %	.68	.72	.33	.69	.61
Ear-muscle area : lean %	-.47	-	.47	.92	.31
Method of estimate	H	H	H	U	-
Source	(15)	(5)	(9)	(7)	

2. The improvement of fattening and carcass traits through cross-breeding

In commercial production, the rapid supply of large quantities of fine quality carcasses can be made by crossing the Chinese native pig breeds with the modern lean type breeds.

i) Two-breed crossing

The mean effects of the Chinese native pig breeds crossed with modern foreign breeds like Yorkshire (Y), Landrace (L), Duroc (D), Hampshire (H), Russian white (RW), etc. are shown Table 5.

It is evident that the main characters of the Chinese native breeds improve notably after being crossed with the modern foreign breeds. For example, in two-breed crossbred, the ADG increases by about 20%, the LMP by 10% (about 5 percentage units). There is some decrease in the backfat thickness and abdominal fat percentage, but the changes are not as obvious as the former.

2) Three-breed crossing

Three-breed crossing is conducted by one native breed, which is used as the female breed, and by two modern foreign breeds as the male breeds. The fattening and carcass traits of the three-breed crossbred are expected to achieve greater improvement. In other experiments, the ADG is about 600 g, the LMP is about 52%. In the selective preference D × (L × TH) combination (n=406), the ADG is as much as 630 g, and LMP 58.04%⁽¹⁾.

IV. CONCLUSION

China is rich in pig breed resources. Under given ecological and natural economic conditions and through long-term artificial selection, the fattening and carcass traits of all these breeds have developed the following characters : early maturity, easy fattening, strong fat

deposition ability, slow growing, rather low LMP, rather thick skin, fine and tender meat quality, tastiness, high dry matter and high fat content in the muscle, etc. All these characters form a sharp contrast with the modern breeds which contain PSE and DFD meat.

These fine characters in the carcass and meat quality of the Chinese pig breeds did not only play an important part in cross-breeding with breeds of Yorkshire, Berkshire, Poland-China and so on in history, but will continue to be an important part of the world resources in future. It is worth preserving and furthering the development.

On the basis of maintaining their intrinsic advantages it is necessary to speed up the growth rate and improve the carcass quality. According to the fact that these traits have rather high heritability and genetic correlation, both direct and indirect selections can be applied to the pure breeds. In the case of a commercial herd, the native pig breeds should be used as the female and the modern breeds (Y., L., D., H. etc.) as the male to carry out two-breed crossing or three-breed crossing. These are the effective ways of speeding up growth rate and supplying larger amounts of fine quality lean meat.

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Table 5 The mean effects of fattening and carcass traits in two-breed crossbred

	M	TH	JH	NX	NJ	SE
No. pigs	40	-	40	70	73	48
ADG (g)	502	542.7	559	492.4	540	412
Dressing percentage (%)	74.52	71.83	75.09	74.26	69.17	-
Backfat thickness (cm)	4.21	3.71	4.35	3.69	3.89	-
LMP (%)	46.85	46.67	48.20	47.02	47.51	42.64
Abdominal fat (%)	6.56	-	8.05	7.46	5.80	-
Source	(4)	(3,4)	(4)	(13)	(10)	(6)

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