

EFFECT OF BOER GOAT CROSSBREEDING WITH HAIMEN GOATS AND HUAI GOATS IN JIANGSU PROVINCE

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ABSTRACT

The carcass weight at one year of Huai goat and Haimen goat in Jiangsu province, local breeds, averaged 9.4Kg and 7.35Kg, respectively, only 78.33% and 61.25% of the average of the nation (12Kg), which indicates that the goat meat production is very low. After introducing Boer goats, the crossbred progenies showed great progress in meat production, with birth weight increasing by 90.97% and 119.30% for F₁ generation of Boer Huai (BH) and Boer Haimen (BHm), respectively, by 95.14% and 139.47% for F₂ generation of Boer BH (BBH) and Boer BHm (BBHm). Yearling carcass of the crossbred weighs 15.11Kg and 14.37Kg, respectively, 60.74% and 95.51% higher than Huai and Haimen. Effect of crossbreeding on production improvement is significant. However, the crossbred goats showed less obvious heat signs and are usually non-pregnant. The average litter size was 2.10 and 1.80 for the does of BH and BHm, both lower than the local breeds respectively.

Key words: Boer goat; Crossbreeding; Effect

There are totally 11.25 million goats kept in Jiangsu province, 6.67% of the total goats in China. It ranks fourth in number nationally. Annual fattened livestock numbers 16.423 million. Fattened stock to total livestock on hand is 1.46:1. The marketing rate of fattened livestock is 59.35%. 4.51 million goats, 40.09% of the total in Jiangsu province, are kept in three municipalities (Lianyungang, Yancheng, Nantong), located close to the Yellow Sea. Meat production amounts to 48.06% of that for the whole province. It is concluded that goat production along coastal regions occupies an important place in this province.

In the coastal regions, there are two major local breeds, Huai in the north and Haimen in the south. Adults average 27 Kg in body weight for Huai bucks, 23 Kg for Huai does; while 23Kg for Haimen bucks and 18Kg for Haimen does. Huai goats are pastured during the whole year and Haimen are kept by zero-grazing. Due to lack of selection and poor mating practices over a long period of time, frequent inbreeding and intensive rearing and management system contributed to gradual productivity degeneration, especially for Haimen. Average yearling carcass (including skin) weight is only 7.35 Kg. This is an average of only 4.85 Kg without skin, which is only 40.42% of the national average. At the same time, Huai's yearling carcass weight is 9Kg, 75% of the national average. There is a serious need to use quality crossbreeding programs for improving the production. In recent years, Boer goats were introduced in the coastal regions to promote the development of the meat goat industry. Remarkable progress has been reached in crossbreeding Boer with Huai and Haimen. Following is the effect of hybrid improvement.

1 MATERIAL AND METHODS

1.1 Experiment location and stock

Xiangshui county and Rugao municipality, along the Yellow sea coast, were selected as the locations. Both are located in the Subei Plain. The former, located in the northeast part of Jiangsu, is economically under-developed for some historical reasons, with broad mudflats and rich salt in the soil. The latter is located close to the outlet of the Yangtse River into the sea, with highly intensive farming and a developed economy.

In Xiangshui county, Huai goats, as the experiment livestock, were reared in Pingjian Township; in Rugao municipality, Haimen goats were raised in Xiabao Township.

1.2 Means of crossbreeding

Natural breeding was applied to Huai goats in Pingjian Township; Artificial insemination was conducted on Haimen goats in Xiabao Township. Boer bucks mated the local breeds and their F₁ does were bred by Boer to produce F₂ generation.

1.3 Rearing and management

Huai goats in Xiangshui county were grazed the whole year without supplementary feeding. While Haimen goats in Rugao were distributed among the farmers with confinement feeding plus confinement grazing. Weaned Haimen goats were supplied with 60~125g grain daily.

2 RESULTS AND ANALYSIS

2.1 Kid's birth weight (Table 1)

Table 1 Birth weight of Kids

Items	Generation	Number of goats	Average birth weight (Kg)
Boer × Huai	Crossbred F ₂	30	2.81±0.31
	Crossbred F ₁	57	2.75±0.23
Huai		68	1.44±0.42
Boer × Haimen	Crossbred F ₂	25	2.73±0.37
	Crossbred F ₁	31	2.50±0.47
Haimen		51	1.14±0.16

For both males and females

Table 1 indicates that the birth weight of crossbred F₁ generation is much higher than that of local breeds, increasing by 90.97% and 119.30% for Boer × Huai type and Boer × Haimen type, respectively. While crossbred F₂ generation exceeds 95.14% and 139.47%, respectively. That shows crossbred F₂ is superior to crossbred F₁, which is superior to local breeds. The birth weight of crossbred F₂ with Boer is 2.18% and 9.20% higher than Huai and Haimen, respectively.

Also Table 1 shows that the crossbred progeny between Huai and Boer is superior to that between Haimen and Boer. F₁ of BH weighs 10% more than that of BHm, and F₂ 2.93% more.

2.2 Growth

2.2.1 Bodily form and appearance

F₁ and F₂ of both cross types show good body size of meat type, with a big size and compact body, fleshy and solid muscle, broad and deep brisket, flat and straight back, open ribs, wide and long rump with fleshy muscle, and columnar body. Crossed progeny has short hair, with maple hair on forehead, neck, flank and belly. Hair color of F₁ turns lighter gradually after weaning. A small part

of F₂ generation's appearance is similar to Boer goat, while most of them don't have significant traits, but with darker color than F₁. Some of them have a pair of boutons. They have a big floppy ear, flat and straight noses, and horns. Buck's horns are bigger than doe's. F₂ appears more remarkable in meat type body than F₁.

2.2.2 Daily body gain from birth to weaning for crossbred goats (Table 2)

Table 2 Daily body gains from birth to weaning for crossbred goats

Items	Crossing type	Birth weight (Kg)		Weaning weight (Kg)		Average daily gain (g/d)
		Number	Average	Number	Average	
Boer × Huai	Crossbred F ₂	30	2.81	20	16.5	152.11
	Crossbred F ₁	57	2.75	44	15.01	136.22
Huai		68	1.44	53	9.4	8.84
Boer × Haimen	Crossbred F ₂	25	2.73	20	13.24	140.13
	Crossbred F ₁	31	2.5	25	11.18	115.73
Haimen		51	1.14	49	6.09	6.6

For both males and females

Table 2 indicates that there is something in common, that F₂ is higher than F₁, which is higher than local breeds, in the daily body gain from birth to weaning. The daily body gain of F₂ of BH averages 136.22g, 11.66% and 162.07% higher than that of F₁ of BH and Huai goats, respectively. The daily body gain of F₂ of BHm averages 140.13g, 21.08% and 2.232% higher than that of F₁ of BHm and Haimen, respectively.

The average daily body gain between birth and weaning period for Huai goat, its F₁ and F₂ is higher than that of Haimen, its F₁ and F₂, respectively, by 8.55%, 17.71% and 33.94%.

2.2.3 Comparison of body size (Table 3)

Table 3 indicates that the withers height, body length and heart girth for F₁ of BH are higher than those of Huai by 17.06%, 13.92% and 8.70%, respectively. For F₁ of BHm, they are higher than those of Haimen by 17.84%, 11.88% and 11.10%, respectively. For F₂ of BH, they are higher than those of Huai by 3.15%, 2.46% and 1.84%, respectively; For F₂ of BHm, they are higher than those of Haimen by 6.29%, 3.87%, 2.60%.

Table 3 Comparison of yearling body size

Crossing type	Generation	Number of goats	Withers height	Body length	Heart girth
Boer × Huai	F ₂	19	58.88±4.36	62.77±3.01	68.06±4.92
	F ₁	21	57.08±2.59	61.26±2.19	67.33±4.87
Huai		60	48.76±6.23	53.75±5.86	61.94±6.68
Boer × Haimen	F ₂	18	56.03±3.26	58.81±2.76	66.74±4.86
	F ₁	14	55.68±2.24	56.62±2.46	65.05±5.87
Haimen		129	47.25±3.74	50.61±4.38	58.55±4.21

For both males and females

The data shows that the crossbred F₁ generation is larger in size significantly than the local breeds, and F₂ generation is bigger in size than F₁ generation. But the gap between F₁ and F₂ is smaller than that between F₁ and the local breeds. The former shows the increase of 8.70% ~ 17.70%, while the latter shows the increase of 1.84% ~ 6.29%.

2.3 Slaughtering tests

2.3.1 Slaughtering tests at one year of age

Table 4 Slaughtering tests at one year of age

Crossing types	Sex	Number of goats	Live weight (Kg)	Carcass weight (Kg)	Meat weight (Kg)	Dressing weight (Kg)	Meat percentage(%)
F ₁ (Boer × Huai)	Male	2	28.51	15.11	11.4	52.99	40
Huai	Male	4	19.58	9.4	7.5	48.01	38.3
F ₁ (Boer × Haimen)	Male	4	26.13	14.37	10.77	54.35	41.05
Haimen	Male	4	17.79	7.35	6.76	41.32	38

Haimen's carcass weight includes 2.5Kg of the hide.

Table 4 shows that the crossbred progeny shows much better performance in meat production than the local breeds. F₁ of BH and BHm weighs 15.11Kg and 14.37Kg in carcass weight, respectively. The heaviest reached 17.24Kg. They are heavier than those of local breeds by 60.74% and 95.51%, than national average (12Kg) by 25.92% and 19.75%, than Jiangsu provincial average (9Kg) by 67.89% and 59.67%, respectively. If subtracted from the weight of the hide, Haimen's carcass weight only averages 4.85Kg. When Haimen crossbreeds with Boer, carcass weight of F₁ increases by 196.29%. Based on meat production improvement, the income from the sale of meat increases by 68.52 Yuan and 114 Yuan, respectively in terms of the price of 12 Yuan/Kg.

2.3.2 Dressing percentage and Meat percentage with different rearing conditions

From Table 5, the crossbred progeny between Boer and Haimen grew better in the family farm than in the centralized feeding. The former's carcass weight and meat weight averaged 17.24Kg and 12.25Kg, 5.74Kg and 2.95Kg more than the latter, increasing by 49.91% and 31.72%, respectively. When Haimen and crossbred F₁ generation were raised in the decentralized family farms, the carcass weight and meat weight of the latter averaged 12.39Kg and 5.49Kg more than those of the former, increasing by 255.46% and 81.21%, respectively.

F₁ generation of Boer Haimen raised in the decentralized family farms increased its loin eye muscle area, rear legs weight and fore legs weight by 46.10%, 50.61% and 51.00%, respectively more than in the centralized farms.

So from these data, it is concluded that the crossbred fattening performance in the decentralized family farms appeared better than in centralized farms, because the goats could get richer nutrients from fresh grass and crop by-products in the decentralized family farms.

Table 5 Slaughter test results of F₁ generation

Items	Centralized raising	Decentralized family farm	Average
Number	2	2	4
Live weight (Kg)	23	29.25	26.13±4.05
Carcass weight (Kg)	11.5	17.24	14.37±3.74
Meat weight (Kg)	9.3	12.25	10.77±2.55
Dressing percentage (%)	49.98	58.72	54.53±5.64
Meat percentage (%)	40.43	41.66	41.05±6.10
Flesh to bone ratio	3.89	4.09	3.99±0.92
Eye muscle area (cm ²)	11.67	17.05	14.36±5.10
Fat thickness in brisket (cm)	1.85	2.5	2.18±0.38
Fat weight (Kg)	0.53	1.78	1.16±0.85
Rear legs weight (Kg per goat)	1.54	2.32	1.93±0.53
Fore legs weight (Kg per goat)	1	1.51	1.26±0.31

2.3.3 Meat ingredients testing for F₁ generation

Table 6 indicates that F₁ does of BHm raised in decentralized farms showed better performance in cooked meat percentage, dehydration rate, dry matter, CP and CF, with 4.07%, 4.02%, 4.48%, 0.33% and 0.99% higher than those of F₁ does raised in centralized farms. The water ratio of the former was lower than that of the latter. Ash averaged the same value.

According to Hu Laigen (1992), the meat of F₁ of Angora goat crossbreeding with Haimen (AHm) goat contained 75.81% water, 21.08% crude protein, 1.65% crude fat and 1.14% ash. Water ratio and crude protein in AHm were a little higher than those in BHm. While crude fat for AHm was significantly lower than that for BHm. Ash averaged the same value.

Table 6 Meat ingredients testing for F₁

Items	Centralized farm	Decentralized family farm	Average
Number	2	2	4
Cooked meat percentage	56.64	60.71	58.67±2.46
Dehydration rate	30.55	34.57	32.56±2.33
Water ratio	75	70.52	72.76±2.94
Dry matter	25	29.48	27.24±2.94
Ash	1.2	1.19	1.19±0.04
Crude protein	19.2	19.35	19.19±0.44
Crude fat	3.14	4.13	3.64±0.72

2.4 Reproductive traits

Both Huai and Haimen belong to sexually precocious breeds. The first estrus comes at four to five month old. Estrus cycle and the duration of estrus last for 15 ~ 21 days and 1 ~ 2 days, respectively. The duration of gestation period for Huai and Haimen goat last for 147 days and 144 days, respectively. They are not seasonally estrous ruminants. Breeding always occurs in spring and fall. Most can have three litters in two years and a few of them can have two litters in one year. The litter size of Huai averaged 2.44 kids, while that of Haimen averaged 2.0 ~ 2.7 kids. The local breed's estrous signs appear as restlessness and nervousness, swelling redness in vulva and mucus discharge. It is easy to detect estrus with these does, and breeding rate is almost one hundred per cent. However, crossbred progeny of Boer and local breeds are not obviously detected in estrus. They are

not restless, and they just have some redness in the vulva and mucus discharge. F₁ generation of multiparous Huai does crossbred with Boer averages 2.10 kids in litter size, less than 2.44 kids of Huai's litter size. And F₁ of multiparous Haimen and Boer averages 1.80, less than 2.70 kids of Haimen's litter size.

3 CONCLUSIONS

3.1 The population of goats reared along the coastal areas and meat production here amount to 40% and 48% of the provincial total respectively. The goat industry plays an important role in the economy of Jiangsu province. But the original breeds have some traits in common, such as small size and low meat production. It is essential to introduce fine breed to improve the quality of the local breeds.

3.2 The crossbred F₁ of Huai with Boer and Haimen with Boer weighed 90.97% and 119.30% heavier at birth than Huai and Haimen. Accordingly F₂ increased in birth weight by 95.14% and 139.47% compared with Huai and Haimen, respectively. The crossbred yearling carcass weight averaged 15.11Kg and 14.37Kg for F₁ of BH and BHm, increasing by 60.74% and 95.51%, respectively when compared with the local Huai and Haimen. The income could increase by 68.52 Yuan and 114 Yuan from the sale of goat meat.

3.3 Crossbred F₁ generation has a bigger size than local breeds and the increase of F₁ generation in wither height, body length and heart girth ranges from 17.06% to 17.84%, from 13.29% to 11.88% and from 8.7% to 11.10% respectively. The increase of F₂ generation ranges from 3.15% to 6.29%, from 2.46% to 3.87% and from 1.84% to 2.60%, respectively.

3.4 The female crossbred progeny don't show very significant heat signs, which can easily be overlooked. The average litter size was 2.10 and 1.80 for the doe of BH and BHm, both lower than the local breeds respectively.

3.5 In this research, goats were fed with grass. Hai and its hybrid progeny were pastured the whole year and Haimen and its hybrid progeny were provided with a small amount of supplementary grain. When fed with more nutritional under the improved conditions, meat production could be increased.