New broiler cross paternal parent form

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Abstract. The results of the research showed that on the basis of the new lines CM5 and CM6 of the Cornish breed, selected using the gene pool of the SMC "Smena", a new paternal parental form CM56 was created, which has high: live weight of young animals, safety of birds, fertilization of eggs, hatching of chickens at (0.3-8.2%) in comparison with the paternal parental form B56 of the cross "Smena 8". The weight of the testes of males of the paternal parent form during the anatomical dissection of the Smena 9 cross was equal to 39.8 g (30 weeks) and 43.1 g (34 weeks), their relative weight (to live weight) was 0.89 and 0.92 %; cross "Smena 8" - 39.5 g and 43.0 g; 0.88 and 0.91%, respectively, for the indicated ages. In roosters of the paternal parental form of the "Smena 9" cross, there was a tendency towards a slight decrease in their live weight by age (30 and 34 weeks), as well as a slight increase in the absolute and relative weight of the testes in comparison with the "Smena 8" cross. Broilers of the "Smena 9" cross, obtained from the use of CM56 roosters, had advantages in live weight at 5 weeks of age by 10.1%, feed costs per 1 kg of live weight gain - by 4.5%, and safety - by 1.1 %, productivity index - a complex indicator - by 16.7% compared to the cross "Smena 8". Poultry of the paternal parent form and broilers of the "Smena 9" cross with a high genetic potential of important economically useful traits, is competitive, can be used in reproductive farms, parent flocks and broiler poultry farms.

1 Introduction

Breeding work aimed at improving common and developing new lines, forms, crosses with higher productive qualities and the effective use of the genetic potential of poultry is the most important direction for the further development of the industry.

To realize the genetic potential of the productive qualities of a bird, an objective assessment of the family, family, and individuals is of primary importance, as well as environmental factors.

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Evaluation and selection of the best genotypes for egg fertilization, hatchability and chick hatching contribute to improving the reproductive qualities of meat chickens and extending the breeding period [1].

The selection of modern meat poultry is carried out simultaneously in several directions: on the one hand, it is necessary to ensure high productivity of the parent flock, i.e., the yield of high-quality daily broilers from one parent layer, which is highly determined by the reproductive qualities of the rooster, and on the other hand, it is necessary to ensure high broiler growth rate and high live weight at slaughter age.

Since live weight in meat chickens inversely correlates with the efficiency of reproduction, i.e., indicators of egg productivity and the quality of hatching eggs, these two areas compete with each other within a single population [2-3].

Chickens of the parent flock of modern broiler crosses represent a kind of “genetic compromise” between the two basic directions of their selection - for high reproductive efficiency and high live weight, growth rate, which have long been known to be in genetic contradiction with each other [2, 5].

Live weight and reproductive efficiency in meat roosters, as in chickens, negatively correlate with each other.

In heavy roosters, this effect is partly due to a decrease in the sexual activity of natural mating, which leads to a decrease in egg fertilization. This is usually associated with a deterioration in the condition of the legs of roosters [6] or with general changes in body structure, primarily the bone-to-muscle ratio, due to long-term selection for high growth rates [7]; on the other hand, it is known that heavier roosters have more intense competition among themselves for mating, and that they are more aggressive towards females during mating, which also negatively affects the efficiency of reproduction [8].

Heavier roosters were characterized by a better physiological state of the testes, higher blood levels of testosterone and lower levels of corticosterone, although they had a problem with the number of successful matings towards the end of the productive period [9].

A decrease in the number of matings during the productive period was reported by other authors: it was maximum at the age of males 27-29 weeks compared to the ages of 35-37 and 55-57 weeks, although the concentration of testosterone in the blood increased in the period 24-30 weeks and then remained at the level of the reached plateau, 36-60 weeks [10].

For the continuous growth of poultry meat production in the world, crosses have been created and used that ensure broiler weights of more than 2.5 kg at the age of 5 weeks at a feed cost of 1.5-1.6 kg per kilogram of gain. Selection for the growth rate of offspring has led to an increase in the live weight of adult birds. The high live weight of the paternal lines with good muscularity of the chest and legs worsens the indicators of natural resistance and nonspecific immunity, which is the main reason for the decrease in reproductive qualities and causes hormonal changes in the body that contribute to obesity. Taking this into account, the search for approaches to increasing the reproductive qualities of parent flock roosters is relevant.

At the selection and genetic center "Smena" paternal, maternal parental forms and broilers are regularly assessed in order to check the effectiveness of selection of linear birds.

The purpose of the research is to test, under the production conditions of the selection and genetic center "Smena", a new paternal parent form (PPF) of the Cornish and broiler breeds for economically important characteristics.

2 Materials and methods

The work was carried out from 2018 to 2023. in the production conditions of the selection and genetic center "Smena" on Cornish poultry of the two-line paternal parent form of the cross "Smena 9" (600 heads) and four-line final broiler hybrids of the same cross (1000 heads) during floor rearing. Sawdust from coniferous trees was used as bedding.

The two-line paternal parent form CM56 was obtained by crossing specialized highly productive lines of the Cornish breed according to the following scheme:

♂♂CM5 x ♀♀CM6 → ♂♂CM56 / ♀♀CM56

In further work, only CM56 roosters were used to obtain four-line hybrids (broilers). Chickens were raised for meat.

The main technological parameters and feeding program complied with accepted recommendations for meat poultry.

3 Results and Discussion

The breeding qualities of Cornish CM56 roosters are indicated in Table. 1.

Table 1. Breeding qualities of Cornish CM56 roosters.

Sign		Test year			
		2018	**2019**	**2023**	**2023 to 2018**
Live weight of roosters, g:	4 weeks	825	850	856	+3.8
	52 weeks	4950	4915	4900	-1.0
Safety, %:	- young animals	96.7	97.2	97.5	+0.8
	- adult roosters	97.1	97.6	97.7	+0.6
Egg fertilization, %		90.4	94.4	93.4	+3.0
Chick hatch, %		79.4	83.2	83.1	+3.7

Young CM56 roosters have well-developed meat body shapes, strong bones, and the live weight of four-week-old chickens in 2023 was 3.8% higher than in 2018. At 52 weeks of age, this indicator in roosters was maintained at an optimal level over the years to improve reproduction rates.

Egg fertilization and chick hatching rates in 2023 were increased by 3.0 and 3.7% compared to 2018.

At the SMC “Smena”, targeted selection is carried out for the live weight of young animals of the CM5 and CM6 lines, which made it possible to increase this indicator at an early age of roosters in the paternal parental form CM56 compared to the source material (B56 “Smena 8”), Table 2.

The new paternal form (CM56) surpasses the B56 bird (cross “Smena 8”) by 0.3-8.2% in terms of live weight at 4 weeks, safety, egg fertilization and chick hatching.

In Cornish roosters CM 56 of the new cross "Smena 9" at 5 weeks of age (12.072 cm versus 10.701 cm - chest width and 11.65 cm versus 11.207 cm - keel length) and 52 weeks of age (13.97 cm versus 13. 79 cm – chest width and 15.92 cm versus 14.21 cm – keel length) there was a slight increase in chest width and keel length by 0.18-1.37 cm; the length of the metatarsus remained almost at the level of the initial form B56 of the Smena 8 cross (5.981 cm versus 5.93 cm - 5 weeks and 9.12 cm versus 9.07 cm - 52 weeks).

Table 2. Breeding qualities of roosters of the paternal parent form CM56.

Sign		Paternal parent form		CM56 "Shift 9" to B56 "Shift 8", %
		B56 "Smena 8"	CM56 "Smena 9"	
Live weight of roosters, g:	4 weeks	780	850	+8.2
	52 weeks	4905	4890	-0.3
Safety, %:	- young animals	97.1	97.4	+0.3
	- adult roosters	97.3	97.8	+0.5
Egg fertilization, %		91,6	94.0	+3.4
Chick hatch, %		78.4	83.2	+4.8

At the age of 30 and 34 weeks of life, the live weight of roosters of the paternal parental forms of crosses "Smena 9" and "Smena 8" was within the range of 4460, 4495 and 4710, 4770 g, respectively, according to the age periods. Anatomical dissection showed that the average weight of the testes at the age of 30 and 34 weeks was in the range from 39.8 to 39.5 g and from 43.1 to 43.0 g, and the relative weight was 0.89 to 0.88 and from 0 .92 to 0.91%, respectively, for the indicated age periods.

In roosters of the paternal parental form of the cross "Smena 9", there was a tendency to a slight decrease in their live weight by age (30 and 34 weeks), as well as to a slight increase in the absolute and relative weight of the testes in comparison with the cross "Smena 8".

There was no abdominal fat in the male sires of both crosses.

Indicators of natural immune resistance in Cornish roosters at the age of 185 days are given in Table 3.

Table 3. Indicators of natural immunity resistance of Cornish roosters.

Index	Line, PPF		
	CM5	CM6	CM56
Total protein, g/l	40.20±2.54	41.11±2.72	41.02±3.01
Lysozyme activity of blood serum, %	27.91±1.9	30.54±1.77	29.73±1.10
Bactericidal activity of serum, %	39.40±0.82	41.11±0.77	40.14±1.11
Phagocytic activity, %	90.31±2.4	92.44±2.8	91.40±2.45
Phagocytic index, %	23.11±1.02	23.42±1.15	23.35±1.14
Phagocytosis completion index, %	86.25±1.40	87.20±1.23	86.73±1.32

The content of total protein in the blood serum of roosters of the original Cornish breed lines (CM5 and CM6) and the paternal parent form (CM56) was at the level of 40.20-41.11 g/l.

Lysozyme and bactericidal activity of the blood serum of linear roosters (CM5, CM6) and the paternal parent form was in the range of 27.91-30.54% and 39.40-41.11%. A statistically significant difference between the lines CM5, CM6 and the paternal parent form (CM56) has not been established. Also, no statistically significant difference was found in the indicators of phagocytic activity, phagocytic indicator and phagocytosis completion index in roosters of the studied lines and the paternal parent form of the Cornish breed.

Table 4 shows the economically useful qualities of broiler crosses "Smena 9" and "Smena 8".

Table 4. Economically useful qualities of broiler crosses “Smena 9” and “Smena 8”.

CROSS			
	"Shift 8"	**"Shift 9"**	**"Shift 9" to "Shift 8", %**
Live weight at 5 weeks of age, g.	2040	2270	+10.1
Feed costs, kg/kg	1.78	1.70	-4.5
Safety, %	96.7	97.8	+1.1
Broiler productivity index, units.	317	370	+16.7

Broilers obtained from the new CM56 form have high live weight and low feed costs per 1 kg of live weight gain. These indicators largely depend on the father's genotype.

Broilers obtained from the use of CM56 roosters had an advantage in the above indicators by 10.1 and 4.5%.

The safety of hybrid broilers of the cross "Smena 9" was improved by 1.1% compared to the cross "Smena 8".

The complex indicator – productivity index increased by 16.7%.

4 Conclusion

Based on the new lines CM5 and CM6 of the Cornish breed, selected using the gene pool of the SMC “Smena”, a new paternal parental form CM56 was created, which has high: live weight of young animals, bird safety, egg fertilization, chick hatching by 0.3-8.2 % in comparison with the paternal parent form B56 of the cross "Smena 8". The live weight of roosters of the paternal parental forms of the crosses “Smena 9” and “Smena 8” was within the range of 4460, 4495 g (30 weeks) and 4710, 4740 g (34 weeks), the average weight of the testes of roosters of the paternal parental form during anatomical dissection of the cross "Shift 9" was equal to 39.8 g (30 weeks) and 43.1 g (34 weeks), their relative weight (to live weight) was 0.89 and 0.92%; for the cross "Smena 8" - 39.5 g and 43.0 g; 0.88 and 0.91%, respectively, at the indicated ages. In roosters, the paternal parent form of the cross "Smena 9" showed a tendency to a slight decrease by age (30 and 34 weeks) of their live weight, as well as to a slight increase in the absolute and relative weight of the testes in comparison with the cross "Smena 8".

Broilers of the cross "Smena 9", obtained from the use of SM56 roosters, had an advantage in live weight at 5 weeks of age by 10.1%, feed costs per 1 kg of live weight gain - by 4.5%, safety - by 1.1 %, productivity index - a complex indicator - by 16.7% compared to the cross "Smena 8".

Poultry of the paternal parent form CM56 and broilers of the "Smena 9" cross with a high genetic potential of important economically useful traits, are competitive, can be used in reproductive farms, parent flocks and broiler poultry farms.

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