

## INVESTIGATION ON PRODUCTION TRAITS OF BROILER CHICKEN HYBRID COMBINATIONS

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### Abstract

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The experiment was carried out in the selection base of the Poultry farm, Institute of Agriculture – Stara Zagora between April and June 2012. Two broiler chicken genotype combinations were used: the first was the offspring of line M roosters with line K hens (M x K), and the second – of line M roosters with line L hens (M x L).

For this purpose, 300 eggs of each combination were set for incubation. The fertility rate, embryonic death rate, weight loss between incubation days 0 and 18, and the hatchability of set and fertile eggs were determined. The number of chickens included in the study was 100 from each genotype (50 males and 50 females). All chicks were sexed, wing-banded and placed in 4 floor pens with wood shavings as litter material until 49 days of age.

The body weight was determined individually by weighing chickens at 1, 14, 28, 42 and 49 days of age. Feed conversion was calculated based on data on feed intake and weight gain of chickens. By the end of the experiment, a slaughter analysis was performed of three female and three male broilers with a live weight close to the group average. The results on fertility rate and hatchability from eggs set and fertile eggs in studied broiler combinations showed a tendency towards higher values for the M x L combination - 94.45%, 87.50% and 92.57%, respectively.

The body weight of the two different studied broiler genotypes was almost the same by the end of the experiment in both male and female birds. Proportions of bratfertig and grill (as percentage of live weight at slaughter) were better in male M x L hybrids compared to male M x K birds. In females, higher relative values of boneless breast were established in M x K compared to M x L broilers.

Therefore, both combinations carrying the traits of meat type chicken lines from the Institute of Agriculture – Stara Zagora, are appropriate for efficient production of commercial broiler chickens.

*Key words:* broilers, hybrid combinations, body weight, hatchability, slaughter analysis

### Introduction

The main priority of modern poultry meat industry is the high and rapid production with the lowest possible costs. The selection of broiler chickens is aimed at attaining a higher live body weight over a shorter times, with low feed expenditure, low mortality and good slaughter traits.

The published results of experiments with broiler chickens of various genetic origins give evidence not only about increased productivity, but a concern for creation of competitive genotypes (Stringhini et al., 2003). Modern poultry meat production requires continuous efforts to improve the economic efficacy together with satisfying market needs for

novel assortment of products compliant with consumers' requirements (Pavlovski et al., 2009).

The industrial broiler chicken production is based on high-productive two-, three- and four-line hybrids. In Russia the two-, three- and four-line strains for broiler production are the most popular (Karpenko et al., 2000; Kuznikova, 2000). Numerous research studies confirm that the quality of broiler chickens depends on environmental factors such as the production system, the feed (Sterling et al., 2006), but particularly on the genotype (Holsheimer and Veerkamp, 1992; Mac-Leod et al., 1998; Smith and Pesti, 1998; Smith et al., 1998). Slaughter traits of broilers are influenced at the highest extent by poultry genotype and gender (Bogosavljević-Bošković et al., 2004).

In order to improve the genetic potential of meat-type poultry production at the Poultry Breeding Unit at the Institute of Agriculture, Stara Zagora, three lines for broiler chicken production have been created – two maternal White Plymouth Rock lines (L and K) and one paternal Cornish line (M). This implies investigation of the production traits of broilers combinations obtained after their crossbreeding.

The purpose of the present experiment was therefore to compare the meat production traits of the offspring of these lines.

## Materials and Methods

The experiment was carried out in the selection base of the Poultry farm, Institute of Agriculture – Stara Zagora between April and June 2012. Two broiler chicken genotype combinations were used: the first was the offspring of line M roosters with line K hens (M x K), and the second – of line M roosters with line L hens (M x L).

For this purpose, 300 eggs of each combination were set for incubation. The fertility rate, embryonic death rate, weight loss between incubation days 0 and 18, and the hatchability of set and fertile eggs were determined. The number of chickens included in the study was 100 from each genotype (50 males and 50 females). All chicks were sexed, wing-banded and placed in 4 floor pens with wood shavings as litter material until 49 days of age. Birds were fed *ad libitum* on a broiler diet in few nutrition phases: starter (1 - 14 days), containing 22.56% CP and 2940 kcal ME/kg; grower (15 - 28 days) – 20.53% CP and 3125 kcal ME/kg; finisher 1 (29 - 42 days) – 19% CP and 3200 kcal ME/kg; finisher 2 (43 - 49 days) – 17% CP and 3230 kcal ME/kg.

The body weight was determined individually by weighing birds at 1, 14, 28, 42 and 49 days of age. Feed conversion was calculated for each genotype and sex for the periods between 1 – 14, 15 – 28, 29 – 42 and 43 – 49 days of age on the basis of feed intake and weight gain. All dead chickens were also weighed and included in the calculation.

By the end of the experiment, a slaughter analysis was performed of three female and three male broilers with a live

weight close to the group average. The live body weight was determined after a 12 -hour fasting, as well as the weights of the grill, of different carcass parts (breast, thighs, wings), of edible giblets (heart, liver and gizzard) and of abdominal fat. These data served for calculation of the slaughter yield and carcass ratios.

For integral assessment of broiler combinations, the European Poultry efficiency factor (EPEF) was calculated according to the formula:

$$\text{EPEF} = \frac{\text{Live body weight (kg)} \times \text{livability (\%)} \times 100}{\text{fattening period (days)} \times \text{feed conversion (kg/kg)}}$$

Data were statistically processed according to the genotype and sex by ANOVA/MANOVA and LSD post hoc test using Statistica software (StatSoft, 2009). Data in percentages were transformed to arcsine before analysis.

## Results and Discussion

Table 1 presents the weight and the relative weight loss (between days 0 and 18) of incubation eggs, and incubation performance. The weight of incubation eggs was higher in M x K hybrids – 62.77 g, as compared to those from M x L hybrids – 61.15 g ( $p < 0.05$ ). The lowest percentage of egg weight loss during incubation was recorded for eggs obtained from M x K combination – 14.78% vs 16.93% for M x L ( $p < 0.05$ ). Deeming (1995) attributed this to reflection of functional porosity of the shell and the initial mass of each egg. On the other hand, as egg size increases, yolk size increases more than the quantity of albumen (North and Bell, 1990)

The data showed lack of significant differences between genotypes with regard to fertility rate and hatchability from set and fertile eggs, but there was a trend towards higher values for the combination M x L.

Table 2 summarizes the data about the live weight of broilers during the different age periods depending on their genotype and gender. The weight of hatchlings was statistically significantly related to the genotype ( $p < 0.05$ ). One-day-old M x K chickens were heavier compared to M x L chickens. On

**Table 1**  
Egg weight, relative egg weight loss and hatchability traits

Genotype	Weight of incubation eggs, g	Weight loss of incubation eggs, % (days 0-18)	Fertility rate, %	Embryonic death rate, %	Hatchability, %	
					from set eggs	from fertile eggs
M x K	62.77 ± 0.39 a	14.78 ± 0.35 b	88.08 ± 2.70	10.84 ± 2.73	78.46 ± 0.01	89.17 ± 2.73
M x L	61.15 ± 0.23 b	16.93 ± 0.29 a	94.45 ± 2.65	7.43 ± 1.50	87.50 ± 3.76	92.57 ± 1.50

<sup>a-b</sup> – different letters within a column indicate statistically significant differences at  $p < 0.05$

the 14<sup>th</sup> and 28<sup>th</sup> day of fattening, this tendency was preserved and substantial. During the finisher period, M x K broilers were with slightly higher live body weight but these differences were not statistically significant. The evaluation of the total effects of genotype and gender showed that this trend was valid for both M x K males, whose weight was by 0.98% higher at the end of the experiment, and in females – by 1.46% higher. The differences were statistically insignificant.

The feed conversion ratio during the entire experimental period was 2.228 kg and 2.273 kg for M x K and M x L, respectively. During the first fattening periods (days 0 to 14 and days 15 to 28), a better feed conversion was established in male and female M x L broilers, whereas in the later stages of the experiment, the feed intake by this hybrid combination per kg weight gain was higher compared to M x K broilers (Figure 1).

A more objective assessment of studied broiler combinations is given by the European poultry efficiency factor (EPEF), which measures the level of genetic potential use by hybrids. The analysis of EPEF data (Table 3) shows higher values for M x K combination, which exhibited higher absolute EPEF by 1.8 points than M x L.

Absolute values of slaughter traits of broilers did not differ statistically significantly between both combinations (Table 4). The preslaughter weights of male and female broilers from both combinations were comparable, so the studied slaughter parameters were also with similar statistically in-

significant values. In general, female broilers had higher absolute breast weights and relative percentages of breast from the grill than male birds, but the latter have higher weight and percentage of thighs. Our results support data reported by Abdullah et al. (2010).

Table 5 presents the relative values of studied slaughter traits in both broiler combinations.

Regardless of the small and insignificant differences in preslaughter live body weight between genotypes there were statistically significant differences between calculated relative weights of the bratfertig, the grill, and the proportions of

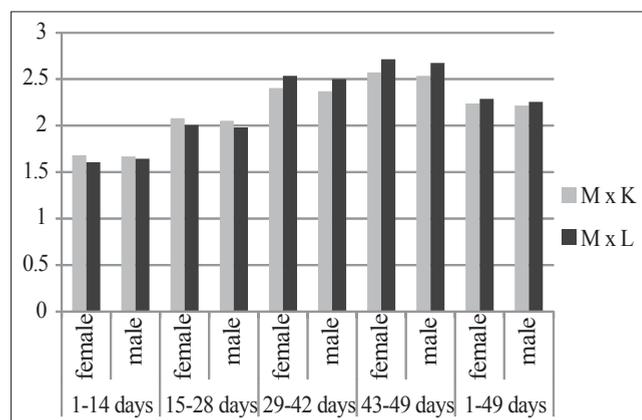


Fig. 1. Feed conversion ratio (kg/kg)

**Table 2**  
Live body weight of broilers (g) depending on the genotype and the gender at different ages

Genotype	Age				
	1 day	14 days	28 days	42 days	49 days
M x K	40.90 ±0.29 <sup>a</sup>	331.79 ±4.42 <sup>a</sup>	1052.01 ±8.73 <sup>a</sup>	1971.48±18.89	2384.63 ±20.04
M x L	39.28 ±0.32 <sup>b</sup>	315.79 ±4.12 <sup>b</sup>	1017.83 ±10.23 <sup>b</sup>	1941.26±15.66	2363.65 ±21.73
<b>Male</b>					
M x K	41.10 ±0.43 <sup>a</sup>	337.36 ±5.33	1062.49 ±11.65	2010.00±27.89	2406.06 ±34.17
M x L	39.33 ±0.44 <sup>b</sup>	323.02 ±5.68	1041.82 ±15.48	1964.78±24.41	2382.29 ±32.28
<b>Female</b>					
M x K	40.70 ±0.37 <sup>a</sup>	326.21 ±4.09 <sup>a</sup>	1041.52 ±12.67 <sup>a</sup>	1932.96 ±21.03	2363.82 ±21.40
M x L	39.22 ±0.48 <sup>b</sup>	308.55 ±5.74 <sup>b</sup>	993.84 ±10.71 <sup>b</sup>	1917.74 ±13.19	2329.23 ±15.30

<sup>a-b</sup> – different letters within a column indicate statistically significant differences at  $p < 0.05$

**Table 3**  
European poultry efficiency factor

Genotype	Body weight at 49 days of age, kg	Livability, %	Feed conversion (kg/kg)	EPEF	
				Absolute	Relative
M x K	2.385	97.00	2.228	211.92	100
M x L	2.364	99.00	2.273	210.12	99.15

**Table 4**  
Slaughter traits of broiler chickens depending on the genotype and the gender

Genotype	Preslaughter weight, g	Bratfertig weight, g	Grill weight, g	Breast w/o bone, g	Thighs, g	Wings, g	Edible giblets, g
M x K	2210.00±17.89	1612.33±14.45	1520.00±18.43	407.17±25.25	487.00±7.67	174.83±4.19	92.33±4.93
M x L	2166.67±12.56	1631.83±15.08	1533.33±15.44	376.50±15.90	517.00±7.55	174.33±2.40	98.00±4.85
Male							
M x K	2236.67±12.02	1625.33±28.72	1536.67±35.34	359.33±11.78	492.33±3.38	172.67±1.33	96.00±7.64
M x L	2173.33±18.56	1655.00±11.37	1556.33±17.15	377.00±31.90	529.00±9.00	178.67±2.19	97.67±9.24
Female							
M x K	2183.33±27.28	1599.33±7.13	1503.33±13.13	455.00±27.59a	481.67±15.94	177.00±9.02	88.67±7.06
M x L	2160.00±20.00	1608.67±21.70	1510.33±19.20	376.00±15.70 b	505.00±7.77	170.00±2.31	98.33±5.67

<sup>a-b</sup> – different letters within a column indicate statistically significant differences at  $p < 0.05$ ;

**Table 5**  
Slaughter yield and slaughter traits, %

Genotype	Bratfertig, % of live weight	Grill, % of live weight	Breast w/o bone, % of grill	Thighs, % of grill	Wings, % of grill	Edible giblets, % of grill	Abdominal fat, % of grill
M x K	72.97 b	68.80 b	26.74 a	32.05 b	11.52	6.1	1.19
M x L	75.32 a	70.77 a	24.56 b	33.72 a	11.37	6.4	0.94
Male							
M x K	72.66 b	68.70 b	23.58	32.04	11.23	6.23	1.61
M x L	76.16 a	71.67 a	24.24	33.99	11.47	6.29	0.59
Female							
M x K	73.25	68.85	30.26 a	31.04 b	11.77	5.89	1.3
M x L	74.47	69.92	24.88 b	33.46 a	11.26	6.51	1.48

<sup>a-b</sup> – different letters within a column indicate statistically significant differences at  $p < 0.05$

boneless breast and thighs from the grill. The other studied slaughter traits and their proportions from the grill had similar values.

Male M x L broilers had considerably higher bratfertig and grill percentages ( $p < 0.05$ ). The proportions of edible giblets and abdominal fat did not differ significantly in M x L and M x K combinations.

Female broilers of both studied hybrids had comparable bratfertig percentages from live body weight – 73.25% for M x K and 74.47% for M x L. The tendency for similar values was preserved for grill percentages from live weight: 68.85% for M x K and 69.92% for M x L, while the relative weights of boneless breast and thighs were significantly different (30.26% and 31.04% for M x K; 24.88% and 33.46% for M x L). The percentages of edible giblets and abdominal fat from the grill in female broilers were also similar.

## Conclusions

The results on fertility rate and hatchability from eggs set and fertile eggs in studied broiler combinations showed a tendency towards higher values for the M x L combination.

The live body weight of the two different studied broiler genotypes was almost the same by the end of the experiment in both male and female birds. Slaughter traits (relative values) were better in M x L hybrids as percentage from the bratfertig and the grill compared to male M x K birds. In females, higher relative values of boneless breast were established in M x K compared to M x L broilers.

Therefore, both combinations carrying the traits of meat type chicken lines from the Institute of Agriculture – Stara Zagora, are appropriate for efficient production of commercial broiler chickens.

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