A comparison of laying performance of egg type strains

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SUMMARY

The primary aim of the experiment was to evaluate the potential of newly created chicken lines from the gene pool of the Agricultural Institute - Stara Zagora to create an efficiently performing commercial egg-laying hybrid. The investigation was conducted on two stages – in 2010 and 2012, using red-coloured egg-type Line T and Line P as sire strains, and the white-coloured Line N as maternal strain for production autosexing chickens. Line T was superior to the other two lines as it had the highest live weight of both males and female chickens, and the lowest feed consumption per egg. Line N had the highest hen-housed egg production, highest laying intensity, lowest age of sexual maturity and highest hatchability. Lines P and T were superior to Line N with regard to average egg weight. The live body weight was determined at the age of 8 and 18 weeks. The egg production was monitored daily per groups on hen-day and hen-housed basis at 150 days of lay. The two-strain hybrid (P♂ x N♀) – group IV, had the highest 150-day hen-housed and hen-day egg production – 139.27 and 142.67 eggs, respectively. Egg weight increased with age in all four groups. Egg weight at group IV (P♂ x N♀) was superior to the other hybrids by the end of the period of lay.

Keywords: hens, eggs, way of breeding, live weight, productivity, feed consumption, hatchability

INTRODUCTION

The contemporary commercial egg production relies upon the utilisation of selected chicken strains. The aim for specialised egg-type chicken hybrids is to obtain a lower live weight (with regard to lowering costs for maintenance of life) and high egg production. Commercial egg hybrids are produced after selection for higher egg production, higher egg mass and lower feed consumption per egg produced. The selection for some traits could result in lower values of other traits (Poggenpoel et al, 1996). That is why selection programmes should create strains specialised for specific traits.

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Brah and Chaudhary (2010) reported for various performance of different White Leghorn strains. Having studied the effect of housing conditions and the strain on production traits and quality of eggs, Singh et al. (2009) examining the influence of the growing condition and the line on production traits and qualities of eggs by found a significant correlation between them. Gerzilov (2011) has studied the egg production in different chicken genotypes in organic production system and reported different egg production and egg and yolk mass.

Egg weight increases steadily with age (Akimova, 2002). The analysis of Schpitz et al. (1989) demonstrates that during the first month, egg weight increased by 8% on average, during the 2nd and 3rd months – by 3% to become stable at peak lay. During the 9th month, the increase was by 3.5%, and by the 12th month – by 8.5% or the total egg weight increase over the entire production period was by 28 - 30 %. Varakina and Aliev (2003) reported that the mean egg weight for the entire period of lay was the closest to that produced at 35 weeks of age, and thus, believed that this age was the most appropriate to evaluate layer strains using egg weight. Sharma et al. (1992**)** established a significant maternal effect on egg production at hens.

The primary aim of the experiment was to evaluate the potential of newly created chicken lines from the gene pool of the Agricultural Institute - Stara Zagora to create an efficiently performing commercial egg-laying hybrids.

MATERIAL AND METHODS

The investigation was conducted on two stages – in 2010 and 2012, using red-coloured egg-type Line T and Line P as sire strains, and the white-coloured Line N as maternal strain. Line T was superior to the other 2 lines as it had the highest live weight of both males and female chickens, and the lowest feed consumption per egg. Line N had the highest hen-housed egg production, highest laying intensity, lowest age of sexual maturity and highest hatchability. Lines P and T were superior to Line N with regard to average egg weight (Lalev et al.**,** 2012).

In 2010, the following crosses were obtained in the elite poultry farm of the Agricultural Institute – Stara Zagora:

First stage – 2010: two strains were crossed, used further as sire strain for production of the final three-strain hybrid.

P♂ x T♀
T♂ x P♀

Second stage – 2011

Group I (P♂ x T♀) ♂ x N♀
Group II (T♂ x P♀) ♂ x N♀
Group III (T♂x N♀)
Group IV (P♂x N♀)

Line N has white plumage and brown eggshells. It was used as maternal strain for autosexing chickens. After hatching, chickens' sex was determined by the down colour - golden-reddish in females and white in males. Female chicks were divided into 4 groups, according to the crossing schedule with 180 hens. They were housed in separate boxes in the same premise on deep litter and fed rations respective to their age *ad libitum*.

The live body weight was determined individually at all chicks with precision of 10 g at the age of 8 and 18 weeks. The egg production was monitored daily per groups on hen-day and hen-housed basis for 150 days after starting egg production (from December to May). Hen-housed and hen-day laying intensity percentages were determined as eggs produced for a specific period of time. The average egg weight was determined at 2-week intervals between 36 and 46 weeks of age. The survival rate (%) was the ratio of number of birds for the entire period of lay and the number of hatched birds. Thirty eggs were obtained from each group at 34 weeks of age for study of their morphological traits.

Data were processed with Excel 2003-ANOVA using the Descriptive Statistics and F-Test Two-Sample for Variances procedures (Zhelyazkov and Tsvetanova, 2002).

RESULTS AND DISCUSSION

Table 1 presents the live body weights of the four groups of hybrids at 8 and 18 weeks of age. The highest live weight at 8 weeks of age was attained by birds from groups III and I, and this trend was observed by the next studied age ($p<0.05$).

The results for egg production and laying intensity are given in Table 2. The egg production was detected for a 150-day period. The hen-housed and hen-day values were very close due to the high survival rate. The highest hen-housed and hen-day egg production was detected in group IV with 139.27 and 142.42 eggs, respectively. Next was group II with 130.93 and 139.6 eggs. The intensity of lay was also maintained – 75.28% and 76.98 % for group IV. The results were statistically insignificant due to group housing and determination of eggs produced. The liveability was within the normal range for the used production system – from 97.97% for group I to 95.58% for group III.

Table 1 Live body weight (g) of hens

Groups	At 8 weeks of age	At 18 weeks of age
Group I	495.96±5.62[a]	1421.80±9.01[a]
Group II	491.12±6.36[a]	1392.28±10.21[b]
Group III	509.67±6.01[b]	1431.69±8.86[a]
Group IV	492.31±6.59[a]	1393.91±9.23[b]

[a – b] different letters within a column indicate statistically significant differences at $p<0.05$;

Table 2 Production of the four groups of layers

Groups	Number of eggs produced in 150 days of lay		Laying intensity (%)		Feed consumption per 1 egg (g)	Liveability (%)
	hen-housed	hen-day	hen-housed	hen-day		
Group I	130.54	132.03	70.56	71.37	166.45	97.74
Group II	130.93	139.6	70.39	75.05	167.15	97.59
Group III	123.53	125.61	66.06	67.17	170.56	96.69
Group IV	139.27	142.42	75.28	76.98	165.78	95.58

Egg weight is a primary egg production trait. Numerous factors influence the weight eggs, among them are the age and genotype of laying hens (Farhad Ahmadi and Fariba Rahimi, 2011). Table 3 and figure 1 show the egg weight of the hybrids in groups at the different ages.

Table 3 Dynamics of egg weight (g) in the four groups

Groups	Weeks of age						Mean
	36	38	40	42	44	46	
Group I	59.07	61.05	61.00	61.95	63.33	63.09	61.58±0.64
Group II	59.53	60.26	61.49	61.23	62.38	63.04	61.32±0.53
Group III	59.60	59.61	60.67	62.34	61.97	62.69	61.15±0.56
Group IV	58.13	60.68	60.27	63.08	63.70	63.53	61.57±0.91

Egg weight increased with age (Hasan Akyurek and Aylin Agma Okur, 2009, Hristakieva et al. 2009). As seen from Fig. 1 in the four hybrid groups egg weight increased with age. Group IV had the lowest egg weight (58.13 g) in the beginning and highest (63.53 g) by the end. Group III had highest egg weight (59.60 g) in the beginning and lowest (61.15 g) by the end.

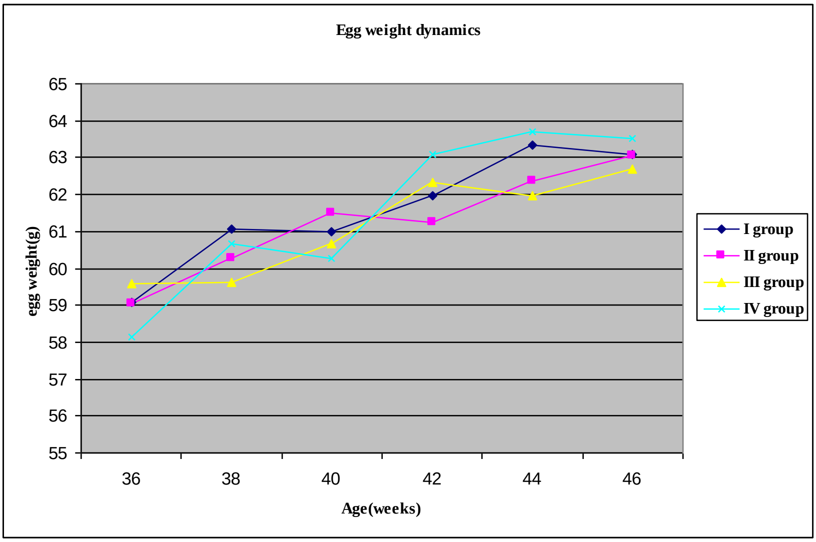

Fig 1 Egg weight (g) dynamics; Age (weeks)

As a result of prolonged selection, the different egg-laying chicken strains differ with regard to egg weight, quality and production (Curtis et al., 1995, De Ketelaere et al., 2002)

A number of researchers established a relationship between the chicken genotype and egg albumen quality (Abrahamsson et al., 1996; Scott and Silversides, 2000; Silversides and Scott, 2001, Silversides et al., 2006), while Wall et al. (2010) did not observed any effect of the genotype on egg quality.

The age of layers is an important factor for albumen quality (Roberts and Ball, 2004), as well as the genotype (Scott and Silversides, 2000; Tharrington et al., 1999; Toussant and Latshaw, 1999).

The results for egg quality parameters and the proportions of their parts are presented in Table 4.

At the age of 34 weeks, hens produced eggs of comparable weight: 63.71 g for group II and 62.02 g for group IV, with insignificant differences. The hens from group III had significantly heavier eggshells (p<0.01). In this case, the heavier eggs were with lightest eggshells, which did not correspond to data obtained in original lines (Lalev et al., 2010).

The amount and quality of egg yolk is associated to egg weight (Hristakieva, P. 2005; Lalev et al. 2010). In this study, the heaviest eggs did not exhibit the highest yolk weights. Chickens from group I laid eggs with 17.91 g yolks and thus, were superior only to eggs from group IV, which were with lowest egg weight (p<0.01). The relative shares of yolks were very similar. The albumen weights were proportional to egg weights – the heaviest eggs produced by group II had the heaviest albumens (39.16 g). With regard to egg quality, expressed through the albumen index, statistically significant differences were observed between groups III and II (p<0.05). Regardless of the lack of variation between egg weights, the egg shapes were different – they were rounder in group IV as compared to group I (shape index 79.03% and 76.45% respectively; p<0.001). The variations in Haugh units within groups were considerable – so, the differences between groups were not statistically significant, despite their magnitude of several units – 76.03 for group III and 72.86 for group IV.

Table 4 Morphological egg traits and egg proportions in four egg-laying hybrids at the age of 34 weeks (n=30).

Parameters	I (P♂ x T♀)♂ x N♀	II (T♂ x P♀)♂ x N♀	III T♂ x N♀	IV P♂ x N♀
Egg weight (g)	62.17±0.78[a]	63.71±0.68[b]	62.68±0.48[b]	62.02±0.72[ab]
Eggshell weight (g)	6.49±0.13[a]	6.07±0.10[b]	6.84±0.11[c]	6.23±0.07[d]
Eggshell percentage	10.44±0.15[a]	9.54±0.14[b]	10.92±0.18[c]	10.06±0.12[d]
Yolk weight (g)	17.91±0.23[a]	17.56±0.26[ab]	17.48±0.26[ab]	17.27±0.17[b]
Yolk percentage	28.86±0.34[a]	27.60±0.38[b]	27.88±0.35[b]	27.95±0.31[b]
Albumen weight (g)	36.62±0.59[a]	39.16±0.60[b]	37.33±0.39[a]	37.12±0.46[a]
Albumen percentage	58.97±0.65[a]	61.41±0.68[b]	59.55±0.42[a]	59.82±0.43[a]
Eggshell thickness, mm	0.37±0.01[a]	0.35±0.01[a]	0.37±0.01[a]	0.35±0.01[a]
Shape index %	76.45±0.55[a]	78.04±0.77[b]	77.62±0.42[c]	79.03±0.48[b]
Yolk index %	42.56±0.38[a]	42.57±0.44[a]	42.57±0.35[a]	42.19±0.38[a]
Albumen index %	6.82±0.36[a]	6.71±0.34[a]	7.54±0.26[b]	6.94±0.32[a]
Haugh units	74.96±1.51[a]	73.96±1.74[a]	76.03±1.19[a]	72.86±1.43[ab]

[a, b, c, d] – different letters within a column indicate statistically significant differences at p<0.05;

CONCLUSIONS

1. The two-strain hybrid (P♂ x N♀) – group IV, had the highest 150-day hen-housed and hen-day egg production – 139.27 and 142.67 eggs, respectively.

2. Egg weight increased with age in all four groups. Group IV (P♂ x N♀) was superior to the other hybrids by the end of the period of lay – 63.53 g.

3. The egg quality traits varied within the usual ranges reported in similar studied of ours and others.

4. The surveyed laying hens had good egg quality parameters and the proportions of their parts.

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