10 years - **ANNIVERSARY EDITION** ***TRAKIA JOURNAL OF SCIENCES***
Trakia Journal of Sciences, Vol. 10, No 1, pp 43-47, 2012

Available online at:
http://www.uni-sz.bg

ISSN 1313-7050 (print)
ISSN 1313-3551 (online)

Original Contribution

DEVELOPMENT OF NEW LAYING HEN LINES. I. GROWTH POTENTIAL AND EGG PRODUCTION RATE

M. Lalev, M. Oblakova*, P. Hristakieva, N. Mincheva, I. Ivanova

Agricultural Institute - Stara Zagora, Bulgaria

ABSTRACT
The experiment was performed in the Poultry Breeding Unit at the Institute of Agriculture, Stara Zagora, in 2009-2010. Three different chicken genotypes obtained by a specific plan were used: line R and line T from the Rhode Island Red breed and line N from the Rhode Island White breed. For each line, 20 selection nests with 12 hens and 2 cockerels (one principal and one spare) were formed. On the basis of observed zootechnological parameters, the line T was found to be superior to the other two lines with the highest live body weight of hens and cockerels and the lowest feed consumption per egg. Line N exhibited the highest hen-housed egg production rate, the intensity of egg laying, the age of egg laying's start and hatchability. The fertility or eggs produced from this line was higher than that of Line N by 7.94%, whereas the hatchability of fertile eggs was by 2.19% higher than that of Line P. The egg mass for Line P and Line T with 60.90 g and 60.24 g ($p< 0.01$) was superior to Line N.

Key words: hens, eggs, breeding, live weight, productivity, feed consumption, hatchability

INTRODUCTION

At a worldwide scale, contemporary poultry breeding is based upon the utilization of a limited number of chicken breeds and lines (1). Leghorn and Rhode Island are recognized among commercial egg laying breeds, whereas Cornish and Plymouth Rock – among broiler production breeds. The main reason is the intensification of poultry industry, the distribution and utilization of highly productive hybrids that have replaced the non-competitive breeds and have limited the genetic diversity (2, 3, and 4).

The issue of bird genetic fund preservation should be related to the development of a new trend in selection, permitting the reasonable use of the diversity of existing breeds and strains to create new lines and combinations. The prevailing opinion (5, 6, and 7) is that the successful future selection in poultry should be based upon a rich and diverse genetic resource.

It is acknowledged (8, 9) that the hatchability is a trait influenced more strongly by the maternal line than by the sire line. (10) has reported a weak maternal effect on fertility. Body weight has a various importance in the different productive types of chickens. The development of special egg laying lines is targeted to lower live body weight with regard to reducing the maintenance costs. Body weight and reproductive traits are inversely related and hence, require the existence of specialized lines to emphasize a particular trait.

(11) and (12) established a significant maternal effect on the live body weight of chickens at the age of 0–8 weeks – 5.23 % on the average. According to (13) the maternal effect is important for the period from hatching to 4 weeks of age (14) have determined the dam's role on hatchability.

The research carried out by (15) has shown that the average mass of eggs for the entire production period was the closest to egg mass at the age of 35 weeks and that age was therefore assumed as the most appropriate for evaluation of layers using egg mass as a production trait.

The aim of this research was to develop and evaluate three laying hen lines that will be used to develop autosexing stock hybrids with a good egg production rate and high egg mass.

***Correspondence to**: *Magdalena Oblakova, Institute of Agriculture, Stara Zagora, Bulgaria, E-mail: moblakova@abv.bg*

For this purpose, the present study has evaluated 1) the growth potential of birds; 2) their eggs productivity and reproduction traits.

MATERIAL AND METHODS

The experiment was performed in the Poultry Breeding Unit at the Institute of Agriculture, Stara Zagora, in 2009-2010. Three different chicken genotypes obtained by a specific plan were used: line R and line T from the Rhode Island Red breed and line N from the Rhode Island White breed. For each line, 20 selection nests with 12 hens and 2 cockerels (one principal and one spare) were formed.
Breeding plan:

Stage 1

In this study, the production traits of the following F1 crosses were investigated:

1. Red colour ♂ ISA Brown x ♀ Line B
2. Red colour ♂ Lohmann brown x ♀ Line B
3. White colour ♂ Line D x ♀ ISA White

During the new breeding season (month of June), F2 crosses were obtained according to the following plan:

1. Red colour
♂ ISA Brown x♀ (♂ ISA Brown x ♀ Line B)
2. Red colour
♂ Lohmann Brown x ♀ (♂ Lohmann Brown x ♀ Line B)
3. White colour
♂ ISA White x ♀ (♂ Line D x ♀ ISA White)

The following production traits were controlled:

1. Fertility and hatchability: relative share of fertile eggs from all eggs set in the incubator and relative share of hatched chickens from all eggs set, respectively.
2. Live body weight – measured collectively at hatching and then, determined individually for all birds with a balance (precision of 10 g) at 18 weeks of age.
3. Age of sexual maturity (days) – when 50% hatchability has been reached for each group.
4. Egg production – determined on a daily basis, per hen-housed and per hen-day.
5. Egg laying intensity (%) – determined by the number of eggs produced over a specific period of time, per hen-housed and per hen-day.
6. Average egg mass – at 2-week intervals from the age of 32-44 weeks to the end of the egg production cycle.
7. Survival rate (%) of birds at a specific age and the number of hatched chickens.

The evaluation of strains according to genotype and phenotype was done using M± m, δ, Cv. The results were statistically processed by means of ANOVA- 2000.

RESULTS

Data for live body weight determinations are shown in **Table 1**. By the age of 18 weeks, female birds from the red-coloured Line T achieved the highest body weight of 1897.14 g ($p<0.001$) followed by the red-coloured Line P - 1810 g and the white-coloured Line N with 1694.43 g. Cockerels from Line T (2785 g) and Line P (2660 g) were heavier than those from Line N – 2285 g at $p< 0.001$.

Table 1. *Live body weight of egg-laying hens by the age of 18 weeks.*

18-weeks of age	Line N x ± Sx	VC%	Line T x ± Sx	VC%	Line P x ± Sx	VC%
female	1694.43±43	8.90	1897.14±11.80 **a**	9.39	1810±8.	7.42
male	2285±38.23	7.48	2785±89.52 **b**	14.36	2660±28.6	4.82

a- T- N at p< 0.001 **b-** T-P at p< 0.001 **c-** P-N at p< 0.001
*** p< 0.001 ** p< 0.01 * p< 0.05

The earliest age of egg laying start occurred in hens from Line N – 166.10 days whereas the start of egg laying was the most postponed in hens from Line P – 188.75 days **(Table 2)**. Over the 120-day period, all three lines exhibited a good egg production rate without statistically significant differences. Most eggs were laid by Line N 101.12 followed by Lines T and P with 97 eggs.

***Table 2.** Egg production of laying hens over 120 days.*

Line	Egg mass, g	Eggs produced per hen-housed	Eggs produced per hen-day	Egg laying intensity per hen-housed, %	Egg laying intensity per hen-day, %	Start of egg laying, days of age	Survival rate	Feed consumption per 1 egg , g
Line N	57.15	101.12±2.11	101.54±2.13	84.27±1.76	84.62±1.77	166.10	99.17	168.24
Line T	60.48	100.76±1.86	104.13±1.57	81.47±1.54	86.75±1.31	179.65	95.70	167.44
Line P	60.89	97.82±2.39	98.03±2.31	81.52±2	82.32±2.03	188.75	99.16	191.60

The dynamics of egg mass from the 32nd to the 44th week of age is presented on **Fig. 1** and **Table 3**. Laying hens from Line N were characterized with the lowest egg mass over that period.

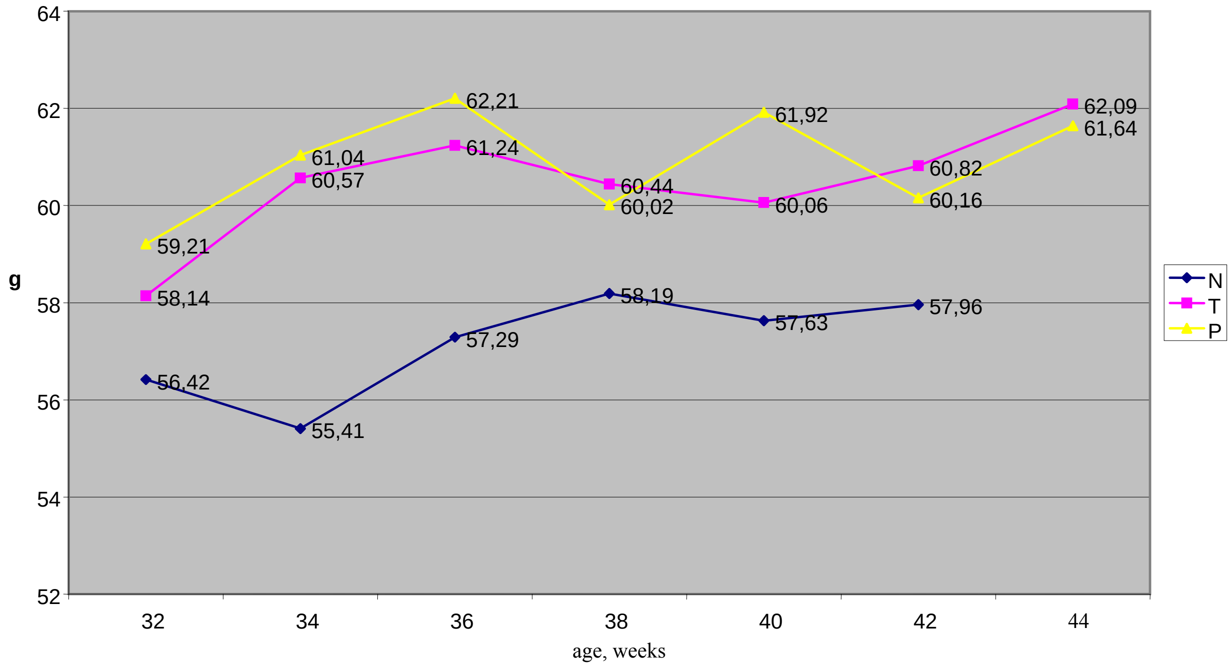

Fig. 1. Dynamics of egg mass

***Table 3.** Dynamics of egg mass*

Line/ week	32	34	36	38	40	42	44	Средна маса на яйцата
Line N	56.41±0.39	55.41±41	57.21±0.25	57.86±0.40	57.68±0.29	57.79±76	-	57.15±0.43
Line T	58.14±0.37	60.01±0.37	61.28±0.47	60.44±0.46	60.05±0.36	60.88±0.37	60.90±0.26	60.24±0.27 **d**
.Line P	59.20±0.44	61.04±0.49	62.26±	60.105±0.21	61.92±0.44	60.30±0.41	61.60±0.3	60.90±0.24**e**

d- T-N - ** at p< 0.01 **e- P-N** ** at p< 0.01

A principal zootechnological parameter as feed consumption was the lowest in Lines T and N – 167.44 g and 168.24 g, respectively and the highest in Line P (191.60 g or by 12.63% higher).

The survival rate during the production period was the highest in Line P – 99.16% and Line N– 99.17%. The differences vs Line T (survival rate 95.70%) were not statistically significant. Cockerels from all lines exhibited a survival rate of 100%.

Egg incubation traits **(Table 4)** showed the highest fertility in Line N – 93.74%, that was by 7.94% higher than Line T and by 9.3% higher than Line P. The hatchability of fertile eggs was 92.19%, i.e. by 2.19% and 4.89% higher than Line P and Line T, respectively.

Table 4. *Reproductive traits of laying hens*

Line	Incubation egg mass	Hatching weight of chickens female	male	Number of eggs set	Infer-tile	Dead embryos at first inspec-tion	Dead embryos at second inspection	% Fertility,	% Hatchability of eggs set	% Hatchability of fertile eggs
Line N	58.21	39.20	39.46	1215	76	5	72	**93.74**	86.42	**92.19**
Line T	60.49	40.07	40.65	1303	185	20	111	**85.80**	74.90	**87.30**
Line P	61.32	38.71	38.31	1343	209	18	92	**84.44**	76.02	**90.04**

DISCUSSION

The mean square error for the three laying hen lines by the end of the 18-week period was 150 g, 178 g, 134.32 g for Lines N, T, and P, respectively, indicating the greatest variation of the live body weight in that order. For cockerels, the MSE value was the highest for Line T (400 g) followed by Line N – 170.98 g and Line P – 134.32 g.

The genetic potential of birds could be assessed by the age of sexual maturity and the egg production rate. The differences in the age when sexual maturity is reached are due to genetic variations.

The egg production rate was followed over a period of 120 days. In this case, the percentages per hen-housed and hen-day are very close because of the high survival rates of hens. The results showed that the intensity of egg laying per hen-housed was the highest in Line P – 84.52% followed by Line T with 81.47% and Line N with 81.27%. The egg mass is a major production trait in laying hens. The highest average mass was established for eggs of Lines P and T – 60.89 g and 60.48 g, respectively ($p<0.01$).

In the beginning, hens from Line P showed better values of that parameter with 59.21 g, by the age of 36 and 42 weeks they heavier than eggs of Line T but by the end of the period exhibited lower egg mass vs Line T (61.64 g and 62.09 g, respectively).

CONCLUSION

On the basis of observed zootechnological parameters, the line T was found to be superior to the other two lines with the highest live body weight of hens and cockerels and the lowest feed consumption per egg.

Line N exhibited the highest hen-housed egg production rate, intensity of egg laying, age of egg laying's start and hatchability. The fertility or eggs produced from this line was higher than that of Line N by 7.94%, whereas the hatchability of fertile eggs was by 2.19% higher than that of Line P.

The egg mass for Line P and Line T with 60.90 g and 60.24 g ($p< 0.01$) was superior to Line N.

REFERENCES

1. Fulton, J. E. Avian genetic stock preservation: An industry perspective – *Poulry Sci.* 85 : 227 – 231, 2006.
2. Gandini, G. C. and E. Villa. Analysis of the cultural value of local livestock breeds: a methodology – *J. Anim. Breed. Genet.*,120, 1 – 11, 2003.
3. Beaumont, C., Bihan – Duval, E. Le and P. Magdelaine, Productive et qualite du poulet de chair – *INRA Prod. Anim*., 17 : 265 – 273, 2004.
4. Hoffman, I. Livestock biodiversity – *Revue scientifique et Technique – Office International des Epizooties,* vol. 29, № 1, pp. 73 – 86, 2010.
5. Levin, G. Productivity of laying hens from non-industrial breeds. *Poultry Breedi*ng, 3:21 – 24, 1989.
6. Nadiradze, K., Djikia, L. and A. Nasuashvili.Conservation of domestic poultry breeds in Georgia – *4-th European Poultry Genetics Symposium*, Croatia, 2005.
7. Gryzinska, M. M.; Niespodziewanski, M. History of the autosexing breed of Polbar

(Pb) hens. - *Wiadomości Zootechniczne*, Vol. 47 No. 1 pp. 31-35, 2009.

8. Nordskog, A. W., G. M. Hassan. Direct and maternal effects of egg – size genes on hatchability. *Genetics*, 67 (2): 267 – 78, 1971.
9. Boshnakov, A. Genetics of Reproduction. *Proceedings of a Scientific Technical Conference with International Participation on Problems of Domestic Fowl Selection*, Varna, pp. 17 – 24, 1986.
10. Kunev, K. Determination of genetic parameters of fertility and hatchability of New Hampshire hens. *Proceedings of a Scientific Technical Conference with International Participation on Problems of Domestic Fowl Selection*, Varna, pp. 52 – 63, 1986.
11. Khalil, M. K., Hermes I. M., Al -Homidan, A. H. . Estimation of heterotic components for growth and livability traits in a crossbreeding experiment of Saudi chickens with White Leghorn. *Egypt. Poultry Sci*., 19 (3): 491 – 507, 1999.
12. Sabri, H. M., Khattab, M. S. and A. M. Abdel – Ghany. Genetic analysis for body weight traits of a diallel crossing involving RIR, WL, Fayomi and Dandarawi chickens. *Anna. of Agric. Sci*., Moshtor, 38 (4) : 1869 – 1883, 1999.
13. Prado – Gonzalez, E. A., Ramirez – Avila, L. and Segura –Preisinger, R. Internationalization of breeding programs – breeding egg type chickens for a global market, *6th World Congress on Genetics Applied to Livestock Production*, 26, 135 – 142; Anim. Genetics and Breeding Unit, Univ. of New England, Armidale, Australia, 2003.
14. Sharma, D., Johari, D., Kataria, M. and Singh, D. Combining ability analysis for egg production traits of light and heavy breed crosses of egg type chickens, *Indian Journal of Poultry Science* , 27 (4): 183 – 187, 1992.
15. Varakina, R. I., Aliev, M. S. Increase of egg mass in hens from the BT1 line, Bugulm crosses. *Proceedings of Research Works of VNITP,* 2003.