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PHENOTYPIC CORRELATION OF HENS BODY WEIGHT AND REPRODUCTIVE TRAITS OF BROILER PARENTS

Vladan Djermanović[1], Sreten Mitrović[1], Živan Jokić[1], Goran Stanišić[2]

[1]University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Republic of Serbia.
[2]College of Agriculture School of Professional Studies, Vojvode Putnika 56, 15000 Sabac, Republic of Serbia.
Corresponding author: djermanovic@agrif.bg.ac.rs
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Abstract: Examinations were conducted in two flocks of broiler parents' hybrids Ross 308 and Cobb 500. At the beginning of the production cycle (24th weeks of age) was determined that the average hens body weight of hybrid Ross 308 was 2680.40 g, and to hybrid Cobb 500 was 2697.80 g. At 42nd weeks of age (middle of the production cycle) hens body weight was 3565.10 g (Ross 308) and 3599.05 g (Cobb 500), while at the end of the production cycle (61st weeks of age) hens body weight of hybrid Ross 308 was 3841.50 g, and to the Cobb 500 was 3850.00 g. Determined differences of hens body weight (17.40 g, 33.95 g and 8.50 g) in specific periods of the production cycle, and the difference in hens body weight for the entire cycle (23.26 g) weren't statistically significant ($P>0.05$). Specific consideration of the impact of hens' body weight on reproductive performances of broiler parents was determined by calculating the coefficients of phenotypic correlation among the tested indicators. Thus, between hens body weight and most reproductive indicators of broiler parents were determined statistically very significant ($P<0.001$) coefficients of phenotypic correlation, while between hens body weight and the percentages of chickens feasibility from fertilized eggs were determined significant ($P<0.001$; $P<0.01$; $P<0.05$) correlation coefficients for a slightly shorter period than anticipated production cycle.

Key words: hens, body weight, reproductive traits, broiler parents, correlation.

Introduction

On reproductive performances of broiler parents, besides age and optimal gender ratio, significant impact has a body weight of hens during the production cycle (*Savić et al., 2004; Ciacciariaello and Gous, 2005; Đermanović et al., 2005; Vieira et al., 2005; Almeida et al., 2006; Djermanovic et al., 2008; Djermanovic et* *al., 2009; Djermanovic, 2010; Đermanović et al., 2010; Mitrovic et al., 2010; Mitrovic et al., 2011; Đermanović et al., 2012*). Proper hormonal functioning of the endocrine system of hens except age and photostimulation (*Lewis et al., 2005; Lewis and Gous, 2006; 2007; Usturoi et al., 2007*) to a large extent depends on body's growth of breeding animal. In particular age with the optimal body weight ovary functioning is stimulated, and thus accelerates the maturation of oocytes, i.e. egg production. It is necessary to ensure to the fertilized ovum proper conditions for embryo development to bring offspring from fertilized egg.

Only proper feeding and the technology of exploitation parental flock can provide prerequisite for the maximum percentage of feasibility and necessary vitality and quality of eggs for incubation hatched offspring (*Barnett et al., 2004; Maiorka et al., 2004; Enting et al., 2007; Wolanski et al., 2007*). To be production period of fertilized eggs, i.e. day-old chickens, longer it is necessary to permanently keep hens in breeding shape, with special care to their development. Also, should have in mind that flock uniformity in terms of body weight is especially important factor in the second half of production cycle. Among other factors, body weight of breeding hens directly influences on reproductive performances. It is similar to the production of eggs for incubation, i.e. broiler chickens of different genotype. In most line hybrids eggs production for incubation begins in 24th weeks of age when the intensity of capacity is about 5% and higher. Since that period eggs production, fertility and chickens feasibility gradually increases to the maximum, and after that productivity of broiler parents reduces to a lesser or greater extent. Therefore it can be said that the period of exploitation of broiler parents depends to a very large extent by this time interval. As an indicator to give estimates to what period is reasonable to use the broiler parents in production of hatching eggs and day-old chickens, a significant contribution can provide calculated coefficients of phenotypic correlation between hens body weight and reproductive traits in the final period of the production cycle, that represents a turning phase in the in the utilization of parent flocks.

Material and Methods

Examinations were conducted in two parent flocks of heavy hen hybrids Ross 308 and Cobb 500. During the production cycle, was used the technology proposed by the breeders of the mentioned hybrids. Both broiler parent flocks were kept on the floor of the deep litter, and feeding, watering, ventilation and lighting were automatically regulated. Studied flocks were grown to the 61st week of age, i.e. both flocks have laid eggs in the beginning of the 22nd week, and for incubation were used eggs that have been laid from 24th week of age to the end of the production cycle, because it satisfied the minimum weight suitable for incubation (>50.00 g). From the results it follows that the period of egg production, i.e. production of day-old broiler chickens has lasted 38 weeks.

As the initial sample material were used 5200 birds of both genders of hybrids Ross 308 and 5430 broiler breeders of hybrids Cobb 500. Hybrids were kept in two separate objects. In the first object were stationed 4750 ♀ and 450 ♂ Ross 308 hybrids, and in the second 4960 ♀ and 470 ♂ Cobb 500 hybrids, so the gender ratio was 1 : 10.56 (Ross 308) and 1 : 10.55 (Cobb 500). In the preparation period from the 21st till the 24th week of the flock age mortality and cast aside were 13 birds (0.297%) to hybrid Ross 308, and to hybrid Cobb 500 12 birds (0.24%). That means that at the beginning of utilization of eggs for incubation to broiler parents of hybrid Ross 308 in the flock was 4737 hens, i.e. 4948 hens to hybrid Cobb 500. In order to control body weight each week individually was measured per 200 hens of hybrid Ross 308 and Cobb 500, selected randomly.

By this measuring was followed uniformity of hens tested flocks during the production cycle, furthermore was tested the influence of hens body weight on the reproductive performances of broiler parents: eggs weight, chickens feasibility from fertilized eggs, day-old chicken weight, relative share of chicken in egg weight, absolute weight loss of eggs and relative weight loss of eggs.

Basic data processing was performed using variation statistical methods, and testing the differences between hybrids by using t-test. Nevertheless, the obtained results were used to calculate the correlation of tested traits by weeks of the production in the last third of the production cycle, i.e. from the 50th to the 61st weeks of age, by using correlation analysis. Statistical data processing was performed by using the program SAS/STAT (*SAS Institute*, *2000*).

Results and Discussion

Average values, variability, importance of the difference in body weight of hens at certain times of the production cycle and for the whole period of egg production, are shown in the Table 1.

Table 1. Average values, variability, importance of the difference in body weight of hens at certain times of the production cycle

Production cycle period	Weeks of age (production)	Hybrid	$\bar{x}$ ±SEM	S	$\bar{d}$
Beginning	24 (1)	Ross 308	2680.40±14.63	206.93	17.40^{ns}
		Cobb 500	2697.80±17.09	241.66	
Middle	42 (19)	Ross 308	3565.10±19.86	280.92	33.95^{ns}
		Cobb 500	3599.05±20.12	275.28	
End	61 (38)	Ross 308	3841.50±21.39	302.56	8.50^{ns}
		Cobb 500	3850.00±21.68	306.59	
Entire production cycle	61 (38)	Ross 308	3411.15±61.58	394.33	23.26^{ns}
		Cobb 500	3434.41±61.03	390.76	

^{ns} P>0.05.

Table 1 data show that the average body weight of hens of both hybrids is increased gradually during the production cycle. Body weight of hens in the 24th week was 2680.40 g (Ross 308) and 2967.80 g (Cobb 500), and at the end of utilizing 3841.50 g to hybrid Ross 308 and 3850.00g to hybrid Cobb 500. During the production cycle Cobb 500 hybrid hens compared to hens Ross 308 had a higher average body weight, which was not statistically confirmed (P>0.05). Average body weight of Ross 308 hybrid hens for the whole exploitation period was 3411.15 g, and to hybrid Cobb 500 3434.41 g, the difference in body weight (23.26 g) between the tested hybrids hens was not statistically significant (P>0.05), indicating that genotype had no significant effect on body weight of hens.

The body weight was slightly higher than the genetic potential of the tested hybrids. To the similar results, in terms of average body weight of hens had come *Djermanovic et al. (2009), Djermanovic (2010)* and *Mitrovic et al. (2010). Usturoi et al. (2007)* during the breeding of the Ross 308 broiler parents found slightly lower average body weight of hens, depending on which groups of hens, in the 60th week of age was between 3988.95 g and 3990.44 g *Lewis et al. (2005)* and *Lewis and Gous (2006)* are in the 60th week of age Cobb 500 hybrid hens determined slightly higher average body weight of hens, between 4.21 and 4.25 kg, while *Lewis and Gous (2007)* in the 59th week of age determined slightly higher average body weight of hybrid Ross 308 (4.43 kg) and Cobb 500 (4.56 kg).

Beside established variation measures of hens body weight of the analyzed parent flocks, in order to gain better insight of the impact of body weight on reproductive performances of hens, coefficient of phenotypic correlation among tested traits in the last third of the production cycle was calculated (Table 2).

Table 2. The phenotypic correlation of hen's body weight and reproductive traits

Age (weeks)	Hybrid	BW, g	Coefficients of phenotypic correlation					
			r_1	r_2	r_3	r_4	r_5	r_6
50	Ross 308	3685.50	0.989^{***}	0.677^{***}	0.961^{***}	0.763^{***}	0.650^{***}	-0.763^{***}
	Cobb 500	3710.00	0.989^{***}	0.657^{***}	0.961^{***}	0.765^{***}	0.719^{***}	-0.765^{***}
51	Ross 308	3703.50	0.992^{***}	0.620^{***}	0.966^{***}	0.781^{***}	0.581^{***}	-0.781^{***}
	Cobb 500	3722.00	0.994^{***}	0.585^{***}	0.969^{***}	0.792^{***}	0.654^{***}	-0.792^{***}
52	Ross 308	3710.50	0.991^{***}	0.556^{***}	0.966^{***}	0.797^{***}	0.485^{**}	-0.797^{***}
	Cobb 500	3732.50	0.994^{***}	0.525^{**}	0.970^{***}	0.809^{***}	0.574^{***}	-0.809^{***}
53	Ross 308	3743.00	0.989^{***}	0.495^{**}	0.964^{***}	0.812^{***}	0.369^{*}	-0.812^{***}
	Cobb 500	3755.00	0.993^{***}	0.466^{**}	0.969^{***}	0.815^{***}	0.490^{**}	-0.815^{***}
54	Ross 308	3754.00	0.989^{***}	0.440^{*}	0.959^{***}	0.809^{***}	0.264^{ns}	-0.809^{***}
	Cobb 500	3767.50	0.992^{***}	0.413^{*}	0.967^{***}	0.817^{***}	0.398^{*}	-0.817^{***}
55	Ross 308	3770.00	0.987^{***}	0.375^{*}	0.957^{***}	0.812^{***}	0.174^{ns}	-0.812^{***}
	Cobb 500	3777.50	0.991^{***}	0.362^{*}	0.963^{***}	0.821^{***}	0.293^{ns}	-0.821^{***}
56	Ross 308	3782.50	0.986^{***}	0.315^{ns}	0.951^{***}	0.805^{***}	0.095^{ns}	-0.805^{***}
	Cobb 500	3792.50	0.991^{***}	0.316^{ns}	0.957^{***}	0.817^{***}	0.172^{ns}	-0.817^{***}
57	Ross 308	3797.00	0.988^{***}	0.254^{ns}	0.944^{***}	0.794^{***}	-0.003^{ns}	-0.794^{***}
	Cobb 500	3805.00	0.991^{***}	0.261^{ns}	0.950^{***}	0.812^{***}	0.032^{ns}	-0.812^{***}
58	Ross 308	3805.50	0.986^{***}	0.183^{ns}	0.938^{***}	0.786^{***}	-0.067^{ns}	-0.786^{***}
	Cobb 500	3812.50	0.989^{***}	0.203^{ns}	0.943^{***}	0.803^{***}	-0.062^{ns}	-0.803^{***}
59	Ross 308	3812.50	0.985^{***}	0.091^{ns}	0.929^{***}	0.774^{***}	-0.129^{ns}	-0.774^{***}
	Cobb 500	3825.00	0.987^{***}	0.121^{ns}	0.934^{***}	0.791^{***}	-0.157^{ns}	-0.791^{***}
60	Ross 308	3827.50	0.983^{***}	-0.016^{ns}	0.919^{***}	0.752^{***}	-0.134^{ns}	-0.752^{***}
	Cobb 500	3835.00	0.984^{***}	0.015^{ns}	0.923^{***}	0.781^{***}	-0.252^{ns}	-0.781^{***}
61	Ross 308	3841.50	0.986^{***}	-0.126^{ns}	0.909^{***}	0.724^{***}	-0.135^{ns}	-0.724^{***}
	Cobb 500	3850.00	0.981^{***}	-0.097^{ns}	0.910^{***}	0.756^{***}	-0.253^{ns}	-0.756^{***}

BW – Body weight (g). * P<0.05; ** P<0.01; *** P<0.001; ^{ns} P>0.05.

r_1-hens body weight (g) x eggs weight (g); r_2-hens body weight (g) x chickens feasibility from fertilized eggs (%); r_3-hens body weight (g) x day-old chickens weight (g); r_4-hens body weight (g) x relative share of chicken in egg weight (%); r_5-hens body weight (g) x absolute egg weight loss (g); r_6-hens body weight (g) x relative egg weight loss (%).

Between body weight and weight of hens eggs, i.e. chickens weight determined absolute correlation connection (P<0.001). However, between hens body weight and chickens feasibility from fertilized eggs, to the both hybrids, calculated coefficients of phenotypic correlation were statically significant (P<0.001; P<0.01; P<0.05) to the 55th week of age (Table 2). This was reached because of slightly higher body weight of Cobb 500 hybrid hens, compared to Ross 308, during the production cycle (Table 1). Despite of this, it can be said that in term of this indicator achieved results were solid to the both tested hybrids.

Based on the data presented in the Table 2, to the both parent flocks was determined increasing trend of relative share of chicken in egg weight with increasing hens' body weight, similar to egg weight, i.e. chickens weight. Determined coefficients of phenotypic correlation between these indicators, to the both tested genotypes, were statistically very significant (P<0.001). Analogue to the values for the relative share of chicken in egg weight was determined, but negative, statistically very significant values ($P<0.001$), between hens body weight and relative egg weight loss to the both hybrids. Beside of this, between hens body weight and absolute egg weight loss were determined positive statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) coefficients correlation connection till the 53rd weeks of age (Ross 308), i.e. till the 54th weeks of age (Cobb 500).

Since this periods till the end of the production cycle determined coefficients of correlation connection between analyzed parameters weren't statistically significant ($P>0.05$), but to Ross 308 hybrids from the 57th weeks of age, and to Cobb 500 from 58th week, to the end of the production cycle were negative.

The most of the authors, in their researches, mainly have been dealt with impact of age on productive and reproductive indicators of broiler parents, and in less extent with impact on hens' body weight. However, to the similar but also to the opposite results in terms of correlation connection of reproductive indicators in the first place age of broiler parents have come *Savić et al. (2004), Đermanović et al. (2005), Djermanovic et al. (2008), Djermanovic et al. (2009), Mitrović et al. (2009), Sahin et al. (2009), Djermanovic (2010), Đermanović et al. (2010), Mitrović et al. (2011)* and *Djermanovic et al. (2012).*

Conclusion

Based on the obtained results can be ascertained that average hens body weight to the both tested hybrids, in relation to technological normative, were lower in the beginning and at the end of the production cycle. However, the differences between hens body weight to the both tested hybrids weren't statistically significant ($P>0.05$), i.e. genotype had no significant effect on body weight of hens.

Based on calculated coefficients of phenotypic correlation and its relevance, we can say that the hens body weight significantly affected their breeding ability because to the both parent flocks, between hens body weight and eggs weight, day-old chickens weight, relative share of chicken in egg weight and relative egg weight loss were determined statistically very significant ($P<0.001$) coefficients of correlation. But, between hens body weight and chickens feasibility from fertilized eggs to the both tested genotypes statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) coefficients of correlation were determined for a slightly shorter period (55th week of age) than expected production cycle, leading to the fact that increase in body weight decreases the ability of hens breeding. This also indicates that increase in hens' body weight causes reducing of the production cycle than anticipated, i.e. existence of the turning phase in the last third of the production cycle.

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Fenotipska povezanost telesne težine nosilja i reproduktivnih osobina brojlerskih roditelja

Vladan Djermanović, Sreten Mitrović, Živan Jokić, Goran Stanišić

Rezime

Ispitivanja su sprovedena na dva jata brojlerskih roditelja hibrida Ross 308 i Cobb 500. Na početku proizvodnog ciklusa (24. nedelja starosti) kod hibrida Ross 308 utvrđena je prosečna telesna težina nosilja 2680,40 g, a hibrida Cobb 500 2697,80 g. U 42. nedelji starosti (sredina proizvodnog ciklusa) telesna težina nosilja iznosila je 3565,10 g (Ross 308) i 3599,05 g (Cobb 500), dok je na kraju proizvodnog ciklusa (61. nedelja starosti) telesna težina nosilja hibrida Ross 308 iznosila 3841,50 g, a Cobb 500 3850,00 g. Utvrđene razlike telesne težine nosillja (17,40 g, 33,95 g i 8,50 g) u određenim periodima proizvodnog ciklusa, kao i razlika u telesnoj težini nosilja za ceo proizvodni ciklus (23,26 g) nisu bile statistički signifikantne (P>0,05). Konkretnije sagledavanje uticaja telesne težine nosilja na reproduktivne performanse brojlerskih roditelja utvrđeno je izračunavanjem koeficijenata fenotipske korelacije između ispitivanih pokazatelja. Tako su između telesne težine nosilja i većine reproduktivnih pokazatelja brojlerskih roditelja utvrđeni statistički vrlo signifikantni (P<0,001) koeficijenti fenotipske korelacione povezanosti, dok su između telesne težine nosilja i procenta izvodljivosti pilića od oplođenih jaja utvrđeni statistički signifikantni (P<0,001; P<0,01; P<0,05) koeficijenti korelacije za nešto kraći period (55. nedelja starosti) od predviđenog proizvodnog ciklusa.

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