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PHENOTYPE CORRELATION BETWEEN PRODUCTION TRAITS AND BODY WEIGHT OF HEAVY BROILER BREEDER HENS

SUMMARY

Research was conducted on two broiler parent flocks of Ross 308 and Cobb 500 hybrids. At the beginning of productive cycle (24 weeks of age) for Ross 308 hybrid average body weight of laying hens was 2680.40g, while for Cobb 500 hybrid it was 2697.80g. In the middle of the productive cycle (42nd week) body weight was 3565.10 g (Ross 308) and 3599.05 g (Cobb 500), while at the end of productive cycle (61st week) body weight for Ross 308 hybrid was 3841.50 g, and for Cobb 500 3850.00 g. Determined differences in body weights of laying hens in specific periods of productive cycle (17.40 g, 33.95 g and 8.50 g), as well as difference in weight for entire productive period (23.26 g) were not statistically significant ($P>0.05$). More thorough research of broiler laying hen body weight influence on productive performances was done by determining phenotype correlation coefficient between researched parameters. Therefore between hen body weight and most of productive parameters statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) phenotype correlation coefficients were determined, while between body weight of laying hens and laying intensity of breeding and fertilized eggs determined correlation coefficients were not statistically significant ($P>0.05$).

Keywords: broiler breeder, laying hens, body weight, production, correlation.

INTRODUCTION

Productive abilities of broiler parents are influenced by many non-genetic factors. One of important non-genetic factors that influences productive performances is change inbody weight of laying hens during productive cycle (Savić et al., 2004; Ciacciariaello et al., 2005; Vieira et al., 2005; Almeida et al., 2006; Đermanović et al., 2005; 2008; 2010; Djermanovic, 2010; Mitrović et al., 2005; 2009; 2010; 2011; Pandurevic et al., 2013; Djermanovic et al., 2009; 2016; 2017). Proper hormonal function of endocrine system of laying hens is significantly influenced, next to age and photo stimulation, by body development of breeding animals (Lewis et al., 2005; Lewis and Gous, 2006; 2007; Usturoi et al., 2007). At optimal body weight at specific age ovaries are stimulated and maturing speed of egg cells is increased (egg production).

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Only with proper diet and adequate utilization technique of the flock pre condition for necessary laying hen vitality and incubation egg quality can be created (Barnett et al., 2004; Luquetti et al., 2004; Maiorka et al., 2004). In order for fertilized egg production to last for longer time period it is needed to keep laying hens in reproductive condition, where special attention should be given to their development during productive cycle.

For the most of heavy line hybrids egg production starts in 24th week when laying intensity is about 5% and more. From that period egg production is increased till it reaches maximum and then productivity of broiler parents in smaller or higher rate deteriorates. As parameter for more through research of parent flock body weight influence on productive parameters determined phenotype correlation coefficients between laying hen body weight and productive parameters during productive cycle can have significant contribution.

MATERIALS AND METHODS

In this research two parent flocks of heavy hybrids Ross 308 and Cobb 500 were taken. During productive cycle breeding technology suggested by selection scientists for this type of hybrids was used. Flocks were reared till 61st week of age, both flocks started laying at the beginning of 22nd week, and for incubation eggs laid from 24th week and until the end of production cycle were used, because in that period eggs had minimal weight needed for incubation (>50.00 g). Therefore egg production period lasted 38 weeks.

As starting experimental material total number of 5200 birds of both sexes Ross 308 and Cobb 500 were used, they were reared in two separate facilities. First facility was inhabited by 4750 ♀ and 450 ♂ Ross 308 hybrid birds, and in second 4960 ♀ and 470 ♂ Cobb 500 hybrid birds, so that gender ratio was 1:10.56 (Ross 308) and 1:10.55 (Cobb 500). In preparation period from 21st until 24th week mortality and exclusion for Ross 308 was 13 birds (0.279%), and for Cobb 500 12 birds (0.24%). Which further means that at the beginning of utilization of eggs for incubation there were 4737 Ross 308 parents in the flock, and 4948 for Cobb 500 flock.

In order to control body weight, 200 Ross 308 and Cobb 500 laying hens individual body weights were taken, by method of random sample. Using this readings uniformity of laying hens of researched flocks during production cycle was monitored, then, influence of laying hen body weight on broiler parent production parameters was researched (brooding egg laying intensity, fertilized egg laying intensity, egg weight, daily food consumption per bird, food consumption per brooding egg and food consumption per fertilized egg).

Basic data analysis was done by applying variation - statistical methods, testing of the differences between hybrids was done with T-test. Moreover, obtained results were used to calculate correlation of researched parameters by applying correlation analysis. Statistical data rendering was done using statistical program SAS/STAT (2000).

RESULTS AND DISCUSSION

Average values, variability and significance of laying hen body weight in specific periods of production cycle, and for entire period of egg production is shown in Table 1.

Table 1. Average values, variability and significance of laying hen body weight (g) weight in specific periods of production cycle (Djermanovic et al., 2017).

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.

Data from table 1 shows that average body weight of laying hens of both hybrids gradually increased during the production cycle. Body weight of laying hens in 24th week was 2680.40 g (Ross 308) and 2697.80 g (Cobb 500), and at the end of the cycle 3841.50 g for Ross 308 and 3850.00 g for Cobb 500. During the production cycle Cobb 500 laying hens compared to Ross 308 hens had higher average body weight which was not statistically significant (P>0.05). Average body weight for Ross 308 hybrid for entire cycle was 3411.15 g, and for Cobb 500 3434.41 g, where difference of (23.26 g) in laying hen body weight between researched hybrids was not statistically significant (P>0.05), and that shows that genotype haven't had significant influence on laying hen body weight.

Body weight of researched hybrids was slightly higher than the weight proposed by their genetic potential. However, in their researches (Djermanovic, 2010; Djermanovic et al., 2009; 2016; 2017; Mitrovic et al., 2010; 2011; Pandurevic et al., 2013) other authors also obtained similar results regarding the body weight of laying hens of above mentioned hybrids. Depending on breeding conditions and technologies used, some researchers have achieved different results, where for broiler parents of Ross 308 hybrid they detected slightly lower body weight in 60th week of age which was between 3988.95 g and 3990.44 g (Usturoi et al., 2007). Moreover, on the contrary to above mentioned in 60th week for Cobb 500 significantly higher body weight of laying hens was determined, it was between 4.21 and 4.25 kg (Lewis et al., 2005; Lewis and Gous, 2006), and in 59th week of age (Lewis and Gous, 2007), significantly higher body weight for Ross 308 was determined Ross 308 (4.43 kg) and Cobb 500 (4.56 kg).

Production abilities of parent flocks depend on large number of para genetic factors and mostly from laying hen body weights. Therefore, special attention should be given to larger number of parameters (Table 2) on which success of specific type of production depends.

Table 2. Average values, variability and difference significance of broiler parents production parameters

Parameters	Hybrid	$\bar{x}$ ±SEM	S	$\bar{d}$
Brooding eggs laying intensity %	Ross 308	59.29±2.62	16.16	1.39^{ns}
	Cobb 500	60.68±2.67	16.45	
Fertilized eggs laying intensity %	Ross 308	56.92±2.54	15.66	1.15^{ns}
	Cobb 500	58.07±2.56	15.77	
Egg weight, g	Ross 308	62.03±0.80	4.96	0.22^{ns}
	Cobb 500	62.25±0.90	5.57	
Daily feed consumption per bird g/day	Ross 308	173.59±1.89	11.68	4.05^{ns}
	Cobb 500	177.64±1.95	12.01	
Food consumption per brooding egg g/egg	Ross 308	325.25±22.45	138.38	2.03^{ns}
	Cobb 500	327.28±23.39	144.16	
Food consumption per fertilized egg g/egg	Ross 308	339.38±23.71	146.18	2.54^{ns}
	Cobb 500	341.92±24.28	149.66	

$^{ns}P>0.05$

Similar to the values of average body weights of laying hens from table 1, between researched parameters for broiler parents, no statistically significant (P>0.05) differences were determined (Table 2). Regardless to genotype other authors who researched this subject concluded that with age of the flock, increase of the body weight of broiler parents laying hens of different genotype egg weight increases. Same as for laying hen body weight, for egg weight some authors obtained similar values (Lewis and Gous, 2007; Djermanovic et al., 2016; 2017), higher (Luquetti et al., 2004; Vieira et al., 2005; Almeida et al., 2006) and lower values (Barnett et al., 2004; Maiorka et al., 2004; Ciacciariaello et al., 2005). However, in contrast to laying hen body weight and egg weight, laying intensity depending on exploitation period of the flock is variable. Therefore, results of some research point out at similar (Savić et al., 2004; Đermanović et al., 2005; 2008; 2010; Djermanovic, 2010), and totally different values (Mitrović et al., 2005; 2009) when it comes to laying intensity of brooding and fertilized eggs in approximately similar period of flock exploitation.

Next to determined variation results for body weight of laying hens and productive parameters of analyzed parent flocks, with aim to better understand influence of body weight of laying hens on productive performance, phenotype correlation coefficients between researched parameters were calculated (Table 3).

Table 3. Phenotype correlation between laying hen body weight and productive parameters of broiler parents.

Paramenter	Hybrid	Correlation coefficients
Body weight hens (g) : Brooding egg laying intensity (%)	Ross 308	0.046^{ns}
	Cobb 500	0.122^{ns}
Body weight hens (g) : Fertilized egg laying intensity (%)	Ross 308	0.045^{ns}
	Cobb 500	0.122^{ns}
Body weight hens (g) : Egg weight (g)	Ross 308	0.986^{***}
	Cobb 500	0.981^{***}
Body weight hens (g) : Daily feed consumption per bird (g/day)	Ross 308	0.376^{**}
	Cobb 500	0.669^{***}
Body weight hens (g) : Food consumption per brooding egg, g/egg	Ross 308	-0.305^{*}
	Cobb 500	-0.272^{*}
Body weight hens (g) : Food consumption per fertilized egg, g/egg	Ross 308	-0.307^{*}
	Cobb 500	-0.270^{*}

* $P<0.05$; ** $P<0.01$; *** $P<0.001$; ^{ns} $P>0.05$.

For both researched hybrids between hen body weight and brooding, fertilized egg laying intensity for entire productive cycle phenotype correlation coefficients were determined and they were not statistically significant (P>0.05). However, between body weights of laying hens and egg weight complete correlation was determined for both parent flocks (P<0.001). Moreover, between body weight of laying hens and feed consumption per birds and produced eggs statistically significant (P<0.05; P<0.01; P<0.001) phenotype correlation coefficients were determined. Determined correlation coefficients between laying hen body weight and food consumption for brooding and fertilized eggs were negative, and between hen weight and daily feed consumption per bird results were positive (Table 3).

Between hen body weight and egg weight total correlation was determined for both parental flocks, and between hen body weight and food consumption per bird and per produced eggs statistically significant (P<0.05; P<0.01; P<0.001) correlation coefficients were determined. Depending on breeding conditions and technology used some researchers determined similar (Djermanovic, 2010; Đermanović et al., 2005; 2008; 2010; 2016; 2017; Mitrovic et al., 2010), and totally opposite values (Mitrović et al., 2009) of correlation coefficients connected to link between hen body weight and productive performances for different broiler parent genotypes.

CONCLUSION

Compared to technological normative for researched hybrids, average laying hen body weight was lower, at the start and at the end of production cycle. However, differences between body weights of laying hens for both hybrids were not statistically significant (P>0.05), genotype had no significant influence on hen body weight.

Based on calculated phenotype correlation coefficient and their significance it can be concluded that body weight of laying hens had significant influence to production performances because for both parent flocks, between laying hen body weight and most of monitored parameters statistically significant (P<0.001; P<0.01; P<0.05) correlation coefficients were determined, while between body weight of laying hen and laying intensity for brooding and fertilized eggs determined correlation coefficients were not statistically significant (P>0.05). From above said it can be noted that with increase of laying hen body weight production ability of laying hens decreases which leads to shorter productive cycle.

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