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# ROOSTER BODY WEIGHT INFLUENCE ON THE REPRODUCTIVE PERFORMANCE OF THE BROILER PARENTS

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**Abstract:** In this research influence of the rooster body weight on reproductive performance of broiler parents was examined for Ross 308 and Cobb 500 hybrids. At the beginning of the productive cycle (24 weeks of age) for roosters Ross 308 hybrids average body weight of 3,030.00 g has been determined, while for Cobb 500 rooster average body weight was 3,045.00 g. In the 42$^{nd}$ week of age (middle of productive cycle), body weight of Ross 308 roosters was 4,306.00 g and 4,323.00 g for Cobb 500 roosters, while at the end of productive cycle in the 61$^{st}$ week of age Ross 308 hybrids had average 4.908,00 g and Cobb 500 had 4,918.50 g. Determined differences in body weight of roosters (15.00 g, 17.00 g and 10.50 g) in specific periods of productive cycle, as well as difference in body weight for the entire productive cycle (19.97 g) were not statistically significant ($P>0.05$). Between rooster body weight and fertilized eggs laying intensity positive statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) correlation coefficients were determined. Between rooster body weight and hatchability percentage of the chicks positive statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) correlation coefficients were determined for both hybrids. However, based on correlation coefficient it has been determined that rooster body weight had positive influence on laying intensity of fertilized eggs till 58$^{th}$ week of age (Ross 308) and 60$^{th}$ week of age (Cobb 500), while on hatchability of chicks it had positive influence till 58$^{th}$ week of age for both hybrids.

**Key words:** roosters, body weight, reproductive performance, broiler parents.

## Introduction

Keeping and utilizing the parental flock, as well as incubating the planting eggs are highly specific and complex phases in production process. One has to bear

in mind that average production of one broiler parent flock, planting eggs production and day old chick production in practice is a combined result of genetic potential of the breed and breeding technology as well as the result of the egg incubation technology.

Moreover, poultry reproduction is very specific biologic process. In order to hatch a chick out of fertilized egg, it is necessary to provide needed conditions for the embryo to develop and grow. Therefore, nutrition and proper breeding conditions have influence on the poultry reproductive process. Only with proper diet, chicks breeding technology and proper utilization of the parental flock the maximal hatchability, needed chick vitality, and quality of the hatched chicks will be achieved. In order to prolong production of the fertilized eggs (day old chicks production), it is necessary to keep the roosters in constant breeding condition, where special attention should be given to the body weight. Uniformity of the flock in the terms of body weight is especially significant factor in the last weeks of the production cycle.

Next to the optimal gender aspect and age of broiler parents, on egg fertility and hatchability, body weight has significant influence *(Celeghini et al., 2001; McDaniel et al., 2004; Djermanovic, 2010; Djermanovic et al., 2009; Mitrovic et al., 2010)*. Proper hormonal functioning of the endocrine system of the laying hens and roosters is significantly dependant on the age and body development *(Wilson et al., 1979; Renden and Pirson, 1982; Bramvell et al., 1996; McGary et al., 2002; Bowling, 2003)*. At optimal body weight and specific age, laying hens ovaries are stimulated, ripening of the egg cells is being speeded up, while for roosters better ejaculate with larger number of active, movable and vital spermatozoids is being created, it has higher volume and proper pH value *(El Sahn, 2007; Gebriel et al., 2009; Abd El Ghany et al., 2011; Udeh et al., 2011; Makhafola et al., 2012a; Makhafola et al., 2012b; Orunmuyi et al., 2013)*, therefore the percent of fertilized eggs is being increased. This shows that on egg fertility and chick hatchability male and female units have equal influence. Roosters are responsible for "real" fertilization while laying hens influence the number and the chick hatchability percent from the fertilized eggs *(Djermanovic, 2010; Djermanovic et al., 2009; Mitrovic et al., 2010)*.

Body weight of the breeding birds, next to the other factors, especially age, has direct influence on laying intensity and hatchability percent from the number of fertilized eggs. Rooster breeding value is directly conditioned with the average body weight in specific age (week of the production process). Therefore, special attention is given to the influence of the body weight of roosters on the basic reproductive indicators during the production cycle. Main aim of this research was to determine what type of influence body weight of roosters has on the laying intensity of the fertilized eggs and at the hatchability percent.

## Material and Methods

In the present research, two parental flocks of heavy hybrids Ross 308 and Cobb 500 were taken. During the production technology recommended by selection office was used. Broiler parents of both flocks were kept on the floor with deep bedding, diet; watering, airing and illumination were automatically controlled. Effective floor surface per facility was approximately 900 $m^2$, where density of population was approximately 6 birds/$m^2$ of floor surface.

Researched broiler parents flocks were bred till 61$^{st}$ week of age, both flocks started laying eggs at the beginning of the 22$^{nd}$ week. Eggs that were laid from the 24$^{th}$ week and till the end of the production cycle, were used for incubation, because at that week they were at proper minimal weight for incubation (>50.00 g). This shows that period of egg production (production of day old broiler chicks) lasted 38 weeks (from 24$^{th}$ till 61$^{st}$ week of age of broiler parents).

As starting experimental material total number of 5200 birds of both genders of Ross 308 hybrid and 5430 broiler parents of Cobb 500, bred in two separate facilities, were used. First facility was populated with 4750 ♀ and 450 ♂ Ross 308 hybrids, and second facility was populated with 4960 ♀ and 470 ♂ Cobb 500 hybrids, so that gender ration was 1:10.56 (Ross 308) and 1:10.55 (Cobb 500).

In preparation period from 21$^{st}$ till 24$^{th}$ week of age mortality and elimination for Ross 308 roosters was 4 units (0.89%), and with Cobb 500 3 units (0.64%). This means that at the beginning of the use of incubation eggs, Ross 308 broiler parents had 446 roosters, and Cobb 500 had 467 roosters.

In order to control the body weight, every week body weight of 80 roosters was individually taken using random sample method (40 roosters of Ross 308 and Cobb 500 hybrids each). By this inspection uniformity of roosters of researched flocks during production cycle and the influence of rooster body weight on reproductive indicators of broiler parents was tested.

Basic data processing was conducted using usual variation – statistical methods, and testing of the differences between hybrids was done using the T- test. For all monitored indicators average value, random sampling error and standard deviation were calculated. Determined results were used to calculate the correlation of researched indicators per week of production by using the correlation analysis. Statistical data processing was done using Analyst Program SAS/STAT *(SAS Institute, 2000)*.

## Results and Discussion

Average values, variability and significance in weight difference of the roosters (g) in specific periods of the production cycle and for the entire period of incubation egg production are displayed in table 1.

**Table 1. Average values, variability and significance in weight difference of the roosters (g)**

| Production cycle period | Weeks of age (production) | Hybrid | $\bar{x}$ ±SEM | S | $\bar{d}$ |
|---|---|---|---|---|---|
| Beginning | 24 (1) | Ross 308 | 3.030,00±26.23 | 165.92 | 15.00 ns |
| | | Cobb 500 | 3.045,00±27.84 | 176.11 | |
| Middle | 42 (19) | Ross 308 | 4.306,00±38.33 | 253.90 | 17.00 ns |
| | | Cobb 500 | 4.323,00±40.26 | 254.58 | |
| End | 61 (38) | Ross 308 | 4.908,00±60.42 | 382.17 | 10.50 ns |
| | | Cobb 500 | 4.918,50±61.90 | 391.52 | |
| Entire production cycle | 61 (38) | Ross 308 | 4.058,75±52.33 | 322.61 | 19.97 ns |
| | | Cobb 500 | 4.078,72±56.19 | 346.43 | |

Data from table 1 shows that average body weight for roosters of both researched hybrids, compared to technologic normative *(www.rossbreeders.com; www.cobb-vantress.com)*, at the beginning of the production cycle was significantly lower, and at the end of the production cycle insignificantly lower (within the limits of the technologic normative). However, even beside mentioned deviation considering the rooster body weight, differences between researched hybrids were not statistically significant (P>0.05), for the specific production periods as well as for the entire usage period.

*Djermanovic (2010)*, *Djermanovic et al. (2009)* and *Mitrovic et al. (2010)* determined similar results during the productive cycle with slightly higher body weights of the roosters. Moreover, significantly higher body weight of Ross hybrid broiler parents bred till 71$^{st}$ week of age, in specific phases of productive cycle was determined by *Celeghini et al. (2001)*: between 24$^{th}$ and 27$^{th}$ week of age (3.152 kg), 40$^{th}$ and 43$^{rd}$ week (4.990 kg), and between 60$^{th}$ and 63$^{rd}$ week of age (5.333 kg). Slightly lower average body weight for Ross hybrid roosters (4.27 kg) during the middle of the production cycle (18 weeks of production) was determined by *McDaniel et al. (2004)*.

For analyzed parent flocks, next to the determined variations for rooster body weight, with aim to have better overview of body weight influence on reproductive performance, phenotype correlation coefficients between monitored indicators were calculated (table 2).

Up to 50$^{th}$ week of age for Ross 308 hybrid and 53$^{rd}$ week of age for Cobb 500 parental flocks, statistically positive (P<0.001; P<0.01; P<0.05) correlation coefficient was determined between body weight and laying intensity of fertilized eggs (table 2). From the data in table 2 it is noticeable that from 51$^{st}$ week of age (Ross 308) and 54$^{th}$ week of age (Cobb 500), weak, very weak or no correlation was determined between rooster body weight and laying intensity of fertilized eggs and determined correlation was not statistically significant (P>0.05).

**Table 2. Phenotype correlation between rooster body weight, laying intensity (%) of the fertilized eggs ($r_1$) and hatchability (%) of the chicks from fertilized eggs ($r_2$)**

| Weeks of age (production) | Ross 308 | | | Cobb 500 | | |
|---|---|---|---|---|---|---|
| | Body weight, g | $r_1$ | $r_2$ | Body weight, g | $r_1$ | $r_2$ |
| 41 (18) | 4220,00 | $0,673^{***}$ | $0,880^{***}$ | 4223,00 | $0,737^{***}$ | $0,882^{***}$ |
| 42 (19) | 4306,00 | $0,642^{**}$ | $0,859^{***}$ | 4323,00 | $0,704^{***}$ | $0,873^{***}$ |
| 43 (20) | 4335,00 | $0,614^{**}$ | $0,826^{***}$ | 4381,50 | $0,670^{***}$ | $0,863^{***}$ |
| 44 (21) | 4495,00 | $0,575^{**}$ | $0,777^{***}$ | 4498,00 | $0,631^{**}$ | $0,840^{***}$ |
| 45 (22) | 4495,00 | $0,539^{**}$ | $0,735^{***}$ | 4493,50 | $0,599^{**}$ | $0,809^{***}$ |
| 46 (23) | 4500,00 | $0,508^{**}$ | $0,689^{***}$ | 4523,00 | $0,570^{**}$ | $0,768^{***}$ |
| 47 (24) | 4507,50 | $0,475^{*}$ | $0,645^{***}$ | 4552,00 | $0,541^{**}$ | $0,717^{***}$ |
| 48 (25) | 4546,00 | $0,443^{*}$ | $0,593^{***}$ | 4574,50 | $0,514^{**}$ | $0,643^{***}$ |
| 49 (26) | 4594,00 | $0,407^{*}$ | $0,544^{**}$ | 4602,00 | $0,486^{**}$ | $0,560^{**}$ |
| 50 (27) | 4599,00 | $0,381^{*}$ | $0,476^{**}$ | 4625,35 | $0,458^{*}$ | $0,480^{**}$ |
| 51 (28) | 4610,50 | $0,336^{ns}$ | $0,420^{*}$ | 4634,00 | $0,429^{*}$ | $0,406^{*}$ |
| 52 (29) | 4645,00 | $0,298^{ns}$ | $0,358^{ns}$ | 4667,00 | $0,399^{*}$ | $0,345^{ns}$ |
| 53 (30) | 4668,00 | $0,262^{ns}$ | $0,303^{ns}$ | 4680,00 | $0,369^{*}$ | $0,289^{ns}$ |
| 54 (31) | 4682,00 | $0,228^{ns}$ | $0,253^{ns}$ | 4692,50 | $0,338^{ns}$ | $0,241^{ns}$ |
| 55 (32) | 4735,00 | $0,186^{ns}$ | $0,193^{ns}$ | 4742,50 | $0,300^{ns}$ | $0,192^{ns}$ |
| 56 (33) | 4750,00 | $0,133^{ns}$ | $0,140^{ns}$ | 4755,00 | $0,260^{ns}$ | $0,149^{ns}$ |
| 57 (34) | 4800,50 | $0,083^{ns}$ | $0,084^{ns}$ | 4807,50 | $0,213^{ns}$ | $0,097^{ns}$ |
| 58 (35) | 4842,50 | $0,027^{ns}$ | $0,017^{ns}$ | 4846,50 | $0,159^{ns}$ | $0,041^{ns}$ |
| 59 (36) | 4884,00 | $-0,028^{ns}$ | $-0,069^{ns}$ | 4890,00 | $0,093^{ns}$ | $-0,037^{ns}$ |
| 60 (37) | 4902,50 | $-0,085^{ns}$ | $-0,163^{ns}$ | 4911,00 | $0,025^{ns}$ | $-0,134^{ns}$ |
| 61 (38) | 4908,00 | $-0,140^{ns}$ | $-0,251^{ns}$ | 4918,50 | $-0,050^{ns}$ | $-0,226^{ns}$ |

However, in the last three weeks (59th, 60th and 61st) with Ross 308, and 61st week of age for Cobb 500 negative correlation was determined, but it wasn't statistically significant (P>0.05). Unlike for laying intensity of fertilized eggs, between rooster body weight and chick hatchability positive statistically significant (P<0.001; P<0.01; P<0.05) correlation was determined up to 51st week of age for both hybrids (table 2). For both parent flocks from 52nd till 58th week of age (29th till 35th week of production) positive phenotype correlation, between monitored indicators, was determined but it wasn't statistically significant (P>0.05). Moreover, in the last three weeks of production cycle, for both broiler parents flocks, rooster body weight had negative influence on hatchability of the chicks, but determined phenotype correlation between monitored indicators was not statistically significant (P>0.05). Based on results, it can be noted that rooster body weight had positive influence on laying intensity of fertilized eggs up to 58th week of age for Ross 308 hybrid and up to 60th week of age for Cobb 500 hybrid, and it had positive influence on hatchability of day old broiler chicks up to 58th week of age for both researched parent flocks.

*Djermanovic (2010)* had similar results regarding the rooster body weight influence on reproductive traits in his research of the reproductive performances of

two broiler parent flocks (Ross 308 and Cobb 500), whereas *McGary et.al. (2002)* had similar results with two different strains of different age (strain A – 50 weeks and strain B – 48 weeks). Similar research was conducted by *Wilson et al. (1979)* and *Bowling (2003)* where authors are pointing out that rooster fertility, due to larger number of abnormal spermatozoids, decreases with the increase of age, therefore the body weight of males decrease too. Authors determined negative correlation between growth rate and fertility of the roosters. *Bowling (2003)* found negative correlation (r = -0.23) between body weight of young (35 – 45 weeks) and older (50 – 65 weeks) roosters and fertility, whereas *Wilson et al. (1979)* determined weak correlation (r = -0.39 do r = 0.09). However, *El Sahn (2007), Gebriel et al. (2009), Abd El Ghany et al. (2011), Udeh et al. (2011)* and *Orunmuyi et al. (2013)* determined positive correlation between body weight of different genotype roosters and volume, concentration of ejaculate, while *Makhafola et al. (2012a)* and *Makhafola et al. (2012b)* points out that body weight of Naked Neck roosters and Ovampo genotypes is in negative correlation with volume, concentration and pH value of the sperm, and for the autochthonous South African strain Potchfstroom Koekoek the correlation was positive. In the contrary of the above stated, *Renden and Pirson (1982)* and *Bramvell et al. (1996)* determined that there is no difference in fertility of the young (39 weeks) and old (65 weeks) roosters, therefore pointing out that spermatozoids retain their physiological ability to fertilize in at least two productive cycles.

# Conclusion

Based on obtained results it can be concluded that average body weight for both researched hybrids, compared to technologic normative, was lower at the beginning as well as in the end of the productive cycle. However, even with variations in specific periods, differences between rooster body weight of the researched hybrids were not statistically significant ($P>0.05$).

In weekly observation, between average body weight of the roosters and laying intensity of fertilized eggs positive statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) correlation was determined up to the $50^{th}$ week of age ($27^{th}$ production week) for Ross 308 hybrid, and for the Cobb 500 hybrid up to the $53^{rd}$ week of age ($27^{th}$ production week). Between rooster body weight and hatchability percent positive statistically significant ($P<0.001$; $P<0.01$; $P<0.05$) correlation was determined up to the $51^{st}$ week of age ($28^{th}$ production week) for both researched hybrids.

Based on obtained phenotype correlation coefficients and their significance it can be said that rooster body weight has had a significant influence on breeding ability, because in the last three weeks of the production cycle, for both flocks, between researched indicators especially egg fertilization, negative correlation coefficients were determined. This leads to the fact that with increase of body

weight breeding ability of the roosters declines, which points out the requirement to significantly lessen the production cycle time.

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## Uticaj telesne težine petlova na reproduktivne performanse brojlerskih roditelja

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## Rezime

Ispitivanje uticaja telesne težine petlova na reproduktivne performanse brojlerskih roditelja sprovedeno je kod hibrida Ross 308 i Cobb 500. Na početku proizvodnog ciklusa (24. nedelja starosti) kod hibrida Ross 308 utvrđena je prosečna telesna težina petlova 3.030,00 g, a Cobb 500 3.045,00 g. U 42. nedelji starosti (sredina proizvodnog ciklusa) telesna težina petlova iznosila je 4.306,00 g (Ross 308) i 4.323,00 g (Cobb 500), dok je na kraju proizvodnog ciklusa (61. nedelja starosti) telesna težina petlova kod hibrida Ross 308 iznosila 4.908,00 g, a hibrida Cobb 500 4.918,50 g. Utvrđene razlike telesne težine petlova (15.00 g, 17.00 g i 10.50 g) u određenim periodima proizvodnog ciklusa, kao i razlika u telesnoj težini petlova za ceo proizvodni ciklus (19.97 g), nisu bile statistički signifikantne ($P>0.05$). Između telesne težine petlova i intenziteta nosivosti oplođenih jaja utvrđeni su pozitivni statistički značajni ($P<0.001$; $P<0.01$; $P<0.05$) koeficijenti korelacije do 50. nedelje starosti kod hibrida Ross 308, odnosno 53. nedelje kod roditeljskog jata hibrida Cobb 500, a između telesne težine petlova i procenta izvodljivosti pilića utvrđeni su pozitivni statistički značajni ($P<0.001$; $P<0.01$; $P<0.05$) koeficijenti korelacije do 51. nedelje starosti kod oba ispitivana hibrida. Međutim, na osnovu koeficijenata korelacije utvrđeno je da je telesna težina petlova pozitivno uticala na intenzitet nosivosti oplođenih jaja do 58. nedelje starosti (Ross 308), tj. 60. nedelje starosti (Cobb 500), a na izvodljivost jednodnevnih brojlerskih pilića do 58. nedelje starosti kod oba ispitivana roditeljska jata.

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