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Full Length Research Paper

The influence of age on the exploitation period in broiler reproduction of parents in Ross hybrid 308

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These investigations were intended to identify the influence of parental flock age at heavy hybrid Ross 308 (usage period) on more important reproductive capabilities (carrying eggs intensity of brood eggs, egg mass, one day old chick mass, relative chick mass share in complete egg mass) and consumption of food per processed – hatched chicken (final product of production cycle). Flock usage period lasted for 40 weeks (all eggs), respectively, 38 (brood eggs) weeks and there was possibility, based on achieved results, with evaluation of phenotype correlation, to get some concrete conclusions about the age influence on analyzed parameters during mentioned flock rising period. Phenotype correlation among investigated characteristics has been identified since second half of parental flock using period, since 41st week age (20th carrying eggs week) up to the end of production process when parental flock was 61 week old (41st egg production week). Flock age has statistically important positive ($P < 0.05$) influence on carrying eggs intensity of brood eggs until 49st week ($r_p = 0.391$) and on percentage of chicken feasibility regard the complete number of inputted eggs until 50th week ($r_p = 0.434$). There was statistically significantly increasing of egg mass and one-day old incubated chicken mass ($P < 0.001$) as parental flock was older. Complete correlation connectivity has been identified between egg mass and absolute chick mass ($P < 0.001$), while very strong ($P < 0.001$) or strong ($P < 0.01$) correlative connectivity between egg mass and relative chick share [(chicken mass/egg mass) x 100]. Further more, we determined negative correlation between eggs age and food consumption per hatched chicken for all time of breeding broiler parents, except 61st week when we determined positive coefficient of phenotype correlation ($r_p = 0.062$), but statistically inconsequent.

Key words: Broiler breeder age, hatching eggs, chick weight, phenotypic correlation.

INTRODUCTION

Beside genotype, technology of rising, nutrition and health care (bio security), significant place belongs to parental flock age (period-rising stadium) in production of brood eggs and their incubation characteristics. That age of broiler parents (beside genotype and majority of para-genetic factors) impacts on intensity of carrying brood and fertilized eggs and therewith on new laid chicks were ascertained by numerous authors as: Cooper and Rowell (1958), McDaniel et al. (1981), Eslick and McDaniel (1992), Elibol et al. (2002), Elibol and Brake (2003, 2004), Savic et al. (2004), Mitrovic et al. (2005) and Abiola et al. (2008). Most authors emphasize that younger flocks (age between 29 and 41 weeks), comparing with older flocks (ages between 52 and 68 weeks) achieve, statistically considerably larger intensity of laying brood and fertilized eggs and thereby larger percentage of new laid chicks from total number of incubated eggs.

It is well known that egg mass grows as parental hen flock is older and incubated chick mass gets to its

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maximum at the end of productive cycle (Weatherup and Foster, 1980; Asusquo and Okon, 1993; Adams and Bell, 1998; Smith, 2000; Barnett et al., 2004; Maiorka et al., 2004; Hamidu et al., 2007; Sahin et al., 2009). Furthermore, hen age also has influence on yolk share, egg white and egg shell in total egg mass (Fletcher et al., 1981; Akbar et al., 1983; Curtis et al., 1985; Butcher at al., 1991; Danilov, 2000; Luquetti et al., 2004), also on egg mass, chick's mass and relative share of chick mass in total egg mass (Luquetti et al., 2004).

All these researches pointed out that there is a certain phenotypic, correlative connectivity between parental flock age of different species and types of poultry, caring eggs intensity, brood egg mass and one day old chicks mass. That was how Perényi and Sütó (1980) and Mitrovic et al. (1998) identified high (r_p = 0.82) and strong (r_p = 0.73) correlate connectivity between turkey eggs mass before incubation and mass of one day old dried turkey chick. Perényi et al. (1985). Besides that, identified strong correlate connectivity among number of incubated eggs and number of incubated turkey chick per average layer (r_p = 0.83), while Djermanovic et al. (2008) at broiler parents of Ross 308 hybrid identified strong, middle and week phenotypic correlate connectivity between age of flock and carrying eggs intensity of brood eggs that are 50 weeks old.

The aim of this work, as regard the mentioned, was to analyze reproductive capabilities of parental flock Ross 308 hybrid which was raised on the farm in Serbia. Usage period of parental flock lasted relatively long time (40 weeks). There was possibility of calculating phenotypic correlation and based on achieved results to conclude something concrete about influence of age on productive indicators (carrying eggs intensity of brood eggs, food consumption per hatched chick, incubation results, egg mass, one day old chicks mass and relative share of chick in egg mass). Something about rising of mentioned parental flock and analyzing the period until it is economically improved. Established results can help as bases for further research, aiming for improvement of productivity of broiler parents with different genotypes.

MATERIALS AND METHODS

The research was carried out in 2008, on farm in central Serbia, where the main activities were exploitation of Ross 308 strain's broiler breeders as well as incubation of their eggs.

The period of broiler breeders exploitation lasted 38 weeks (between the age of 24 and 61 week). During the mentioned period applied technology was adjusted due to official recommendations (www.rossbreeders.com). Nutrition, water supplying, ventilation and photoperiod were automatically adjusted due to proper program. There was 5200 birds in the flock where the sex ratio was 1♂ : 10,55♀ (at the age of 24 weeks).

During the period between age of 21 and 61 weeks, the most important parameters of production and reproduction of broiler breeders were monitored (body weight, mortality and culling, feed consumption, etc.). The most important issues in this paper were rate of lay, weight of breeding eggs, the results of incubation, posthatch body weight and the correlations between mentioned parameters. Briefly, the goal of this research was to find out how do the monitored parameters effect each to other, particularly the correlations between the flock age and weight of brood eggs.

During the entire period exploitation, number of laid eggs was monitored on daily base and those data was rearranged due to weeks, which is presented in tables as absolute and relative values (the beginning, peak and the end of period of exploitation). Measurement of breading eggs weight was carried out every week. 600 of randomize sampled eggs were measured over a 14 days interval and presented in tables.

The number of hatching eggs, number and rate of fertile eggs and of newly hatched broiler chick, posthatch body weight and hatch weight relative to egg weight were monitored in the hatchery. Those parameters were monitored weekly or in the other words for every cycle of incubation. Hatching eggs were 2-5 days old. After the hatching (once in a week), body weight of 500 one day old broiler chicks was measured. Those chicks were sampled by the randomized mode.

The basic processing of obtained data was carried out according to common statistical procedures (descriptive statistics). The coefficient of phenotype correlations between analyzed traits were calculated by the usage of appropriate software (SAS, 2000).

RESULTS AND DISCUSSION

It is well known that percentage of egg production, fecundity and hatchability, regardless of the hen type, after the beginning, rises and reached peak at certain age, after which they decrease. It is therefore advisable to the farmer to pay attention to the right selection of the genotype (hybrid) and the use of adequate (appropriate) breeding and incubation technology of the fertile eggs in order to produce as much chicks as possible, since they are the final product of the parent production.

There is no domestic (local) chick hybrid in Serbia, so brood eggs or one-day-old parent chick was imported. Consequently, a significant number of authors in their researches (published works) concluded that genetic potential of imported broiler breeders increased in Serbia (whereas enough data have not been used) and that usage period and basic productive-reproductive results were under expected technological normative, predicted by inventor of that hybrid. In the global level, in the last ten years, productive potential of broiler parents has been improved, but still on unsatisfactory level compared to genetic potential predicted in technologies normative for risen hybrid.

Rising (usage) broiler parents started on the 21st week, while egg production started on the 22nd week (carrying eggs intensity over 5%). When broiler breeder age was 23 weeks old, carrying egg intensity was over 10%; but eggs were small (under 50 g) and were not used for hatching. That means the production of egg started on 24th week (brood eggs) and lasted until the 61st week of parental flock age, so production period of brood eggs producing and one-day-old broiler chicken, lasted for 38

Table 1. Summary revival of production brood eggs and broiler chicken of analyzed parental flock.

Traits	Weeks of age/ production	Hatching eggs		Broiler chickens	
		Eggs	% Carrying	Chicks	% Laying
Beginning of hatching egg production	24 (1)	0.87	12.38	0.57	65.71
Maximum production of hatching eggs	32 (9)	5.50	78.57	4.51	81.92
Maximum laying of broiler chickens	38 (15)	5.18	74.05	4.68	90.25
The end of the production cycle	61 (38)	2.19	31.25	1.16	63.22
Total	61 (38)	157.70	59.29	128.07	81.21

weeks (Table 1).

Analyzed parental flock accomplished the smallest intensity of carrying eggs intensity at the beginning of productive cycles and few weeks before the end of usage period, carrying eggs intensity under 50%. The best intensity was achieved between the 29th and 41st week (over 70%), while maximal intensity of carrying eggs intensity was achieved on 32nd week and it was 78.57%, in that week; production was 5.50 eggs per settle layer (Table 1). From the 24th to 61st week (38 weeks of production cycles), 157.70 brood egg per settle layer was produced, which is almost 2 eggs more than technological normative. However, the percentage of incubating as regards the number of incubated eggs was firmly lower, because production per settle layer was around 128, which was about 10 chicks less than technological norm. Weekly observed, it can be noticed that analyzed parental flock, when it was younger, between the 30th to 40th week, achieved the biggest percentage of incubating as regards the number of incubated eggs (between 80 and more than 90%; maximum 34th week – 90.25%). Savic et al. (2004) and Mitrovic et al. (2005) came to the similar conclusion. Cooper and Rowell (1958), McDaniel et al. (1981), Eslick and McDaniel (1992), Elibol et al. (2002) and Elibol and Brake (2003, 2004), concluded that breeder age effect on percentage of chick incubating, noticing also that younger flock (age 31, 37 and 41 weeks) give significantly higher incubating percentage as regards the number of brood eggs (89.3, 91.08 and 90.32%) compared to older flock (age 52 weeks - 84.3%; 59 weeks - 86.77% and 63 weeks - 86.31%). Achieved results about incubating chick percentage in our researches were somewhat inferior compared to cited authors, which is understandable in a way considering that the percent of hatchability is covering the number of incubated, not fertilized eggs. In the work, we did not show incubating percentage from the number of brood eggs because incubated eggs were measured individually and not brood eggs.

Table 2 presents average values of mass, absolute and relative measures of variation on fertile and laid dried chicks. The flock became older, while brood eggs mass, incubation and the number of dried chickens increased. On the 24th week, average mass of brood eggs was 51.29 g, of chicks 31.76 g and on the 61st week (38 weeks of flock using), 67.22 or 44.48 g. Weekly observed absolute (S) and relative (CV) measures of variation were almost the same for average brood eggs mass and incubated chickens (exception of arithmetic point are relatively small), while the mistake of average value was on satisfactory level and was 600 (brood eggs); in other words, 500 (incubated chickens), considering especially that the number of repeating (size of sample) was big. Our findings on how the flock becomes older, the egg mass increases, as well as increase in the mass of incubated chickens, are also in agreement with the reports of other researchers (Luquetti et al. 2004; Maiorka et al. 2004; Barnett et al. 2004; Sahin et al. 2009).

Luquetti et al. (2004), at the heavy hybrid Cobb 500 parental flock which was 30 weeks old, identified that the average egg mass was 58.3 g and in the 60th week 68.2 g, while the average chicken mass, two hours after incubating, was 42.2 g (30th week) and 48.6 g (60th week). Studying hybrid Cobb 500 and Ross 308, Maiorka et al. (2004) found that average egg mass was 53.90 g (30th week) and in 60th week 65.92 g, while mass chicks were 41.80 g (30th week) and 45.63 g (60th week). According to the newest research carried out by Sahin et al. (2009), by incubating from the light eggs (57.95 g), middle weight eggs (62.76 g) and heavy eggs (67.15 g), they got chicks whose approximate masses were 38.00, 41.20 and 43.79 g. The biggest relative share of chicks in egg mass was at the middleweight eggs (65.65%) and that means the smallest lost of egg mass than at the light eggs - 65.57% and the smallest at the group of heavy eggs - 65.21%. Bigger relative share of chick in egg mass were gotten by Barnett et al. (2004). At the flock aged from 48 to 56 weeks, authors identified eggs mass of 64.40 g, chickens mass of 44.7 g and relative share of chicken in egg mass of 69.90%. In our researches, during whole usage period of Ross 308 hybrid broiler parents, average egg mass was 62.03 g and incubated chickens 39.85 g, while relative chick share in egg mass was 64.12%. Based on exposed, it is hard to bring conclusion about relative chick share in egg mass because the technique, especially, the measuring time of incubated chick, was different in mentioned researches, but surely

Table 2. Average values ($\bar{x}$) and variability mass of eggs and one day old chickens mass (g).

Weeks of age/ Production	Mass of eggs, g (n=600)				Chick's mass, g (n=500)			
	$\bar{x}$	$S\bar{x}$ [1]	S[2]	C.V.[3]	$\bar{x}$	$S\bar{x}$ [1]	S[2]	C.V.[3]
24 (1)	51.29	0.16	3.83	7.47	31.76	0.11	2.38	7.49
26 (3)	52.01	0.16	3.90	7.50	32.27	0.11	2.40	7.44
28 (5)	55.40	0.17	4.15	7.49	34.35	0.11	2.55	7.42
30 (7)	55.52	0.17	4.17	7.51	34.20	0.11	2.54	7.43
32 (9)	57.84	0.17	4.25	7.35	35.87	0.12	2.65	7.39
34 (11)	59.05	0.17	4.30	7.28	36.37	0.12	2.68	7.37
36 (13)	60.81	0.17	4.30	7.07	37.82	0.12	2.77	7.32
38 (15)	62.55	0.18	4.35	6.95	39.10	0.13	2.85	7.29
40 (17)	62.85	0.18	4.41	7.02	39.34	0.13	2.87	7.29
42 (19)	63.00	0.18	4.45	7.06	39.37	0.13	2.83	7.19
44 (21)	63.97	0.18	4.51	7.05	40.89	0.13	2.86	6.99
46 (23)	64.86	0.19	4.60	7.09	42.19	0.13	2.96	7.02
48 (25)	65.10	0.19	4.64	7.13	43.86	0.14	3.08	7.02
50 (27)	65.45	0.19	4.67	7.13	44.11	0.14	3.15	7.14
52 (29)	66.18	0.19	4.74	7.16	44.61	0.14	3.21	7.20
54 (31)	66.48	0.19	4.79	7.20	44.21	0.15	3.26	7.37
56 (33)	67.02	0.20	4.86	7.20	44.35	0.15	3.28	7.40
58 (35)	67.22	0.20	4.91	7.30	44.43	0.15	3.30	7.43
60 (37)	67.11	0.20	4.94	7.36	44.36	0.15	3.33	7.51
61 (38)	67.22	0.20	4.99	7.42	44.48	0.15	3.36	7.55

[1]Standard error of mean; [2]Standard deviation; [3]Coefficients of variation, %.

can be said that the heaviest chicks incubated from the heaviest eggs and contrary.

The age of broiler parents has influence on production and reproductive performances which is shown in correlation coefficients presented in Table 3.

From second half of egg production, exactly from the 41st week, age statistically has positive effect on carrying eggs intensity upon the 49th week of production. In the 41st week, very strong correlate connectivity has been identified and coefficient of correlation was $r_p = 0.705$ ($P < 0.001$) and on the 49th week slim correlate connectivity and coefficient of correlation $r_p = 0.391$ ($P < 0.05$). Between age and incubating percentage on the 41st week of production, complete correlate connectivity was identified and coefficient of correlate connectivity was $r_p = 0.922$ ($P < 0.001$). From mentioned flock age, the percentage of egg incubating gradually decreased and on the 50th week, between mentioned characteristics middle correlate connectivity was identified ($r_p = 0.434$, $P < 0.05$). From the 50th or 51st week age has no statistical significant influence ($P > 0.05$) on carrying eggs intensity and incubating percentage from incubated eggs, except on the 61st week (end of productive cycles) when negative correlation coefficient between age and carrying eggs intensity of chicks from the number of input, was identified ($r_p = -0.407$) and was statistically significant ($P < 0.05$). From the data in Table 3, it can be seen that complete correlate connectivity was identified ($P < 0.001$) between broiler parents age, egg mass and chick mass. Food consumption per hatched chicken in all productive cycle was on satisfactory level because all time of breeding of parent flock coefficients of phenotype correlation were negative (except the 61st week), statistically approved to the length of the 52nd week ($P < 0.05$) and from the 53rd till the 61st week, ascertained coefficients of correlation between flock age and food consumption per hatched chicken were not statistically relevant. ($P > 0.05$). Between egg mass and chicken mass, complete correlate connectivity was also identified ($P < 0.001$) and between egg mass and relative chick share, strong and very strong correlate connectivity were identified and calculated coefficients of correlation were statistically significant ($P < 0.001$, $P < 0.01$).

Mitrovic et al. (2005) identified at Arbor Acres hybrid parental flock, similar coefficient of phenotype correlation between age and carrying eggs intensity and percentage of chicks incubating from the number of incubated eggs and statistically significant coefficient of phenotype correlation was identified on the 58th week ($r_p = -0.362$, $P < 0.05$), three weeks earlier than in these researches.

Table 3. Phenotype correlate connectivity among flock age: carrying eggs intensity of brood eggs (%), percentage of egg incubating, brood eggs mass (g) and chick mass (g), food consumption per hatched chick; brood eggs mass (g): chicks mass (g) and relative chick share in egg mass (%).

Breeder age (wk)	Coefficients of phenotypic correlation $r_{(p)}$						
	r^1	r^2	r^3	r^4	r^5	r^6	r^7
41.	0.705^{***}	0.922^{***}	0.982^{***}	0.985^{***}	-0.606^{**}	0.998^{***}	0.648^{**}
42.	0.672^{***}	0.904^{***}	0.978^{***}	0.953^{***}	-0.589^{**}	0.998^{***}	0.676^{***}
43.	0.634^{**}	0.876^{***}	0.974^{***}	0.955^{***}	-0.572^{**}	0.998^{***}	0.700^{***}
44.	0.596^{**}	0.840^{***}	0.973^{***}	0.960^{***}	-0.555^{**}	0.996^{***}	0.671^{***}
45.	0.558^{**}	0.784^{***}	0.971^{***}	0.965^{***}	-0.535^{**}	0.993^{***}	0.664^{***}
46.	0.520^{**}	0.721^{***}	0.976^{***}	0.974^{***}	-0.515^{**}	0.991^{***}	0.670^{***}
47.	0.478^{*}	0.654^{***}	0.970^{***}	0.972^{***}	-0.489^{*}	0.980^{***}	0.624^{***}
48.	0.436^{*}	0.587^{**}	0.967^{***}	0.975^{***}	-0.465^{*}	0.974^{***}	0.635^{***}
49.	0.391^{*}	0.518^{**}	0.962^{***}	0.975^{***}	-0.441^{*}	0.971^{***}	0.654^{***}
50.	0.342^{ns}	0.434^{*}	0.963^{***}	0.980^{***}	-0.416^{*}	0.969^{***}	0.674^{***}
51.	0.296^{ns}	0.358^{ns}	0.963^{***}	0.982^{***}	-0.391^{*}	0.968^{***}	0.695^{***}
52.	0.247^{ns}	0.280^{ns}	0.961^{***}	0.983^{***}	-0.363^{*}	0.969^{***}	0.714^{***}
53.	0.203^{ns}	0.208^{ns}	0.959^{***}	0.980^{***}	-0.337^{ns}	0.970^{***}	0.730^{***}
54.	0.157^{ns}	0.143^{ns}	0.957^{***}	0.980^{***}	-0.311^{ns}	0.971^{***}	0.743^{***}
55.	0.103^{ns}	0.080^{ns}	0.957^{***}	0.979^{***}	-0.281^{ns}	0.973^{***}	0.756^{***}
56.	0.036^{ns}	0.014^{ns}	0.956^{***}	0.977^{***}	-0.250^{ns}	0.974^{***}	0.764^{***}
57.	-0.023^{ns}	-0.052^{ns}	0.955^{***}	0.974^{***}	-0.211^{ns}	0.975^{***}	0.771^{***}
58.	-0.087^{ns}	-0.127^{ns}	0.954^{***}	0.972^{***}	-0.169^{ns}	0.976^{***}	0.778^{***}
59.	-0.148^{ns}	-0.219^{ns}	0.951^{***}	0.905^{***}	-0.121^{ns}	0.977^{***}	0.783^{***}
60.	-0.212^{ns}	-0.316^{ns}	0.948^{***}	0.964^{***}	-0.046^{ns}	0.978^{***}	0.789^{***}
61.	-0.275^{ns}	-0.407^{*}	0.945^{***}	0.961^{***}	0.062^{ns}	0.979^{***}	0.794^{***}

[1]Age x carrying eggs intensity of brood eggs (%); [2]Age x percentage of egg incubating; [3]Age x egg mass (%), [4]Age x chick mass (g) [5]Age x food consumption per chick; [6]Egg mass (g) x chick mass (g); [7]Egg mass (g) x relative chick share (%); ***Statistically significant difference (P < 0.001); **Statistically significant difference (P < 0.01); *Statistically significant difference (P < 0.05); nsnon-significant (P > 0.05).

Between mentioned characteristics at Ross 308 heavy line hybrid, Djermanovic et al. (2008) identified statistically significant ($P < 0.05$) coefficient of correlation upon the 49th week whose value was $r_p = 0.391$ (age x carrying eggs intensity) and $r_p = 0.439$ (age x percentage of chick incubating). Beside that, authors determined that there were, till the 56th week of age, negative statistical significant correlation ($P < 0.05$) between flock age and food consumption per chick ($r_p = -0.343$) and from the 57th till the 61st week, as well, negative coefficients of correlation that were not statistically significant ($P > 0.05$). Similar correlation connectivity between mass of turkey eggs before incubation and mass of one day old dried turkey ($r_p = 0.82$; $r_p = 0.73$) was identified by Perényi and Sütó (1980) and Mitrovic et al. (1998) and significantly stronger correlation connectivity between the number of incubated eggs and number of incubated turkey per average layer ($r_p = 0.83$) was identified by Perényi et al. (1985).

Conclusion

The analyzed parental flock of Ross 308 hybrid gave solid results in most of the parameters. It showed somewhat shorter exploitation period (38 weeks, 61 weeks of age) than expected, although their genetical potential was not fully utilized. The calculated phenotypic correlation coefficients and the level of the statistical significance were between the age and production intensity and percentage of chick hatchability. However, food consumption per reproduced chick were on satisfactory level and in limits with technological standard for respective hybrid. Nevertheless, derived results show that there is a merit in parent deposition after 61 weeks of age, which is not in agreement with technological standards, which recommend the use of the reproduction flock of 65 weeks.

In the end, we can say that these explorations were initial stage and even preliminary, but in the nature of accompanying parameters and derived data, handled with adequate mathematical and statistical methods, they give precise contribution to the perception of realistic situation in success of breeding broiler parents in the time. At the same time, they give starting point for further, supplemental exploration with a view to increasing production of qualitative broiler chicks and thus at most, demonstration of genetically potentiality broiler parents, both in terms of period of exploration (eksploitation) and in view of productivity.

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