

## **INFLUENCE OF THE COBB 500 HYBRID PARENT AGE AND EGG STORAGE PERIOD ON INCUBATION PARAMETERS**

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Original scientific paper

**Abstract:** Main goal of this research was to determine the influence of Cobb 500 hybrid broiler parent age (BPA) and egg storage (ES) period, the impact of egg maturity on egg fertilization and chick hatching, as well as on embryonal mortality of chicks during incubation period. There were three phases of production cycle, three different ages of broiler parents 25, 41 and 58 weeks (BPA25, BPA41, BPA 58). The eggs there were differentiated according to storage time: eggs stored up to 7 days and eggs stored over 7 days (ES<7; ES>7). Using the random sample method, 1.050 eggs were chosen (total number of chosen eggs was 6.300), with the aim to determine above mentioned reproductive parameters, one day old chick weight and relative share of chick weight in total egg weight were determined. Age of broiler parents had the highest influence on egg fertility as the highest number of fertilized eggs was recorded during the middle of production cycle (BPA41 = 97.05%), then at the beginning of the cycle (BPA25 = 96.09%), and lowest number of fertilized eggs was during the last phase of the cycle (BPA58 = 93.00%). The storage period of the eggs did not have any influence on egg fertility. However, the age of broiler parents and storage period had significant influence on hatching, therefore it influenced embryonal mortality during incubation period. Without considering the storage period, the lowest embryo mortality was detected with eggs that originated from BPA41 – 13.05%, eggs that originated from BPA58 had significantly higher embryo mortality rate 15.87%, and the highest mortality rate was noted with eggs that originated from BPA25 16.93%. However, extended storage period for the eggs or egg maturity (ES<7 and ES>7) had influence on total embryonal mortality rate in all three phases of the production cycle. Moreover, broiler parent age had statistically significant influence on increase of egg weight (P<0.001) and hatched chick weight

( $P < 0.001$ ), while the relative share of chick weight in total egg weight was decreased, therefore storage period in all three phases of production cycle had negative influence on chick percent, with increase of storage time of the egg, relative share of chick weight in total egg weight decreased, especially during start BPA25 and end BPA58 phase of the production cycle ( $P < 0.001$ ).

**Key words:** storage, parents, eggs, embryo, mortality, chicken.

## Introduction

In optimal production conditions, incubation stations insert eggs after 3-5 days of storage time and by doing so they minimize the negative effects of egg storing on hatchability and quality of one day old chicks. The highest hatching percent compared to number of fertilized eggs (embryo mortality is minimal) and good quality vital chicks are achieved. However, incubation stations in some situations have to extend storage period of the eggs, which happens due to availability of breeding eggs, station capacity, market demand and price for one day old broiler chicks.

Numerous researches, such as - *Reis and Soares (1993)*, *Gustin (1994)*, *Reis et al. (1997)*, *Suarez et al. (1997)*, *Tona et al. (2004)*, *Miclea and Zahan (2006)*, *Elibol and Brake (2006)*, *Petek and Dikmen (2006)*, *Schmidt et al. (2009)*, *Al-Bashan and Al-Harbi (2010)*, *Abudabos A. (2010)*, *Mitrović et al. (2012)*, *Alsobayel et al. (2013)*, *Kopecky (2015)*, *Malik et al. (2015)*, *Jaiswal et al. (2016)*, *Araujo et al. (2016)*, *Iqbal et al. (2016)* have determined that the age of broiler parents of different genotypes and egg maturity (storage time) influence the incubation results therefore influence egg fertility and embryo mortality during incubation period.

Above mentioned authors have also determined that extended storage period of eggs extends incubation period, decreases the hatching percent, decreases the chick quality after hatching which further has negative influence on growth rate, mortality, food conversion of broiler chicks during the fattening period. Similarly with the age of broiler parents' the egg weight increases, while the percent of fertilization and hatchability decrease, especially during the end of production cycle. However, even though negative effects of extending the storage period in certain measure are known, it has not been fully researched how the age of broiler parents, and especially the egg maturity (storage time) influence embryo development during incubation period, number and percent of hatched high quality one day old chicks.

Therefore, main goal of this paper was to determine the influence of specific factors on incubation results, especially the age of broiler parents (BPA) and the storage time (ES). The egg fertility, hatchability (compared to number of

incubated, and to number of fertilized eggs) as well as embryo mortality during incubation, hatched chick weight and relative chick weight share in total egg weight were determined during different age of broiler parents 25, 41 and 58 weeks BPA25, BPA41 and BPA58, as well as for eggs stored up to 7 days ES<7, and eggs stored over 7 days ES>7.

## Material and methods

Experimental part of this research was conducted at chicken farm and incubation station Agreks d.o.o. Donji Zabari, Republika Srpska – B and H. Among other things this farm is engaged in breeding and rearing of Cobb 500 broiler parents, production of breeding eggs and one day old chicks.

With the goal to determine influence of the age of broiler parents in different phases of production cycle (beginning, middle and end) at the flock age of 25 (BPA25), 41 (BPA41), and 58 (BPA58) weeks, and storage period (egg maturity) up to 7 days (ES<7), and over 7 days (ES>7) on the fertility and hatchability, embryo mortality and chick weight, research was conducted on total number of 6.300 eggs. Using the random sample method, six groups (treatments) of eggs were chosen and during each phase 1050 eggs stored up to 7 days were incubated and 1050 eggs stored for over 7 days ( $1.050 \times 2 = 2.100 \times 3 = 6.300$  eggs). All eggs were kept in storage room at temperature ranging from 15° C to 18° C at relative air humidity ranging from 75% to 85%.

Special attention was given to fertilized eggs and eggs from which chicks hatched, to number of embryo that died during the incubation period and to one day old chick weight.

During all production phases, at all ages of broiler parents (BPA25, BPA41, BPA58), eggs were individually measured (and numbered) twice, specially eggs from ES<7 group (stored up to 7 days) and eggs from ES>7 group (stored between 8-14days). That means that in all phases 1.050 eggs were incubated that were up to 7 days old and 1.050 eggs that were over 7 days old. During transfer of eggs from laying section of incubator to hatchery (18<sup>th</sup> day), they were placed in specially built compartments so that each hatched chick could be identified and determined from which egg it originated.

Basic data calculation was done by using computer programme *Stat. Soft. Inc.* (2003) STATISTICA (data analysis software system) version 6, usual variation statistic methods were used (descriptive statistics). For the most of monitored parameters the following was calculated: arithmetic mean ( $\bar{x}$ ), arithmetic mean error ( $S_{\bar{x}}$ ), standard deviation (S) and variation coefficient (C.V.).

Difference of significance testing between researched incubation parameters was conducted by applying appropriate variance models (two-factorial experiment plan – 3 ages of broiler parents x 2 periods of egg storing;  $Y_{ijk} = \mu +$

$(BPA)_i + (ES)_j + (BPA \times ES)_{ij} + e_{ijk}$ ) using equal and different number of repetitions per treatment.

Relative share of chick weight in total egg weight (percent of the chick/PC) was determined using the formula: P.C. = [(chick weight/egg weight) x 100].

## Results and discussion

The effects of parent flock age (BPA25, BPA41 and BPA58 weeks), the phase of production cycle (starting, middle and ending) and time spent in storage to and over 7 days (ES<7 and ES>7) in incubation station on incubation parameters are shown in table 1.

**Table 1. Egg fertility, chick hatchability, and embryo mortality (%)**

| Parentflock age (BPA) | Egg maturity (ES) | Fertilized eggs | Hatched chicks <sup>A</sup> | Hatched chicks <sup>B</sup> | Embryo mortality |
|-----------------------|-------------------|-----------------|-----------------------------|-----------------------------|------------------|
| BPA25                 | <7                | 96.95           | 81.43                       | 83.99                       | 16.01            |
|                       | >7                | 95.24           | 78.29                       | 82.20                       | 17.80            |
|                       | Total             | 96.09           | 79.86                       | 83.10                       | 16.90            |
| BPA41                 | <7                | 97.43           | 87.62                       | 89.93                       | 10.07            |
|                       | >7                | 96.67           | 81.14                       | 83.94                       | 16.06            |
|                       | Total             | 97.05           | 84.38                       | 86.95                       | 13.03            |
| BPA58                 | <7                | 93.05           | 79.43                       | 85.36                       | 14.64            |
|                       | >7                | 92.95           | 76.76                       | 82.58                       | 17.42            |
|                       | Total             | 93.00           | 78.09                       | 83.97                       | 16.03            |

Data from table 1 shows that the age of broiler parents influenced the fertility of eggs, both those up to and over 7 days. The highest fertility compared to number of incubated eggs was during the middle of production cycle (BPA41 = 97.05%), followed by the start phase (BPA25 = 96.09%), and lowest at the end phase (BPA58 = 93.00%) of reproductive cycle. However, age of broiler parents and storage period had significant influence on percent of chick hatching, and especially on the embryo mortality rate during incubation period. The highest chick hatchability compared to number of incubated eggs (number of fertilized eggs) was in BPA41 (84.38% and 86.95%), followed by BPA25 (79.86% and 83.10%), and lowest was in BPA58 (78.09% and 83.97%). Moreover, extending of egg storage period influenced the decrease of hatching percent of chicks in all three phases of production cycle.

From above mentioned it can be seen that the age of broiler parents influenced egg fertility and hatchability, and that egg maturity (storage period) influenced hatchability percent and hatched chicks quality (vitality). Similar research is conducted by *Tona et al. (2004)*, *Petek and Dikmen (2006)* for broiler parents of different age and during different storage period of brooding eggs. *Tona*

*et al.* (2004) has found that 7 day old eggs of Cobb broiler parents that were 35 weeks old have higher hatchability percent by approximately 4% (88.36% - 84.65%) than parent flock that was 45 weeks old. For both age groups of broiler parents, incubated fresh eggs had statistically significantly lower hatchability percent than eggs that were stored for 7 days. *Petek and Dikmen* (2006) have found that by extending storing period for eggs originating from same age broiler parents (37 weeks) percent of hatchability significantly decreases compared to percent of fertilized eggs. Therefore chick hatchability compared to number of fertilized eggs stored for five days is 97.78%, and from eggs stored over five days only 61.82%. Similar results are obtained by *Reis and Soares* (1993), *Schmidt et al.* (2009). Above mentioned authors state that regardless of the parent flock age, the percent of hatchability significantly decreases if storage period is extended. *Schmidt et al.* (2009) have determined that hatching percent compared to number of fertilized eggs (two days old) is 93.83% and that it decreases to only 74.13% for eggs stored for 14 days. *Jaiswal et al.* (2016) have found that age of broiler parents influences the egg weight, and egg weight influences the hatchability of the chicks, therefore they have determined that light weight eggs have the lowest hatchability percent compared to number of incubated eggs 66.0%, medium weight eggs have hatchability percent of 74.4% and the highest hatchability percent is for heaviest eggs 80.2%. They have used same age broiler parents. For broiler Parents of Cobb hybrid that are 26 and 44 weeks old, *Abudabos* (2010) has determined that chick hatchability, compared to number of incubated eggs, is 85.2% and 70.4% and compared to number of fertilized eggs 92.3% and 82.8%, respectively, which is contrary to our results *Malik et al.* (2015) have also determined for 64 week old Cobb 500 broiler parents, the highest fertility of eggs and the highest hatchability with light weight eggs and the lowest for heaviest eggs.

In general, the results show that embryo mortality during incubation period is influenced by the age of broiler parents as well as the duration of egg storing period. The lowest embryo mortality 13.05% without considering the parent age is determined for the eggs from broiler parents 41 week old (BPA41), significantly higher at the end of production cycle (BPA58) 16.03%, and the highest at the beginning of production cycle (BPA25) 16.90%. Moreover, in all three production phases, extending of egg storage period over 7 days influenced increase of embryo mortality during incubation period. For the eggs originating from 41 day old broiler parents, the greatest difference between storage periods was determined (5.99%), total embryo mortality for the eggs that were stored up to 7 days was 10.07%, and for the eggs that were stored over 7 days it was 16.06%. For the eggs that were laid at the beginning and at the end of production cycle, storage period had less influence on embryo mortality, differences were lower, but in those production phases total embryo mortality was higher.

*Reis and Soares* (1993), *Gustin* (1994), *Reis et al.* (1997), *Suarez et al.* (1997), *Elbol and Brake* (2006), *Miclea and Zahan* (2006), *Schmidt et al.* (2009),

*Al-Bashan and Al-Harbi (2010), Mitrović et al. (2012), Kopecky (2015) and Jaiswal et al. (2016)* also discussed this problem of determining the influence of storage period on incubation results for the different age broiler parent eggs, and especially on embryo mortality.

*Reis and Soares (1993)* have also determined that with the age of Cobb 500 broiler parents embryo mortality increases during incubation period, however it is significantly lower result compared to our research. Therefore total embryo mortality for eggs from 33 week old parents was the lowest (2.46%), slightly higher for 43 week old flock (4.84%) and the highest at the end of production cycle 7.19%. Similarly, *Reis et al. (1997)* have established the embryo mortality of 7.9% when incubating eggs from 32 and 34 week old parents and 8.5% for eggs from 48 and 50 weeks old parents. *Suarez et al. (1997)* have determined the highest embryo mortality for the youngest parent flock of 29 weeks and it was 10.2%, then for the oldest parents 52 weeks 8.8%, and the lowest for 41 week old broiler parents 5.8%. Compared to our results, above mentioned authors have obtained lower or similar total embryo mortality during incubation of the eggs that were stored up to seven days and are from parents of different age. Unlike other authors, *Mitrović et al. (2012), Iqbol et al. (2016)* have obtained values most similar to our results in regard to embryo mortality rate.

*Elibol and Brake (2006)* have incubated eggs from broiler parents of different age (37, 41, 59 and 63 weeks) and tried to determine early, medium and late, as well as total embryo mortality. Contrary to our research, above mentioned authors have determined the lowest (8.33%) embryo mortality for the youngest flock (37 weeks), followed by the 41 week old flock (9.50%), and significantly higher embryo mortality rate for the flock that was 59 and 63 weeks old (12.28% and 12.64%, respectively). However, total embryo mortality rate is quite similar to our results (table 1), especially if we compare our results with *Kopecky et al. (2015)* who have determined the lowest embryo mortality for medium weight eggs 9.71%, for the lightest eggs 11.92% and for the heaviest eggs 16.74%. *Jaiswal et al. (2016)* have determined the highest embryo mortality for the lightest eggs 15.3%, and the lowest for the heaviest eggs 6.13% which is in a way contradictory to our results.

Data from the next table (table 2.) shows that before inserting of the eggs in to the incubator, at the starting phase of the cycle BPA25 the lowest average weight of fertilized eggs was determined (54.77 g and 53.84 g), and the highest (67.25 g and 66.31 g) at the ending phase BPA58 without considering the storage time of the eggs.

**Table 2. Average values and variability of fertilized eggs (g)**

| Production phase/BPA | Egg maturity (ES) (days) | n    | $\bar{x}$ | S $\bar{x}$ | S    | C.V. |
|----------------------|--------------------------|------|-----------|-------------|------|------|
| Start/BPA25          | <7                       | 1018 | 54.77     | 0.12        | 3.69 | 6.74 |
|                      | >7                       | 1000 | 53.84     | 0.12        | 3.78 | 7.02 |
|                      | Total                    | 2018 | 54.31     | 0.08        | 3.76 | 6.92 |
| Middle/BPA41         | <7                       | 1023 | 63.19     | 0.13        | 4.12 | 6.52 |
|                      | >7                       | 1015 | 62.55     | 0.13        | 4.09 | 6.54 |
|                      | Total                    | 2038 | 62.87     | 0.09        | 4.11 | 6.54 |
| End/BPA58            | <7                       | 977  | 67.25     | 0.14        | 4.36 | 6.48 |
|                      | >7                       | 976  | 66.31     | 0.15        | 4.65 | 7.01 |
|                      | Total                    | 1953 | 66.78     | 0.10        | 4.53 | 6.78 |

The fact that age of broiler parents influences the egg weight, that with the age of different parent genotypes during production cycle egg weight increases was confirmed by research of many authors *Viera et al. (2005)*, *Enting et al. (2007)*, *Schmidt et al. (2009)*, *Đermanović et al. (2010)*, *Mitrović et al. (2011)*, *Abudabos (2010)*, *Alsobayel et al. (2013)*, *Araujo et al. (2016)*, *Igbal et al. (2016)*.

Average weight of all eggs (AWE) stored up to 7 days was 61.70 g, WHE – 61.61 g, CW – 42.52 g and CP – 68.99% (table 3.). Extending of egg storage time influenced the decrease in average egg weight (AWE and WHE) and in weight of day old chicks (CW and CP). Highest variation coefficient (over 11, actually 12%) was determined for CW coming from eggs stored up to and over seven days, and lowest (below 5%) with chick weight percent in total egg weight (CP).

**Table 3. Descriptive statistic parameters for egg and one day old chick traits depending on storage time**

| Traits           | n    |      | $\bar{x}$ |       | S $\bar{x}$ |      | S    |      | C.V.  |       |
|------------------|------|------|-----------|-------|-------------|------|------|------|-------|-------|
|                  | <7   | >7   | <7        | >7    | <7          | >7   | <7   | >7   | <7    | >7    |
| AWE <sup>A</sup> | 3150 | 3150 | 61.70     | 60.88 | 0.12        | 0.12 | 6.79 | 6.91 | 11.01 | 11.35 |
| WHE <sup>B</sup> | 2609 | 2480 | 61.61     | 60.74 | 0.13        | 0.14 | 6.73 | 6.79 | 10.92 | 11.18 |
| CW <sup>C</sup>  | 2609 | 2480 | 42.52     | 41.46 | 0.10        | 0.11 | 5.08 | 5.27 | 11.95 | 12.71 |
| CP <sup>D</sup>  | 2609 | 2480 | 68.99     | 68.19 | 0.05        | 0.06 | 2.83 | 3.20 | 4.10  | 4.69  |

AWE<sup>A</sup> – weight of all eggs, g; WHE<sup>B</sup> – weight of eggs that hatched, g; CW<sup>C</sup> – chick weight, g; CP<sup>D</sup> – Chick percent.

Average weight of all eggs stored to and over seven days, eggs that hatched and weight of one day old chicks originating from young parents BPA25 was statistically significantly lower ( $P < 0.001$ ) compared to eggs from BPA41 and BPA58 is shown in the table 4. Differences between BPA41 and BPA 58 for all eggs (-3.88 g), from the eggs that hatched (-3.84 g) and day old chick weights (-1.46 g) were also statistically significant ( $P < 0.001$ ). Relative chick weight share in

the total egg weight (CW) was highest in BPA41 (69.66%), and lowest in BPA58 (67.81%), all differences were confirmed at the level  $P < 0.001$ . From the data it can be concluded that with the age of broiler parents egg and one day old chick weight increased, while chick weight share in total egg weight mostly decreased.

**Table 4. Average egg and chick trait difference significance depending on parent age BPA and egg maturity ES**

| Traits           | Parent age weeks | $\bar{x}$     | d         |
|------------------|------------------|---------------|-----------|
| AWE <sup>A</sup> | BPA25 – BPA41    | 54.30 – 62.84 | -8.54***  |
|                  | BPA25 – BPA58    | 54.30 – 66.72 | -12.42*** |
|                  | BPA41 – BPA58    | 62.84 – 66.72 | -3.88***  |
| WHE <sup>B</sup> | BPA25 – BPA41    | 54.16 – 62.80 | -8.64***  |
|                  | BPA25 – BPA58    | 54.16 – 66.64 | -12.48*** |
|                  | BPA41 – BPA58    | 62.80 – 66.64 | -3.84***  |
| CW <sup>C</sup>  | BPA25 – BPA41    | 36.99 – 43.76 | -6.77***  |
|                  | BPA25 – BPA58    | 36.99 – 45.22 | -8.23***  |
|                  | BPA41 – BPA58    | 43.76 – 45.22 | -1.46***  |
| CP <sup>D</sup>  | BPA25 – BPA41    | 68.27 – 69.66 | -1.39***  |
|                  | BPA25 – BPA58    | 68.27 – 67.81 | 0.46***   |
|                  | BPA41 – BPA58    | 69.66 – 67.81 | 1.85***   |
| AWE <sup>A</sup> | ES<7 – ES>7      | 61.70 – 60.88 | 0.82***   |
| WHE <sup>B</sup> | ES<7 – ES>7      | 61.61 – 60.74 | 0.87***   |
| CW <sup>C</sup>  | ES<7 – ES>7      | 42.52 – 41.46 | 1.06***   |
| CP <sup>D</sup>  | ES<7 – ES>7      | 68.99 – 68.19 | 0.80***   |

AWE<sup>A</sup> – weight of all eggs, g; WHE<sup>B</sup> – weight of eggs that hatched, g; CW<sup>C</sup> – chick weight, g; CP<sup>D</sup> – Chick percent. ns –  $P > 0.05$ ; \*\*\* $P < 0.001$ .

Data from the table 4 shows that storage period for the eggs has statistically significantly ( $P < 0.001$ ) influenced egg and day old chick traits, with extending the egg storage period in all three cycle phases incubated egg weight that hatched decreased as well as day old chick weight and relative chick weight share in total egg weight.

Similar trend of increase, actually decrease of hatched egg weight, depending on parent flock age (BPA) and storage period (ES) was determined for day old chick weight (table 5.)



**Table 5. Average values and variability of chick weight and chick share in total egg weight**

| Production cycle phase/BPA                          | Egg maturity (ES) (days) | n    | $\bar{x}$ | $S_{\bar{x}}$ | S    | C.V.  |
|---|--------------------------|------|-----------|---------------|------|-------|
| <b>Day old chicks weight (g)</b>                    |                          |      |           |               |      |       |
| Start/BPA25   | <7                       | 855  | 37.61     | 0.11          | 3.29 | 8.75  |
|   | >7                       | 822  | 36.34     | 0.11          | 3.26 | 8.96  |
|   | Total                    | 1677 | 36.99     | 0.08          | 3.34 | 9.02  |
| Middle/BPA41  | <7                       | 920  | 44.02     | 0.12          | 3.53 | 8.01  |
|   | >7                       | 852  | 43.48     | 0.12          | 3.61 | 8.30  |
|   | Total                    | 1772 | 43.76     | 0.08          | 3.57 | 8.17  |
| End/BPA58   | <7                       | 834  | 45.89     | 0.14          | 4.18 | 9.11  |
|   | >7                       | 806  | 44.53     | 0.16          | 4.51 | 10.13 |
|   | Total                    | 1640 | 45.22     | 0.11          | 4.40 | 9.72  |
| <b>Relative chick share in total egg weight (%)</b> |                          |      |           |               |      |       |
| Start/BPA25   | <7                       | 855  | 68.87     | 0.09          | 2.77 | 4.02  |
|   | >7                       | 822  | 67.64     | 0.10          | 2.87 | 4.25  |
|   | Total                    | 1677 | 68.27     | 0.07          | 2.89 | 4.23  |
| Middle/BPA41  | <7                       | 920  | 69.73     | 0.08          | 2.59 | 3.72  |
|   | >7                       | 852  | 69.58     | 0.09          | 2.57 | 3.69  |
|   | Total                    | 1772 | 69.66     | 0.06          | 2.58 | 3.71  |
| End/BPA58   | <7                       | 834  | 68.30     | 0.10          | 2.95 | 4.32  |
|   | >7                       | 806  | 67.30     | 0.13          | 3.60 | 5.35  |
|   | Total                    | 1640 | 67.81     | 0.08          | 3.32 | 4.90  |

Average weight of day old chicks hatched from eggs that were stored up to seven days was between 37.61 g (BPA25) and 45.89 g (BPA58), and chicks hatched from eggs that were stored over seven days was between 36.34 g (BPA25) and 44.53 g (BPA58). That means that weight of hatched chicks increased with the age of laying hens, while extending of storage period of eggs influenced the decrease of body weight of day old chicks (table 5.). From the data in the table 5 it is further visible that highest relative chick share in total egg weight share, not considering the storage period of the eggs was highest during the middle of production cycle (BPA41 – 69.66%), and lowest in the ending phase (BPA58 – 67.81%). However, highest relative chick share in total egg weight (69.73%) was with young flock BPA41 and that with eggs that were stored up to seven days, lowest relative chick share in total egg weight (67.30%) was at the end of production cycle BPA58 and that with eggs that were stored for over seven days. Moreover, extending of storage period in all three phases of production cycle influenced the decrease of relative chick share in total egg weight.

Similar average one day chick weight in certain phase of production cycle was determined by *Vieira et al. (2005)*, *Enting et al. (2007)*, slightly lower was determined by *Abudabos (2010)*, *Miclea and Zahan (2006)*, and *Schmidt et al. (2009)* determined slightly higher body weight.

Data from table 5 show that relative chick share in total egg weight (CW) was variable and it pointed out specific trend of decrease connected with age of broiler parents for eggs that were stored up to seven days (BPA25 = 68.87% and BPA58 = 68.30%), while for the eggs stored over seven days highest chick percent was determined for the eggs originating from BPA41 (CP = 69.58%), and lowest was for the eggs that were produced during the ending phase of production cycle (BPA58 = 67.30%). Moreover, in all three phases of production cycle relative chick share (CP) in the egg weight (EW) was higher for the eggs that were stored up to seven days (ES<7), compared to eggs that were kept over seven days (ES>7).

If we look at it from broader point of view, relative chick share in total egg weight, regardless of the phase of production cycle and storage time fits the results of other researchers who dwelled on this matter. It shows that with the age of broiler parents egg and day old chick weight increases but relative chick share in total egg weight, as rule, decreases (Abudabos, 2010; Alsobayjel et al., 2013; Iqbal et al., 2016).

Similar, even better (higher) percent of chick in egg weight (around 70% and more) was determined by Schmidt et al. (2009), Miclea and Zahan (2006), Abudabos (2010), and lower, actually significantly lower relative chick share in total egg weight was determined by Vieira et al. (2005), Enting et al. (2007).

Statistic significance of determined differences for average day old chick weights and relative chick share in total egg weight depending on broiler parent age, storage time is shown in tables 6 and 7.

**Table 6. Significance of average chick weights (CW) depending on parent age (BPA) and egg maturity (ES)**

| Parent age – egg maturity | $\bar{x}$     | d                   |
|---------------------------|---------------|---------------------|
| BPA25ES<7 – BPA41ES<7     | 37.61 – 44.02 | -6.41***            |
| BPA25ES<7 – BPA58ES<7     | 37.61 – 45.89 | -8.28***            |
| BPA25ES<7 – BPA25ES>7     | 37.61 – 36.34 | 1.27***             |
| BPA25ES<7 – BPA41ES>7     | 37.61 – 43.48 | -5.87***            |
| BPA25ES<7 – BPA58ES>7     | 37.61 – 44.53 | -6.92***            |
| BPA25ES>7 – BPA41ES<7     | 36.34 – 44.02 | -7.68***            |
| BPA25ES>7 – BPA58ES<7     | 36.34 – 45.89 | -9.55***            |
| BPA25ES>7 – BPA41ES>7     | 36.34 – 43.48 | -7.14***            |
| BPA25ES>7 – BPA58ES>7     | 36.34 – 44.53 | -8.19***            |
| BPA41ES<7 – BPA58ES<7     | 44.02 – 45.89 | -1.87***            |
| BPA41ES<7 – BPA41ES>7     | 44.02 – 43.48 | 0.54*               |
| BPA41ES<7 – BPA58ES>7     | 44.02 – 44.53 | -0.51 <sup>ns</sup> |
| BPA41ES>7 – BPA58ES<7     | 43.48 – 45.89 | -2.41***            |
| BPA41ES>7 – BPA58ES>7     | 43.48 – 44.53 | -1.05***            |
| BPA58ES>7 – BPA58ES<7     | 44.53 – 45.89 | -1.36***            |

<sup>ns</sup>P>0.05; \*P<0.05; \*\*\*P<0.001.

Highest difference in average one day old chick body weight (-9.55 g) was determined with BPA25ES>7 and BPA58ES<7, and lowest (-0.51 g) with BPA41ES<7 and BPA58ES>7. Determined differences in average chick weights as results of parent age and storage time were statistically confirmed at the level  $P<0.001$ , except for the difference between BPA41ES<7 and BPA41ES>7 which was statistically significant but at the level  $P<0.05$ , while difference - 0.51 g (BPA41ES<7 - BPA58ES>7) was not statistically significant at the level  $P>0.05$  (table 6).

**Table 7. Significance for average chick relative share in total egg weight (CW) depending on parent age (BPA) and egg maturity (ES)**

| Starost roditelja – starost jaja | $\bar{x}$     | d                  |
|----------------------------------|---------------|--------------------|
| BPA25ES<7 – BPA41ES<7            | 68.87 – 69.73 | -0.86***           |
| BPA25ES<7 – BPA58ES<7            | 68.87 – 68.30 | 0.57***            |
| BPA25ES<7 – BPA25ES>7            | 68.87 – 67.64 | 1.23***            |
| BPA25ES<7 – BPA41ES>7            | 68.87 – 69.58 | -0.71***           |
| BPA25ES<7 – BPA58ES>7            | 68.87 – 67.30 | 1.57***            |
| BPA25ES>7 – BPA41ES<7            | 67.64 – 69.73 | -2.09***           |
| BPA25ES>7 – BPA58ES<7            | 67.64 – 68.30 | -0.66***           |
| BPA25ES>7 – BPA41ES>7            | 67.64 – 69.58 | -1.94***           |
| BPA25ES>7 – BPA58ES>7            | 67.64 – 67.30 | 0.34 <sup>ns</sup> |
| BPA41ES<7 – BPA58ES<7            | 69.73 – 68.30 | 1.43***            |
| BPA41ES<7 – BPA41ES>7            | 69.73 – 69.58 | 0.15 <sup>ns</sup> |
| BPA41ES<7 – BPA58ES>7            | 69.73 – 67.30 | 2.43***            |
| BPA41ES>7 – BPA58ES<7            | 69.58 – 68.30 | 1.28***            |
| BPA41ES>7 – BPA58ES>7            | 69.58 – 67.30 | 2.28***            |
| BPA58ES<7 – BPA58ES<7            | 67.30 – 68.30 | -1.00***           |

<sup>ns</sup> $P>0.05$ ; \* $P<0.05$ ; \*\* $P<0.01$ ; \*\*\* $P<0.001$ .

Broiler parents age influence (BPA) and storage period (ES) had slightly different effect on relative chick share in total egg weight, that it had on fertilized eggs that hatched and one day old chicks (table 7). Determined differences 0.34% (BPA25ES>7 – BPA58ES>7) and 0,15% (BPA41ES<7 – BPA41ES>7) were not statistically confirmed ( $P>0,05$ ), while other differences regarding the chick relative share in egg weight between researched groups were statistically significant and confirmed at the  $P<0.001$  level.

## Conclusion

If we observe the production phases (usage) it can be said that broiler parents have best production, reproduction results during the middle of production cycle. Cobb 500 broiler parents are during the middle of production cycle BPA41,

compared to start phase BPA25 and end phase BPA58 of hatching eggs achieved best production and reproductive results. In that period 5,08 eggs, 4,74 fertilized eggs and 4,40 day old chicks per laying hen were produced, while average food consumption per hen was 181,00 g. Average egg weight that were stored up to 7 days was within optimal limits and it counted 63,11 g, egg fertility was 97,43%, chick hatchability was 87,62% (compared to incubated eggs), or 89,93% (compared to fertilized eggs), day old chick body weight was at satisfying level 44,02 g and relative chick share in total egg weight was 69,73%. Moreover, age of broiler parents influenced egg weight increase and hatched chick weight increase, while chick percent in total egg weight decreased, storage period had in all three phases of production cycle negative influence on chick percent, with increase of storage time relative chick share in total egg weight decreased, especially in starting BPA25 and ending BPA58 phase of production cycle.

## **Uticaj starosti brojlerskih roditelja hibrida Cobb 500 i perioda skladištenja jaja na inkubacione pokazatelje**

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### **Rezime**

Osnovni cilj rada bio je ispitivanje uticaja starosti brojlerskih roditelja (SR) Hibrida Cobb 500 i perioda skladištenja jaja, odnosno starosti jaja (SJ) na oplodjenost jaja i leženost pilića, kao i na embrionalni mortalitet pilića u toku inkubacionog perioda. U tri faze proizvodnog ciklusa, odnosno različite starosti brojlerskih roditelja (SR25ned., SR41ned. i SR58ned.) i kod jaja skladištenih do 7 i preko 7 dana (SJ<7 i SJ>7), metodom slučajnog uzorka, odabrano je po 1.050 jaja (ukupno 6.300 jaja), u cilju utvrđivanja pomenutih reproduktivnih pokazatelja, težine pilića starih jedan dan i relativnog udela pileta u težini jajeta. Starost brojlerskih roditelja je uticala na oplodjenost jaja jer je najviše fertilnih jaja bilo sredinom proizvodnog ciklusa (SR41 = 97,05%), zatim početkom (SR25 = 96,09%), a najmanji u završnoj fazi (SR58 = 93,00%) gajenja jata. Period skladištenja jaja nije imao uticaja na to koliko je jaja oplodjeno, dok je starost brojlerskih roditelja i period skladištenja jaja bitno uticao na procenat izvodljivosti pilića, a samim tim i na embrionalni mortalitet u toku inkubacionog perioda. Najmanji ukupan embrionalni mortalitet (13,05%), bez obzira na period skladištenja, utvrđen je kod jaja poreklom SR41, znatno veći 15,87% kod SR58 i najveći 16,93% kod SR25. Zatim, produžavanje perioda skladištenja jaja, odnosno

starost jaja (SJ<7 i SJ>7) je uticalo na povećanje ukupnog embrionalnog mortaliteta u sve tri faze proizvodnog ciklusa.

Pored toga, starost brojlerskih roditelja je statistički značajno uticala na povećanje mase jaja ( $P<0,001$ ) i izležanih pilića ( $P<0,001$ ), dok se procenat pileta u masi jajeta smanjivao, a period skladištenja jaja, kod sve tri faze proizvodnog ciklusa, negativno je uticao na procenat pileta, tj. sa produžavanjem perioda skladištenja jaja, relativni udeo pileta u masi jajeta se smanjivao, posebno u početnoj (SR25) i završnoj fazi (SR58) proizvodnog ciklusa ( $P<0,001$ ).

**Ključne reči:** skladištenje, roditelji, jaja, embrion, mortalitet, pilići

## Acknowledgement

The authors are grateful to the Ministry of Education, Science and Technological Development of the Republic of Serbia for sponsoring part of this study within project № TR – 31033.

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Received 29 September 2017; accepted for publication 15 November 2017