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Effects of Storage Periods and Position of Hatchable Eggs on Hatchability

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Abstract
This study was to investigate the effects of storage period and egg positioning on hatchability of hatchable eggs. A total of 750 eggs were collected from Arbor Acre breed of broiler parent stock, aged 35 weeks. 500 of these eggs were subjected to different storage periods: 1, 4, 7, 10 and 13 days and designated as treatments I, II, III, IV and V, respectively. Each treatment was assigned 100 eggs. The 500 eggs were further divided into two groups of 250 eggs each based on the position of the broad end (either upward or downward) during storage in the hatchery cold room at constant temperature of 18^0C and relative humidity of 75%. Data obtained were subjected to factorial analysis using SAS, 9.2 version. From the study, a significant difference in hatchability among different batches of eggs was observed. The results showed that storage period and egg position significantly ($p<0.05$) affected hatchability. Eggs stored for 1 day had the highest hatchability (92%), while those stored for 13 days had lower hatchability (78%); and the eggs with air sac facing downward position had higher hatchability (88%) than the eggs with air sac facing upward position (85% hatchability). The highest hatchability (94%) was recorded for eggs stored for a day in the downward position. These results indicated that the best hatchability is obtained at 1 day storage period. It therefore appears that storing eggs beyond 7 days contributes to a decline in hatchability; notwithstanding the egg positioning.

Keywords: Egg, storage period, position, hatchability

Introduction

To improve the protein intake of the populace, a poultry type, broiler chickens, reared for the purpose of meat production is a good option in most developing countries like Nigeria. Also, the broiler chicks are the product of hatching of the fertile eggs of broiler breeder parent stocks from poultry hatcheries. Hatchery for poultry enterprise performs the operation of transforming fertile eggs to chicks by the processes of different units of operations that occur in the hatchery. Fertility of eggs and hatchability are the major determinants of profitability in a hatchery enterprise (Peter *et al*., 2008). Due to dynamic market demands for day-old chicks and the large scale of commercial hatcheries, the storage of hatching eggs is often unavoidable. Eggs stored for an average of 24 hours before incubation is assumed to produce healthier chicks than eggs stored for a number of days (Reis *et al*., 1997).

The storage of eggs for more than a week is known to increase embryonic abnormalities and mortality due to the degradation of the viscosity of egg albumen (Fasenko, 2008). Hence egg handling prior to incubation is of utmost importance. Hamre (2008) reported that storage of eggs for longer periods (14 days and above, with the broad end facing upwards) has led to correlated decline in hatchability and increase in the proportion of dead embryos. Contrary to Hamre (2008) report on position of fertile eggs during storage, Van de ven (2004) reported that there is positive effects of storing eggs with the pointed end up as the central position of the yolk (and thus the embryo) is maintained during storage and the embryo seems to be better protected from dehydration and adhesion with the membranes, which results in better survival through storage.

However, no recent investigations or reviews into this method of egg position during storage are known. In order to control the development of the embryo, hatchable eggs should be stored at 13 to 18.3^0C at 75% relative humidity (Whitehead *et al*., 2002), 13 to 18^0C (Fasenko, 2008) and 15 to 18^0C with a relative humidity of about 75% (Hamre, 2008). With these varying temperatures from different research works, carrying out this research work in which a uniform temperature will be maintained throughout the storage periods is inevitable. According to Hamre (2008), chicken eggs should be incubated within 7 days after they are laid as hatchability declines rapidly when incubation is postponed for more than 7 days. Various arguments followed the exact conditions to adhere to when storage of eggs is inevitable, without an attention to the growth performance of the chicks to be hatched.

Therefore, this study will be to examine the effects of storage length period on the egg quality, fertility and hatchability of fertile eggs at a uniform temperature of 18^0C.

Materials and Methods

This study was carried out at the Poultry Hatchery Complex of The Federal University of Technology, Akure, Nigeria, located on Latitude 7^0 18' 01"N and Longitude 5^0 8' 41"E, Ondo State, Nigeria. A total of five hundred (500) hygienically selected hatchable eggs, out of seven hundred and fifty (750) from Arbor Acre breed of broiler parent stock at age thirty-five weeks (35wks) were used for this trial. Eggs were subjected to different Storage periods: 1, 4, 7, 10 and 13 days and designated as treatments I, II, III, IV and V respectively. Each treatment was assigned 100 eggs. The 500 eggs were further divided into two groups of 250 eggs each based on the position of the broad end of eggs (either upward or downward) during storage periods. Eggs to be stored for 13 days (Batch E) were the first to be collected. Eggs were individually weighed and weight recorded as its initial weight before storage in the hatchery cold room under a temperature of 18°C and relative humidity of 75% and tagged treatment V.

Three (3) days later, 100 eggs to be stored for 10 days (Batch D) was collected and same procedure repeated prior to storage in the same storage room as done for treatment V, and also tagged treatment IV. Eggs for Batch C, Batch B and Batch A followed the same procedure with 3 days interval and tagged treatments III, II and I respectively. All eggs were preheated outside the cold room for 6 hours to avoid egg sweating before setting into the Setter at 37.5^0C temperature and 55% humidity (Model: RAMAA INCUBATOR, from India). After 18 days in the setter, eggs were candled to evaluate fertility. The eggs were immediately transferred to the hatcher at 37^0C, and humidity 60% (Model: RAMAA HATCHER) where it was for 3 days for hatching into day - old chicks (DOC).

Data obtained were subjected to factorial analysis based on the two factors (storage periods and position of eggs) using the Statistical Software package (SAS, 2008). Duncan Multiple Range Test was used to separate the mean difference among the treatment.

Results and Discussion

Table 1 shows the effects of storage period and egg position on a number of chicks hatched and hatchability (%) on total egg set. The result shows that storage period and egg position had significant ($p<0.05$) effect on the number of chicks hatched and their hatchability percentage. The interactions between storage period and position also had significant ($p<0.05$) effect on the number of chicks hatched and their hatchability percentage.

Table 1: Effects of storage period and egg position on chicks hatched and hatchability %

Parameters		Number of egg set	Chicks hatch Mean ± SE	% Hatchability on egg set Mean ± SE
Storage period (days)	1day	100	83.34±0.48 [a]	92.59±1.06 [a]
	4 days	100	77.66±0.87 [b]	86.30 ±1.93 [b]
	7 days	100	83.67±0.38 [a]	92.96±0.85 [a]
	10 days	100	77.00±0.71 [b]	85.56±1.58 [b]
	13 days	100	70.66±0.70 [c]	78.52±1.55 [c]
Position	Up	250	193.33±0.55 [b]	85.93±1.22 [b]
	Down	250	199.00±0.52 [a]	88.44 ±1.16 [a]
Storage period*position	1Up	50	40.67±0.78 [c]	90.37±1.74 [c]
	1Down	50	42.67±0.33 [a]	94.82±0.74 [a]
	4Up	50	37.33±1.48 [e]	82.96±3.29 [e]
	4Down	50	40.33±0.67 [c]	89.63±1.48 [c]
	7Up	50	41.67±0.53 [b]	92.59±1.17 [b]
	7Down	50	42.00±0.58 [a]	93.30±1.28[b]
	10Up	50	39.33±0.67 [d]	87.41±1.48 [d]
	10Down	50	37.67 ±1.24 [e]	83.70±2.75 [f]
	13Up	50	34.33±0.73 [g]	76.30±1.61[g]
	13Down	50	36.33±1.13 [f]	80.74±2.51[f]
Storage period(SP)			*	*
Position(P)			*	*
SP*P			*	*

[abcdefg] Means along the same column with different superscripts are significantly ($p<0.05$) different.
Down: Air sac facing downwards, Up: Air sac facing upwards

Significant differences were observed in the number of chicks hatched and their hatchability as the egg period of storage increased. Highest number of chicks was hatched at day 1 and 7 days storage period, which recorded 83.34 and 83.67 with 92.96% hatchability while the lowest number of chicks hatched and percentage hatchability (70.66 and 78.52%) was recorded for eggs stored for 13 days. Significant differences were observed in the number of chicks hatched and their hatchability as the egg position changes. Highest number of chicks was hatched in egg positioned down, which recorded 199.00 and 88.44% hatchability while the lowest number of chicks hatched and % hatchability (193.33 and 85.93%) was recorded for eggs positioned up. The interaction between storage period and egg position revealed that significant differences ($p<0.05$) existed in the number of chicks hatched and hatchability percentage.

Highest values of chick hatched and percentage hatchability (42.67 and 94.82%) were recorded for eggs stored for 1 day and positioned down while eggs positioned up and stored for 13 days had the lowest value of chick hatched and % hatchability as 34.33 and 76.30%. It was noted that storage period influenced the number of chicks hatched and hatchability percentage. Eggs stored for a day or 7 days had better performance in term of hatchability. This result indicated that eggs stored for more than 7 days will slightly decline in hatchability percentage of 92% to 78% if stored till 13 days. This result was in line with the findings of Ewenotu (2016) who studied the effect of storage periods on egg weight loss, hatchability and growth performance of chicks. Egg positioning also influenced the number of chicks hatched and hatchability percentage.

The eggs positioned down had better performance for chick hatched and their hatchability when compared to the eggs positioned up. This result agreed with the findings of Alsobayel *et al*. (2012) and also the result of Van de ven (2004) which reported that there iares positive effects of storing eggs with the pointed end up as the central position of the yolk (and thus the embryo) is maintained during storage and the embryo seems to be better protected from dehydration and adhesion with the membranes, which results in better survival through storage.

Conclusion

This study showed that the hatchability of hatchable eggs were affected by storage periods and egg positions in the storage room (Temperature of 18^0C and 75% Relative Humidity). Hatchability decreased with increase in the length of storage, thereby decreasing the number of chicks hatched. Storing eggs beyond 7 days contributes to a decline in hatchability; notwithstanding the egg positioning. From this study, it can be recommended that the optimum storage period should be less than or equal to 7 days, and eggs meant for hatching should be positioned with the broad end facing downward when to be stored more than 24 hours to attain better performance in terms of number of chicks hatched and hatchability percentage.

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