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Reproductive Efficiency of Selected F1 Crossbred Turkey (Nigeria Indigenous Turkey x Exotic Turkey) at the Mid Stage of Production

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Abstract

Stages of production in life cycle of turkey has a great impact on their reproductive efficiency. This experiment is designed to evaluate the fertility and hatchability potential of selected Nigeria F1 crossbred turkey hens to determine if they are fit to create a base population for breeding plan. Crossbred Poults were brooded and reared from day old to reproduction stage. Only seven turkeys among the reared poults were identified as viable hens among the hens while the remaining population were curled. Hens are housed individually in each cell in a battery cage system. 180g of feeds was fed to hens at laying stage and 250g of feeds were fed to each tom. Ejaculates were collected from two viable toms and pooled for artificial insemination of the hens. Artificial insemination was done twice/week in the evening. The total number of eggs laid/hen/week, number of fertile eggs, hatch chicks and their percentage were recorded over a period 8weeks (38wks- 46wks). The result shows no significant different ($p<0.05$) among the hens on the number of eggs set/week, number of fertile egg/week and percentage of fertile and infertile eggs/week. In contrast, significant difference ($p<0.05$) was observed for hatchability among the hens, while hen 12 has the lowest significant ($p<0.05$) percentage hatchability of eggs set and fertile eggs value compared to other hens. It is therefore concluded that the selected Nigeria F1 hybrid turkey hens exhibited good fertility and hatchability fit for production of base population for genetic improvement program in Nigeria Indigenous turkey.

Keywords: F1 Hybrid, Fertility, Hatchability, Mid Stage, Turkey hen

Full length article **Corresponding Author*, e-mail: balogunadedeji001@gmail.com, https://doi.org/10.71111/2-25-3-3-st-2

1. Introduction

Turkey farming has emerged as a significant aspect of poultry production in Nigeria, reflecting a growing consumer preference for turkey meat. This interest has spurred research into enhancing the productivity and efficiency of turkey breeds, particularly focusing on the potential benefits of crossbreeding. One promising approach involves development of F1 crossbred turkeys, specifically hybrids between Nigeria Indigenous turkeys and exotic breeds, to improve laying efficiency [1] as well as fertility and hatchability. Nigeria Indigenous turkeys, commonly referred to as local or indigenous breeds, are well-adapted to country's diverse climatic conditions and have a natural resilience to local diseases [2]. These birds are valued for their adaptability and ability to thrive in less-than-ideal conditions, which makes them a crucial component of local poultry farming. However, despite their resilience, Nigeria Indigenous turkeys

generally characterized by lower egg production rates compared to exotic turkey breeds.

This lower productivity is a significant limitation for farmers who seek to maximize egg yields to produce more poults and overall profitability [3]. Exotic turkey breeds, such as those developed in Europe and the Americas, are renowned for their superior reproductive traits and higher egg production rates [4]. These breeds have undergone serial selection over generations for high performance in controlled environments, which often translates to increased egg yields and better overall productivity. Introduction of these exotic breeds into Nigerian poultry farming has potential to enhance egg production significantly, but may come with challenges related to adaptability and disease resistance in local context [4]. The concept of F1 crossbreeding involves mating Nigeria Indigenous turkeys with exotic breeds to create hybrid offspring that potentially combine best traits of both parent lines. This hybridization aims to leverage indigenous turkeys' adaptability & disease resistance while incorporating exotic breeds' higher egg production capabilities. Resulting F1 crossbred turkeys expected to exhibit improved laying efficiency benefiting from increased genetic diversity and hybrid vigor [5] as well as fertility and hatchability.

Hybrid vigor, or heterosis, refers to enhanced performance of hybrid offspring compared to their parent breeds. This phenomenon often results in improved growth rates, higher productivity, fertility, hatchability and better overall health. In this context of turkey production, harnessing heterosis may translate to more efficient egg production fertility and hatchability, with F1 crossbred turkeys potentially outperforming purebred lines in terms of reproductive ability [5]. Furthermore evaluating reproductive efficiency of F1 crossbred turkey hens at mid stage of production is a critical area of research, as it directly impacts economic viability & sustainability of turkey farming. Evaluating performance of these hybrids at this stage involves assessing various factors, such as egg production rates, fertility & hatchability rate. Understanding these factors can provide valuable insights into benefits and challenges of using selection simultaneously with cross breeding in Nigeria turkey breeding industries, helping farmers make informed decisions about breed selection and management practices.

2. Materials and Methods

2.1. Ethical Approval

The study was based on ethical rules of Oyo State College of Agriculture and Technology Igboora. Nigeria.

2.2. Study area

The experiment was carried out at the Tukey unit, Animal Health and Production Department of Oyo State College of Agriculture and Technology, Igboora. This location lies at the geographical coordinates of 7°15'N latitude and 3°30'E longitude. The climate of the area is characterized by a tropical monsoon climate with a distinct wet and dry season, providing a conducive environment for poultry farming and related research.

2.3. Crossing of Exotic and Indigenous breed

Two (2) extotic tom semen was collected and diluted with a natural plant based extender for artificial insemination ten (10) hens. Eggs where collected from the hens for 1 week and were taken to the hatchery to produce poults.

2.4. Collection of Hybrid Poults from Hatchery

0n the 28th day of incubation, fifty (50) poults were collected from the hatchery and viable poults was separated for further rearing to adult stage.

2.5. Management and Rearing Poults

Poults were brooded and reared from day old to reproduction stage, toms were separated from hens at eighteen (18) weeks of age. Only seven turkeys among the reared poults were identified as viable hens while the remaining population were curled. Hens are housed individually in each cell in a battery cage system. 180g of feeds was fed to hens at laying stage and 250g of feeds were fed to each tom. Two best toms with the best semen quality after evaluation were selected for artificial insemination practices after 25weeks of age.

2.6. Artificial insemination

Ejaculates were collected from individual viable tom by [6]. Semen collection procedure and the semen was pooled for artificial insemination of the hens. Artificial insemination was done twice/week in the evening.

2.7. Data Collection

2.7.1. Egg Number/week/ hens

The total number of eggs laid per hen per week was recorded over a period 8weeks (38wks- 46wks), beginning at the expected onset of the hens' laying phase for Nigeria indigenous turkey.

2.7.2. Fertility and Hatchability Assessments of eggs from F1 crossbred Hens

- ***Incubated Egg fertility Assessment***

The F1crossbred hens were inseminated with their tom's counterpart pooled semen twice a week. Eggs were identified, recorded and taken to the hatchery weekly for incubation. The fertilizing ability of spermatozoa was assessed by intra vaginal insemination of the hens with 0.05ml (200 x 10^6) viable spermatozoa for 3 weeks with fresh and extended semen. Eggs were collected daily, stored and incubated weekly. The fertility percentage (fertile/incubated eggs×100) was determined by candling 22days after the start of incubation. Using the formula below:

$$\text{Fertility (\%)} = \frac{no\ of\ fertile\ eggs}{total\ no\ eggs\ set} \text{ x } 100$$

- ***Incubated Egg Hatchability Assessment***

At every 22th day of incubation eggs were transferred from the setter to the hatcher through the use of hatching baskets for last 6 days were incubation and hatching take place hatching percentage will be determined by hatching of fertile eggs about 28days after start of incubation. Numbers of chicks hatched will be counted and percentage hatchability will be calculated using formula below:

$$\text{Hatchability of fertile eggs (\%)} = \frac{\text{no of egg hatched}}{\text{total no of fertile eggs}} \text{ x } 100$$

$$\text{Hatchability of eggs set (\%)} = \frac{\text{no of egg hatched}}{\text{total no of eggs set}} \text{ x } 100$$

- ***Percentage Dead in Shell***

At 28th day of incubation the chicks were separated from the unhatch eggs, and the unhatch eggs will be broken to see if there is any chicks inside. The number of the eggs

that has chicks inside will be count and percentage dead in shell will be calculated using formula below:

$$\text{Dead in shell (\%)} = \frac{no\ of\ dead\ in\ shell\ chicks}{total\ no\ of\ fertile\ eggs} \text{x } 100$$

2.8. Statistical Analysis

Data collected were subjected to statistical analysis using SPSS. Descriptive analysis was performed to determine significant differences among the groups. Mean differences Were separated using Duncan's multiple range test at a significance level of $P < 0.05$.

3. Results and discussion

Comparative fertility result of selected F1 crossbred hens at mid stage of production (38- 46wks) is presented in Table 1. The result shows no significant different ($p<0.05$) among the hens on the number of eggs set/week, number of fertile egg/week and percentage of fertile and infertile eggs/week. This reflects that all the hens are at the peak of production at the mid stage and fertility rate is also at peak at this period. Similarly, Koczan et al. [7] reported that crossbred turkeys exhibited improved fertility rates and higher hatchability. Moreover, 100% fertility recorded at this stage signifies that the hens are at their optimum reproductive period irrespective of their laying rate and this period is best for good number of progeny recovery rate. Similarly, Adeola et al. [8] reported that crossbred hens laid more eggs with better shell quality compared to indigenous hens. Also the 100% fertility experience in all the hens could be traceable to the positive effect of hybrid vigor due to paternal heterosis reflecting the evidence that the exotic turkey breeds have been selectively bred for superior reproductive traits, including higher egg fertility and better hatchability [9].

Furthermore, Adeyemo and Onikoyi, [10] reported that crossbreeding aims to harness the desirable traits from both parent lines, which may result in improved egg production rates and better overall reproductive performance in the F1 generation and can also offer a significant improvement over pure indigenous lines, although there may be variability based on specific crossbreeding combinations and management practices [11]. Comparative hatchability result of selected F1 crossbred hens at mid stage of production (38- 46wks) is presented in Table 2. The result revealed significant different ($p<0.05$) in hatchability among the hens. However, hen 12 has the lowest significant ($p<0.05$) percentage hatchability of eggs set and fertile eggs value compared to other hens, although was not significant in value to other hens in number of hatch chicks except for Hen 6 that has the highest significant number of hatch chicks. It was also observed that percentage hatchability of fertile eggs and eggs set was above 85.00% in all the hens except hen 12, which indicate all the hens has good hatchability that can be consider for reproduction of the progeny of next generation with the exception of hen 12 which by nature has self-exhibited natural selection. Similarly, research by Kumar et al. [12] emphasizes the importance of careful selection and breeding management to stabilize desirable traits in subsequent generations.

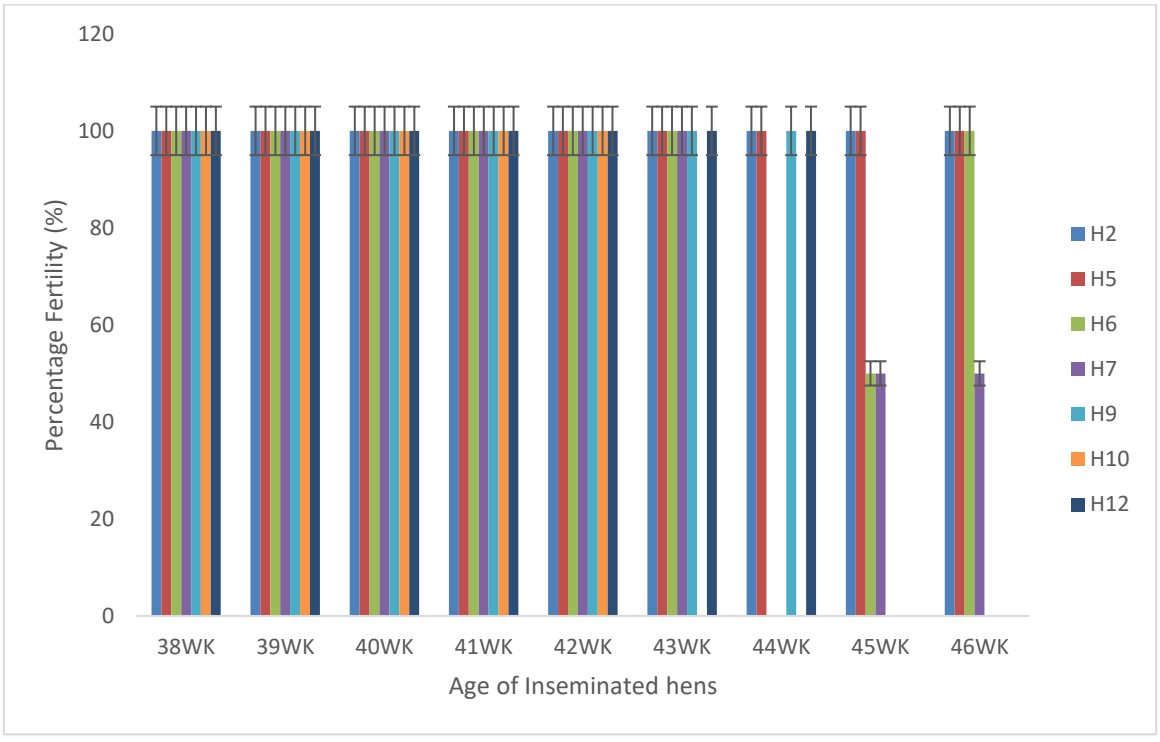

Figure 1. Weekly percentage fertility at mid stage of Production

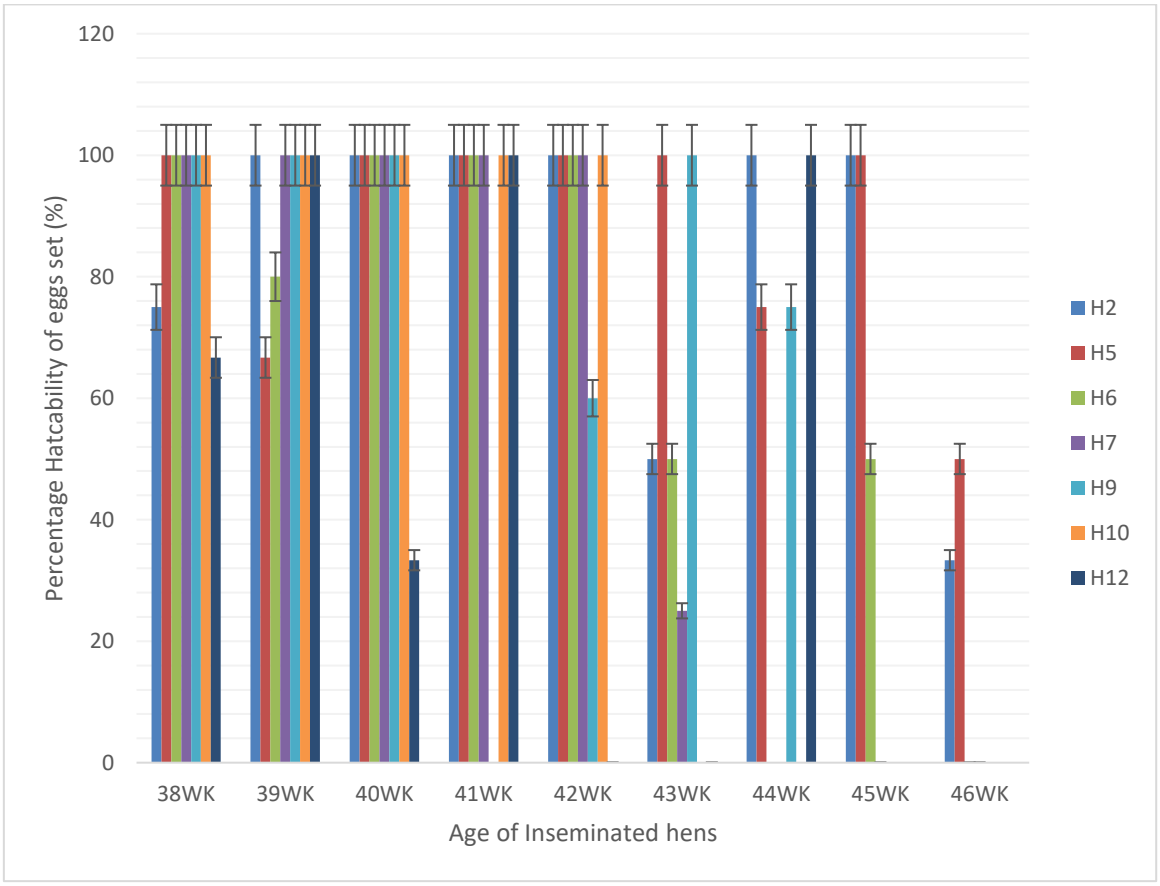

Figure 2. Weekly percentage hatchability of egg set at mid stage of Production

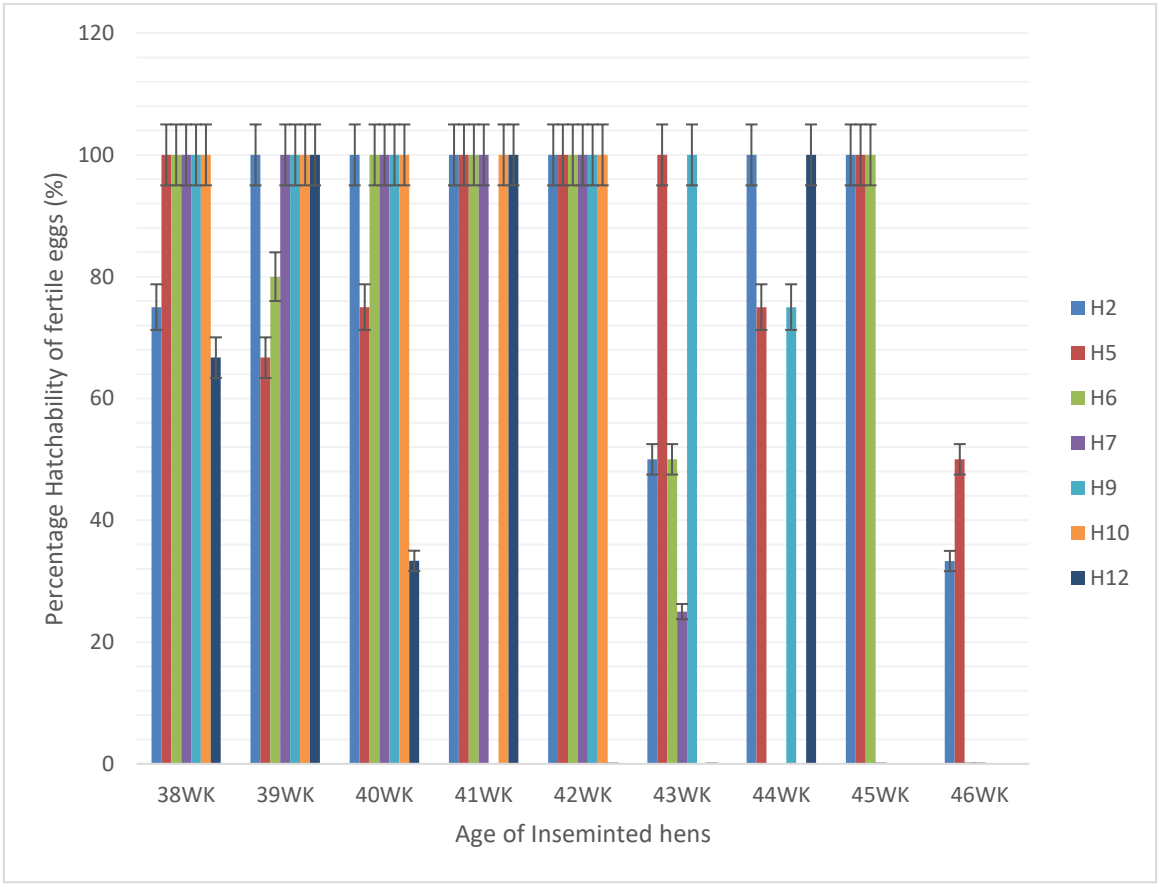

Figure 3. Weekly percentage hatchability of fertile eggs at mid stage of Production

Table 1: Comparative Fertility rate of selected F1 crossbred hens at mid stage of production (38- 46wks)

Hens	No of eggs set/week	Number of fertile eggs/week	Numbers of Infertile eggs/week	Percentage Fertile/week (%)	Percentage Infertile/week (%)
H2	3.67	3.67	0.00	100.00	0.00
H5	3.67	3.67	0.00	100.00	0.00
H6	4.33	4.33	0.00	100.00	0.00
H7	3.00	3.00	0.00	100.00	0.00
H9	4.00	4.00	0.00	100.00	0.00
H10	3.60	3.60	0.00	100.00	0.00
H12	2.83	2.83	0.00	100.00	0.00
SEM	0.20	0.20	0.00	0.00	0.00

Table 2: Comparative hatchability rate of selected F1 crossbred hens at mid stage of production (38- 46wks)

Hens	Numbers of eggs set	Numbers of hatch	Numbers of Dead in shell	Percentage Hatch of eggs set (%)	Percentage Hatch of Fertile eggs (%)	Percentage Dead in Shell (%)
H2	3.67	3.17^{ab}	0.00	87.50^{a}	87.50^{a}	0.00
H5	3.67	3.33^{ab}	0.00	90.28^{a}	90.00^{a}	0.00
H6	4.33	4.00^{a}	0.00	88.33^{a}	88.33^{a}	0.00
H7	3.00	2.50^{ab}	0.17	87.50^{a}	87.50^{a}	4.17
H9	4.00	3.60^{ab}	0.00	92.00^{a}	92.00^{a}	0.00
H10	3.60	3.60^{ab}	0.00	100.00^{a}	100.00^{a}	0.00
H12	2.83	1.67^{b}	0.17	49.95^{b}	50.01^{b}	5.92
SEM	0.20	0.24	0.04	4.26	4.46	1.03

Means with different superscripts a, b shows significant different ($p<0.05$)

Further-more this result reflects the important of continuous research and optimize management practices to further improve reproductive performance of turkeys and further harness the challenges associated with their reproductive ability [13]. Also, Goytain et al. [14] reported that selective breeding enhanced improvements in the reproductive performance of turkeys, particularly in commercial strains. Moreover, Studies have shown improvements in egg fertility, hatchability, and early chick survival in F1 crossbred turkeys [15] which can be attributed to the synergistic effects of combining the genetic traits of indigenous and exotic breeds. Finally, Weekly percentage fertility, hatchability of fertile eggs and eggs set were presented Figs 1, 2 & 3. It was observed that starting from 43weeks of age, zero to lower fertility percentage was recorded for some hens such as hen 10, 6, 7 and 9. Same trend was observed for hatchability of fertile eggs and eggs set. However, it was suspected that these weeks may be the period the hens are preparing for short resting phase a natural habit usually exhibited by turkey before returning to 2nd period of production. This however, implies that some offspring may not always consistently inherit the desired traits, leading to variability in performance among the flock [16].

4. Conclusions

It can therefore be concluded that the selected Nigeria F1 hybrid turkey hens exhibited good fertility and hatchability fit for production of base population for genetic improvement program in Nigeria Indigenous turkey.

Authors' contributions

ASB design, carried out the research and first draft of the manuscript TAS and AJA contribute to the resources and review of final manuscript draft. KIA and BBH took part in the methodology.

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Ethical Consideration

The authors confirm that all authors reviewed and submitted the manuscript to this journal for the first time.

Availability of data and materials

The datasets generated and collated during this research are available from the corresponding author upon request.

Conflict of interests

There is no conflict of interest to declare.

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