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STUDY ON REPRODUCTIVE TRAITS OF TWO BREEDS OF PARENT STOCK (FEMALE BREEDERS) IN THE HUMID ZONE OF NIGERIA

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ABSTRACT: *This study was carried out to assess the reproductive traits of White Plymouth Rock (WPR) and Barred Plymouth Rock (BPR) parent stock reared under similar housing, management and agro-climatic conditions and the traits considered are fertility and hatchability. Total fertile eggs produced by WPR and BPR are 1,763,322 eggs and 1,732,966 eggs respectively during the observed period (2002-2005). The analyzed data showed that breed has no significant (P>0.05) effect on fertility regardless of the batch of breeder hens. WPR and BPR genotypes recorded 3.84±0.04 eggs and 3.80±0.04 eggs/hen/week respectively and were similar. Batch has highly significant (P<0.01) effect on fertility regardless of breeds' performance. Batch 1 recorded the highest mean values, intermediate in batch 2 and batch 3, being the lowest. There was highly significant (P<0.01) effect of breed on hatchability in layer breeders. BPR genotype recorded the highest mean values in hatchability and was superior to WPR. Similarly, batch has highly significant (P<0.01) effect on hatchability. Batch 1 recorded the highest mean values, intermediate in batch 2 and batch 3, being the lowest. The batch effect implies that reproductive efficiency of breeding stock declines with advancing age. It was revealed in this study that BPR genotype was superior in terms of hatchability rate to WPR. There was no significant (P>0.05) breed x batch interaction effects on fertility and hatchability. It was indicated in this study that both genetic and non-genetic factors affected the reproductive traits of parent stock in Nigeria. Important interventions to meet the increasing demand for commercial chicks in this country include favourable environment, adequate nutrition and a more productive breed of parent stock.*

Key words: *Genotype, hen, chick, fertility, hatchability.*

ORIGINAL ARTICLE

INTRODUCTION

The increasing demand for poultry products such as eggs and meat as a means of bridging protein gap in this country could be met only when the poultry industry is equipped with strains of breeder hens that have superior genetic potentials for the production of good quality chicks. The principal objective of commercial hatcheries is to secure the maximum number of quality day-old chicks from the fertile eggs set for hatching. Fertility and hatchability are the two most important determinants for producing more chicks from given number of breeding stock within a stipulated period (Islam et al., 2002a). Fertility and hatchability of breeding hen according to Warren (1953) depends on a number of factors like genetic, physiological, social and environment. Fairfull (1990) and Fairfull and Gowe (1986) reported that maternal inheritance is important for early growth rate, viability or disease resistance of day-old chicks. While comparing fertility and hatchability using 19,205 eggs of White Leghorn (WL), Rhode Island Red (RIR) and White Rock (WR), Jayarajan (1992) reported that fertility was highest for WL and WR during cold season and for RIR during the summer. Similarly, Islam et al. (2002b) reported significant (P<0.05) effect of breed of cocks on fertility and hatchability. The authors also reported significant (P<0.05) effect of batch on fertility but insignificant (P>0.05) batch effect on hatchability. In addition, Ali et al. (1993) reported no significant (P>0.05) effect of breed on fertility and hatchability in RIR, Fayoumi and Fayoumi x RIR fowls. Previous reports in literature had implicated management and environment as two major non-genetic factors influencing hens' performance such as egg production, fertility and hatchability (Singh et al., 1983; Jayarajan, 1992). Fertility according to Gowe et al. (1993) was a trait of the parents, determined primarily by the gametes. Moreover, French (2000) reported that exposing hatching eggs to high incubation temperature tends to lower the hatchability after a long time due to water loss from the eggs.

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As regards breed effect, Abdel-Rahman (2000) reported that naked neck gene reduced fertility and hatchability significantly than normal genotype. The researcher added that total dead embryos and hatchability differed ($P<0.05$) among the genotypes but no genotype x stress interaction effect was indicated. In addition, Islam et al. (2002a) reported significant ($P<0.05$) breed x batch interaction effect on fertility but the reverse was indicated for hatchability. In view of the importance of the poultry sub-sector in generating income, employment and production of high quality animal proteins and the fact that genetic makeup of any animal determines its productivity, this study was undertaken to:

A. Determine the genetic differences in reproductive traits of two breeds of parent stock
B. Evaluate the effect of non-genetic factor on these traits.

MATERIALS AND METHODS

Site of study

Data for this study were collected from the farm records of Ajanla Farms (CHI Ltd.), Ibadan between 2002 and 2005. Ibadan is situated at an elevation of 200m above sea level and lies about $7^{0}28^{1}$ and $3^{0}54^{1}$. The city enjoys two distinct seasonal periods namely, rain (May-October) and dry season (November-April). The minimum and maximum temperatures on average during the year are 20^{0}C and 30^{0}C, respectively.

Breeds and their management

The exotic parent stocks studied are Barred Plymouth Rock (BPR) and White Plymouth Rock (WPR) hens and were managed on the floor throughout the production period for natural mating at ratio 1male:10females. The cocks were declawed to prevent injury during copulation and were separated from the females during growing (rearing) period until about two weeks to the laying time. This method adopted was to prevent pre-cocious mating and it afforded the cocks an opportunity to reach the prescribed weight and maturity. Management practices on the farm during the observed period were uniform. Cleanliness and bio-security measures were strictly adhered to while vaccinations against viral diseases were administered as and when due. Three batches of each breed of parent stock with a total population of 21,780hens (WPR: 10,974; BPR: 10,806) starting from 5% egg production for 48weeks/batch were used for this study. Batch here refers to a sequential order in the placement of certain number of birds on the farm at a particular time. Fertility percent was determined on the candling (18^{th}) day while hatchability percent was taken on the hatching (21^{st}) day.

Hatchery management

Temperatures and relative humidity during incubation were as follows:

a. Setting temperature- 99.75^{0}F (1-18days)
b. Setting humidity- 83%RH (1-18days)
c. Hatching temperature- 99^{0}F (19-21days)
d. Hatching humidity- 85%RH (19-21days)

Data Analysis

Data collected were subjected to analysis of variance (ANOVA) using the General Linear Model (SAS, 2001) and the significant differences between means of breeds and batches were determined by Duncan New Multiple Range Test of the computer package

The appropriate statistical model used for fertility and hatchability was:

$Yijk = \mu + Gi + Bj + \varepsilon ijk$

Yijk= Observation of the k^{th} population, of the j^{th} batch and i^{th} genotype

μ= common mean

Gi= fixed effect of genotype (i=2)

Bj= fixed effect of batch (j=3)

εijk=random errors assumed to be normally and independently distributed with zero mean and common variance.

RESULTS

Table 1 shows the analysis of variance of the effects of breed and batch on fertility and hatchability of the two breeds of layer breeders. There was no significant ($P>0.05$) effect of breed on fertility but the reverse was the case for hatchability. However, batch of breeder birds has highly significant ($P<0.01$) effect on fertility and hatchability.

DISCUSSION

Effects of breed and batch on fertility

The least square means showing the effect of breed on fertility were presented in Table 2. There was no significant ($P>0.05$) effect of breed on fertility in this flock.

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Table 1 - Analysis of variance showing the effects of breed and batch on fertility and hatchability						
Source	Df		MS		F-Value	
	Fertility	Hatchability	Fertility	Hatchability	Fertility	Hatchability
Breed	1	1	0.09	5.67	0.48	21.37***
Batch	2	2	3.95	3.57	20.59***	13.45***
Breed x batch	2	2	0.14	0.40	0.75	1.50
*** =P<0.001						

The average number of fertile eggs per hen per week recorded for BPR and WPR was 3.80±0.037 and 3.84±0.036, respectively and were similar. The result was in agreement with the findings of Ali et al. (1993) who observed that breed has no significant effect on this trait but contradicted those of Islam et al. (2002a) who reported significant effect of breed on fertility of breeder layers. The obtained result implied that maternal inheritance has little influence on percent fertility but that improved management, balanced nutrition and favourable environment would promote good fertility rate. Fertility as one of the reproductive traits is lowly heritable and largely influenced by environmental factors. Therefore, balanced breeder nutrition and optimum housing conditions will enhance the production of high quality fertile eggs in order to meet the increasing demand for commercial chicks.

Furthermore, the least square means for the effect of batch on fertility were given in Table 2. There was highly significant (P<0.01) effect of batch on fertility. Batch 1 recorded the highest mean (4.03±0.045 eggs) values, intermediate in batch 2 (3.80±0.045 eggs) and batch 3 (3.62±0.045 eggs/hen/week), being the lowest. The result was consistent with the findings of Jayarajan (1992) and Islam et al. (2002b) who reported significant effect of batch on fertility. The positive and significant batch influence on fertility indicates that breeder chicks produced from young grandparent stock are more vigorous, productive and efficient in terms of fertility rate than those from older birds. That is, the first set of chicks produced by grandparent birds are more productive than those produced at later or advanced ages and this might be due to declining reproductive efficiency of breeder hens with advancing age.

Interaction effects

There was no significant (P>0.05) breed x batch interaction effects on fertility in this flock (Table 3) and this was not in agreement with the findings of Islam et al. (2002a) who reported significant breed x batch interaction effect on fertility. This implies that breed and batch acted independently on these reproductive traits.

Table 2 - Least square means showing the effect of breed and batch on fertility			
Factors	N (weeks)	LSQ	SE
Genotype			
BPR	145	3.80	0.037
WPR	149	3.84	0.036
Batch			
1	97	4.03	0.045[a]
2	98	3.80	0.045[b]
3	99	3.62	0.044[c]
[a,b]: means along the column with different superscripts are significantly different; BPR- Barred Plymouth Rock; WPR- White Plymouth Rock			

Effect of breed and batch on hatchability

The least square means showing the effect of breed on hatchability was presented in Table 3. There was highly significant (P<0.01) effect of breed on hatchability. It was found that average number of chicks per hen for BPR and WPR respectively was 2.84±0.043 and 2.54±0.042. The former was however, superior to the latter. The result showed that breed differences exists in hatchability trait among breeds of parent stocks even though management and environment also play some positive and significant roles. The result corroborates the findings of Abdel-Rahman (2000) who reported significant effect of breed on hatchability but contradicted those of Islam et al. (2002b) who reported an insignificant effect of breed on this trait. In addition, the least square means showing the effect of batch on hatchability was given in Table 3. There was highly significant (P<0.01) effect of batch on hatchability. Batch 1 recorded the highest mean (2.88±0.053 chicks) values, intermediate in batch 2 (2.67±0.053 chicks) and batch 3 (2.50±0.052 chicks/batch/week), being the least. The batch's result on hatchability was similar to what was reported for fertility rate and it implies that there was a decline in reproductive efficiency of layer breeders with successive hatches from the same grandparent stock birds. The result was in agreement with the findings of Islam et al. (2002a) who reported significant effect of batch on hatchability and Gowe et al. (1993) who posited that there is usually a decline in fitness traits with advancing age of breeder hens. It was indicated in this study that BPR breed was productive, profitable and had superior genetic potential for this trait since more normal chicks were produced than WPR during the observed period which lasted 144 weeks.

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Interaction effects

There was no significant (P>0.05) breed x batch interaction effects on hatchability in this flock (Table 3) and this agreed with the findings of Islam et al. (2002a) who found no significant strain x batch significant effect on this trait.

Table 3 - Least square means showing the effect of breed and batch on hatchability

Factors	N (weeks)	LSQ	SE
Genotype			
BPR	145	2.83	0.042[a]
WPR	149	2.54	0.043[b]
Batch			
1	97	2.88	0.053[a]
2	98	2.67	0.053[b]
3	99	2.50	0.052[c]

[a,b:] means along the column with different superscripts are significantly different; BPR- Barred Plymouth Rock; WPR- White Plymouth Rock

CONCLUSION

Both genetic and non-genetic factors are important in the productivity of parent stock in this hot environment. There was highly significant (P<0.01) effect of breed on hatchability but the reverse was the case for fertility rate. Batch of breeder birds also significantly (P<0.01) affected both fertility and hatchability. BPR genotype appeared good and possessed genetic superiority over WPR in hatchability trait. It is hereby suggested that to meet the increasing demand for commercial chicks in this country, favourable environment, adequate nutrition and a more productive breed of parent stock should be provided.

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