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EFFECTS OF GENOTYPE AND AGE ON FERTILITY IN TWO CHICKEN PARENT STOCKS IN SOUTH-WESTERN NIGERIA

Bababunmi Alaba AJAYI, Kolade Ezekiel ADAMOLEKUN,
Aminat Omolola OLAYIWOLA

Osun State University, College of Agriculture, Faculty of Agricultural Production and Management, Department of Animal Science, (Ejigbo Campus). P. M. B. 4494, Osogbo, Osun State, Nigeria, Phone: +234 8038001269, Emails: bababunmi.ajayi@uniosun.edu.ng

Corresponding author: bababunmi.ajayi@uniosun.edu.ng

Abstract

This study was conducted to determine the effect of genotype and age on fertility of one chicken egg type (Hy-Line) and one broiler (Marshal) parent stocks in the derived savanna zone of South-western Nigeria. Cumulative data records from the hatchery of a reputable commercial poultry breeder farm were extracted and analysed with STATA® statistical package. Descriptive statistics and Pearson's correlation analysis were carried out. Results show that the percentage fertility in the two production types of breeders were high, indicating that the two breeder stocks can be used as egg line and broiler parent stocks in the study area. Pearson's correlation shows that age has a direct relationship with fertility in both breeds although not significant in Hy-Line but significant in Marshal ($p<0.001$). This indicates that there is a significant positive relationship between age and fertility, such that as age increases, fertility also increases to a peak and later declines as the age increases. It was concluded that, Hy-Line out-performed Marshal throughout the period of study and reached peak fertility (98.34%) earlier (30-40 weeks) than Marshal (91.11%) at between 41-50 weeks of age. Hy-Line showed higher fertility percentage than Marshal and it persisted till greater than 60 weeks of age.

Key words: *genotype, Hy-Line, Marshal, production type, fertility, chicken parent stocks*

INTRODUCTION

The reproductive performance of poultry birds is an integral component of their productivity and basic to this is the fertility. Fertility of the chicken parent stocks is vital to successful egg incubation, chick multiplication and production. It is a trait of major interest in the broiler industry due to its influence on chick output [12]. For successful operations in chick production, adequate knowledge is needed for planning and management of parent stocks. [3] noted that fertility in poultry is generally described as an independent trait, which is expressed in either male, after egg fertilization, or embryo development in the female. This author further stated that both male and female sexes contribute to fertility of the egg, and it is influenced by both genetic and non-genetic permanent environmental components. The genotype of the embryo to which both sexes had contributed is also a factor that affects fertility. [2] listed the factors affecting fertility from the male to include some sperm quality parameters which include: semen concentration, sperm motility, sperm metabolism and the percentage of dead sperm cells. [3] adds that, ability of the cock to successfully mate with the hen is another important factor. The hen effects on fertility include egg quality and the prevalence of sperm storage tubules.

[10] listed broadly several factors that can cause low fertility in chickens, and these include, wrong mating ratio, wrong time of collection, age of the breeder cocks and hen, and poor nutrition of the breeders. Others are bad management, social stress, and quality of the breeders. Many reports had indicated that breed or strain had effect on different traits in broilers, such as, carcass characteristics [5]; [8]; [9]; [6] and fertility [13]. This study was carried out to estimate the fertility from eggs set, determine the effect of genotype and age on fertility of two chicken parent stocks Hy-Line and Marshal (broiler) in the derived savanna zone of Southwestern Nigeria.

MATERIALS AND METHODS

Cumulative records, from 2013 to 2015, of incubation and hatchery records on 20,950 parent stocks, comprising 14,874 Hy-Line parent laying hens and 6,076 parent broiler hens from Marshall parents were obtained from RTO Farms in Southwestern Nigeria. The farm is located between Ede junction and Ara, in Egbedore Local Government area of Osun State on geographical coordinates: latitude 7^0 51' 0" North of the equator and longitude 4^0 23' 0" East of the Greenwich Meridian. The location enjoys two separate seasonal periods namely, rainy (April to October) and dry (November to March). The birds were housed in galvanized cages under intensive management. Feed was restricted and served twice daily and water was served *ad-libitum*. The eggs were packed six hourly and all other management practices were standards for breeder chicken rearing. The birds were artificially inseminated with undiluted freshly collected semen and fertility was estimated as percentage of incubated eggs that were fertile, and calculated as:

Fertility (%) = Total fertile eggs/Total eggs set ×100.

Statistical Analysis

Data were analysed with [11] version 15.0 analytical software for descriptive and t-test to determine significant difference in fertility of the two parent stocks. Pearson's product moment correlation coefficient model was utilized to show the relationship between age and fertility of Hy-Line and Mashal parents.

RESULTS AND DISCUSSIONS

The average percentage fertility for Hy-Line and Marshal parent stocks are shown in Table 1. At age below 30 weeks, Hy-Line showed 91.66% average fertility while 73.53% average fertility was observed in the Marshal Parent stocks. Table 1 also shows the values of the average percentage fertility for age groups (weeks) 31-40, 41-50, 51-60, and >60 of Hy-Line and Marshal, with 98.34, 98.02, 96.18, and 96.32%, and 90.15, 91.11, 90.35, and 88.39% respectively.

Average fertility for Hy-Line increased with increase in age from 30-40 weeks of age, and subsequent periods showed a decline in fertility till the end of the records at the 60^{th} week and above. Hy-Line showed the highest percentage fertility up to the 40th week while Marshal recorded its highest percentage fertility up to the 50th week. Furthermore, Table 1 consistently shows a higher absolute figures throughout the study period for Hy-Line. These results show a better performance of egg laying type over the Meat-type parent stocks. This result is in line with the findings of [1] in Saudi Arabia in Ross 308 and Cobb 500 parent stocks indicated that fertility to be affected by age of the breeder stocks. Further report from this author indicated that, eggs from breeder hens from older breeder broilers have large sizes and thus show lower fertility percentage. This might have accounted for the lower fertility shown by the broiler breeders (Marshal) when compared with the higher fertility exhibited by the egg-type breeder (Hy-Line). [7] also reported that as flock age increases fertility also decreases in South Africa. These authors further suggested that improved management should be given to ageing broiler breeder stocks in order to maintain a good level of performance.

Table 1. Fertility of Hy-Line and Marshal parent stocks

Age in weeks	Fertility	
	Hy-Line	Marshal
<30	91.66 ± 7.41	73.53 ± 17.40
31-40	98.34 ± 0.62	90.15 ± 6.73
41- 50	98.02 ± 0.60	91.11 ± 5.09
51- 60	96.18 ± 1.10	90.35 ± 5.03
>60	96.32 ± 1.44	88.39 ± 4.25

Source: Authors' results.

Figure 1 shows the trend in fertility for both Hy-Line and Marshal parent stocks. This shows more consistency in Hy-Line parent stocks than more fluctuations displayed by the Marshal. Fertility in the Marshall broiler breeders in this study was at the peak at between 41 to 50 weeks of age (91.11±5.09%) and continually decreasing from week 51 to 60 (90.35±5.03%) and at greater than 60 weeks of age (88.39±4.3). The trend in this

report is in line with that of [4] and [2] who stated that egg fertility decreased with increasing flock age and it is as a result of reduced mating frequency. This suggests that more attention should be given to older breeder chicken flocks to increase mating in order to improve fertility in the later part of their production cycle when natural mating system is used. This is important in most developing countries where the cost of replacement of breeder stocks might be enormous and thus the need to extend their productive cycle beyond normal.

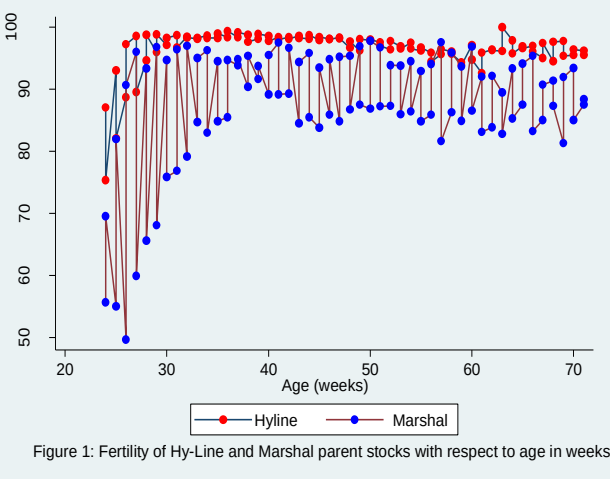

Figure 1: Fertility of Hy-Line and Marshal parent stocks with respect to age in weeks

Fig. 1. Fertility of Hy-Line and Marshal parent stocks with respect to age in weeks
Source: Authors' results.

Table 2 shows the result of the paired t-test between Hy-Line and Marshal. The Hy-Line parent stocks had a mean fertility of 96.53% while Marshal had a mean fertility of 87.91%. The mean difference in the fertility of the two parent stocks is 8.62% with a t-value of 8.3185 ($p<0.0000$) which is highly significant. This indicates a superiority in the fertility of egg line breed over the meat-type breeders. This result in this study is in line with the report of [1] in his study of Ross 308 and Cobb 500 which indicated chicken-type effect on fertility. [4] reported a negative correlation between the flock ages and fertility and early embryonic mortality. The authors reported that, as flock ages increases, the fertility decreases and early embryonic mortality increases in eggs from Ross 308 compared with Cobb 500. This indicates that, the higher the flock age, the lower the fertility and the higher the embryonic mortality. [4] also reported that egg size has effects on fertility, hatchability, embryonic mortality in broiler breeders. Higher percentage fertility was observed in small eggs (96.67%), medium (93.33%) and large (90.33%) ($p\leq0.05$). Further reports by these authors indicated that highest embryonic mortality ($p\leq 0.05$) in eggs occurred in the large size egg group.

Table 2. Paired t-test showing the significant difference in the percentage fertility of Hy-Line and Marshal parent stocks

Genotype	Mean %	Std. Error	Std. Dev	t-statistic	P>|t|
Hy-Line	96.5264	0.3458	3.3860		
Marshal	87.9062	0.9684	9.4885		
Combined	92.2173	0.6001	8.3155		
Difference	8.6181	1.0282		8.3815	0.0000

P>|t| = 0.01
Source: Authors' results.

The result in Table 3 reveals the relationship between fertility and age (in weeks) for both Hy-Line and Marshal. Pearson's correlation coefficient (0.1317) shows that there is a positive correlation between fertility and age of Hy-line and Marshal, however, the correlation is not statistically significant for Hy-Line but for Marshal, with Pearson's correlation coefficient (0.3002) is statistically significant at 1% level of significance. The results of this study are in agreement with that of [13] that reported breed effect in fertility in chicken.

Table 3. Pearson's product moment correlation coefficient showing the relationship between age and fertility of Hy-Line and Marshal parent stocks

	Hy-Line		Marshal	
	Coefficient	P-value	Coefficient	P-value
Fertility vs age (Weeks)	0.1317	0.2010	0.3002***	0.0030

Source: Authors' results.

CONCLUSIONS

This study shows that the percentage fertility of Hy-line and Marshal is high, indicating that, both breeds can be used in the derived savanna zone in Southwestern Nigeria for egg-layers or broiler production respectively. Fertility is significantly higher in Hy-Line than in Marshal parent stocks and it persisted

till greater than 60 weeks of age. Further results indicated that, there is a significant positive relationship between age and fertility, such that as age increases fertility also increases up to a point before a decline.

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