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Genotype X Season Interaction Effects on the Laying Mortality Rates of the Nigerian Local Chicken, the Barred Plymouth Rock and Their Crosses

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Abstract: An experiment was conducted to compare the effects of genotypes, seasons and genotype x season interactions on the laying mortality rates in the Nigerian local chickens (LC), the Barred Plymouth Rock (BR) and their F1 cross-progenies. The parent-stock was separated into four mating groups to produce four genotypes (G):- BR♂ x BR♀ (G1), LC♂ x LC♀ (G2) BR♂ x LC♀ (G3) and LC♂ x BR♀ (G4). The experiment was conducted during the dry and rainy seasons. Weekly mortality rates were computed for 24 weeks of lay. The data generated from the experiment were subjected to a 2 x 4 x 6 factorial analysis using S.A.S package. The results indicate that G2 and G3 with mortality rates (MR) of 1.91 and 3.28 respectively performed better than G1 and G4 with MR of 5.17 and 5.62 respectively. The results further indicate that experimental chickens performed better during the dry season (MR =3.08) than during the rainy season (MR=4.91). However, it was observed that the genotype x season interaction did not produce any significant effect on the mortality rates of the chickens. The results from this experiment underscore the need to improve the livability of the laying chickens by developing genotypes which are more tolerant with the local environment and the prevailing season. Based on the results, it was concluded that the mortality rates in the laying chicken can be reduced by crossing the exotic chicken with the local chicken and that a building system could be designed which can help reduce mortality rates during rainy seasons.

Key words: Local Chicken, developing tolerant genotypes, local environment, reduced mortality rates

Introduction

In the last two decades, the Nigerian poultry industry has depended on foreign breeds. A lot of foreign exchange was wasted on importation of breeding stock as well as drugs to maintain them in the unfriendly environment. Today, most of the poultry farms dotted all over the country have shut down and one of the major reasons responsible for this is the high mortality associated with the exotic chickens. (Ukagha, 1991) Cole *et al*. (2000) and Boettcher *et al*. (2003) in their separate studies observed that for non-production traits, genotype x environment interaction effects are virtually non-existent. However Omeje (1983) had observed earlier that genotype x age interaction effects were prominent in influencing the mortality rates in chickens. He noted that as the birds grew older and got stabilized in the environment, the mortality rates decreased. This investigation was designed to compare the laying mortality rates in the local chicken and the exotic chickens as well as their F_1 crosses during the dry and rainy seasons. The experiment further investigated the presence of genotype x season interaction influence on the mortality rates of the experimental chickens. The information from this investigation will be used to design a programme for the development of a foundation stock with the local chicken as the base because countries that have excelled in animal production have bred and selected their local livestock for traits of economic importance (Aini, 1997, Igboeli, 2000).

Materials and Methods

The study was carried out in the Faculty of Agriculture, Department of Animal Science, Delta State University Asaba Campus- Nigeria. The population under study was derived from 100 mature pullets and 20 mature cockerels of Barred Plymouth Rocks, 100 mature local pullets and 20 mature local cockerels. The parent-stock was separated into 4 mating groups to produce 4 genotype as shown below:

Mating Groups		Genotypes
BR♂ x BR♀: 50 Barred Plymouth Rocks pullets Mated to 10 Barred Plymouth cockerels	=	G1
LC♂ x LC♀: 50 local chicken pullets mated to 10 local chicken cockerels	=	G2
BR♂ x LC♀ : 50 Local chicken pullets mated to 10 Plymouth Rock cockerels	=	G3
LC♂ x BR♀ : 50 Plymouth Rock pullets mated to 10 Local chicken cockerels	=	G4

The mating was by artificial insemination. Hatchable eggs were collected from each mating group and then hatched to produce enough day-old chicks. 120 day-old chicks were randomly selected from each mating group to make up the four genotypes and brooded for 28 days. During the brooding period, the birds were fed *ad lib* with Top feeds mash (21% cp and 3000 Kcal ME/kg). At the end of the brooding, the birds were transferred to the rearing pens where they were fed *ad lib* with Top feeds grower mash (18% CP and 2, 900 Kcal ME/kg). At the

Table 1: Results of the mortality rates of the experimental chickens

Age	Season	Genotypes Mean±SE			
A	S	G1	G2	G3	G4
A1	S1	7.83±1.28^{a}	0.00±0.00^{c}	6.55±0.00^{b}	7.83±0.00^{a}
	S2	7.83±1.28^{a}	3.28±3.28^{c}	6.55±0.00^{b}	7.83±0.00^{a}
A2	S1	4.55±4.56^{b}	0.00±0.00^{d}	3.28±3.28^{c}	7.83±1.28^{a}
	S2	7.83±1.28^{a}	3.28±3.28^{c}	6.55±0.00^{b}	7.83±1.28^{a}
A3	S1	3.28±3.28^{b}	3.28±3.28^{b}	3.28±3.28^{b}	6.55±0.00^{a}
	S2	7.83±1.28^{a}	3.28±3.28^{b}	3.28±3.28^{b}	6.55±0.00^{a}
A4	S1	3.28±3.28^{b}	3.28±3.28^{b}	3.28±3.28^{b}	6.55±0.00^{a}
	S2	6.55±0.00^{a}	0.00±0.00^{c}	0.00±0.00^{c}	3.28±3.28^{b}
A5	S1	3.28±3.28^{a}	0.00±0.00^{b}	0.00±0.00^{b}	0.00±0.00^{b}
	S2	6.55±0.00^{a}	6.55±0.00^{a}	6.55±0.00^{a}	6.55±0.00^{a}
A6	S1	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}	0.00±0.00^{a}
	S2	3.28±3.28^{b}	0.00±0.00^{c}	0.00±0.00^{c}	6.55±0.00^{a}
Total		62.09	22.95	39.32	67.35
Mean		5.17±0.16^{a}	1.91±0.16^{c}	3.28±0.16^{b}	5.61±0.16^{a}

A indicates weeks of lay . A1 = WK1 – 4, A2 = WK4 – 8, A3 WK 8- 12 (28 – 32 WKS) . A4 = wk 12 –16, A5 = WK 16 – 20, A6 = WK 20 – 24 = WKS. S indicates season of production. S_1 = dry season, S2 = rainy season.

Table 2: ANOVA Table on the mortality Rates of the Experimental chickens

Source	df	SS	Ms	F 0.05
Genotype	3	212.54	70.85	9.25*
Age	5	222.20	44.44	5.80*
Season	1	80.12	80.12	10.46*
Genotype x Age	15	87.16	5.81	0.7NS
Genotype x Season	3	11.13	3.71	0.48NS
Age x Season	5	118.12	23.62	3.084*
Genotype x Age x Season	15	90.20	6.01	0.79NS
Error	48	367.73	7.68	
Total	95	2718.81		

Table 3: Separation of means (genotypes)

MSE = 7.661
Harmonic mean sample size =24
α = 0.05
Duncan Grouping

Mean	N	Genotype
1.91 ± 0.16^{a}	24	G2
3.28 ± 0.16^{a}	24	G3
5.17 ± 0.16^{b}	24	G1
5.61 ± 0.16^{b}	24	G4

Means with the same superscripts are not significantly different.

end of 20 weeks, the birds started laying thus collection of data on mortality started. The birds were fed with Top feeds layer mash. Weekly mortality rates were computed for 24 weeks of laying for each genotype after which the experiment terminated. The data were transformed into arcsine (Snedecor and Cochran, 1965) and data subjected to statistical analysis using SAS (2000). There were two experiments. The first one was mounted in September to March (dry season = S1) and the second experiment was mounted in April to October to correspond to rainy season (S2)

Table 4: Separation of means (age)

MSE = 7.661
Harmonic mean sample size =16
α = 0.05
Duncan Grouping

Age	Mean±S.E	N
A6	1.23 ± 0.19^{a}	16
A4	3.28 ± 0.19^{b}	16
A5	3.68 ± 0.19 ^{b}	16
A3	4.66 ± 0.19^{bc}	16
A2	5.14 ± 0.19^{bc}	16
A1	5.99 ± 0.19^{c}	16

Results and Discussion

Table 1 presents the results on the mortality rates (MR) of the experimental chickens, while Table 2 presents the ANOVA on the mortality rates. The results indicated that genotype, age, season as well as age x season interaction effects were significant (P<0.05) in influencing the mortality rates of the experimental chickens. However, the other factors such as genotype x age, genotype x season and genotype x age x season interaction effects were not significant (P<0.05) in influencing the mortality rates. This result appears to confirm earlier conclusions drawn by Cole *et al.* (2000) and Boettcher *et al.* (2003) which asserted that for non production traits, genotype x environment effects are virtually non existent. Table 3 presents separation of genotype means. From this table, it can be observed that G2 (LC) had the least mortality rates (1.91). And it was closely followed by G3 (BR♂ x LC♀) while the highest mortality rates occurred in G1 (BR) and G4 (LC♂ x BR♀). The result indicates that crossing the local chicken with BR could be an option for alleviating the mortality rates in the poultry industry. Table 4 shows that most of the

Table 5: Comparison of mortality rates in the two seasons (Pair wise comparison)

Seasons	Mean	S.E.				
S1	3.08	0.400				
S2	4.91	0.400				
					95% confidence interval	
(I) Season	(J) Season	Mean difference (I-J)	S.E.	Signif. level	lower bound	upper bound
S1 (3.08)	S2 (4..91)	-1.83*	0.565	0.002	-2.963	-0.691
S2 (4.91)	S1 (3.08)	1.83*	0.565	0.002	-691	-2963

*Based on estimated marginal difference, the mean difference is significant at the 0.05 level.

deaths occur during the early part of the laying period and this reduces as birds get older. This agrees with Omeje (1983) who observed that as the birds get older, they become more stabilized in the environment and deaths reduce.

Table 5 presents pair wise comparison of the mortality rates of the experimental birds during the two seasons. The results indicate that the mortality rate in the rainy season (S2 = 4.91) was significantly ($P<0.05$) higher than that of the dry season (S1 = 3.0 8) .The implication of this result is that a building system should be designed or extra prophylactic methods must be adopted to protect the chickens from the environmental hazards that predispose them to high death rate during this period.

Based on the results of this experiment, the following conclusions were made:

1. That the mortality rates are very low in the local chicken, when compared with exotic chickens.
2. That the mortality rates in the reciprocal cross (BR♂x LC♀ = G3) compares very well with the local. chicken This implies that crossing male BR on female LC could be used as a means of improving the local chicken.
3. That since the birds die more during the rainy season, a building system could be designed while more strenuous prophylactic measures should be adopted for the rainy season in order to reduce mortality during this period.

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