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COMPARATIVE ANALYSIS OF THE ECONOMIC PERFORMANCE OF SHIKA BROWN, ISA BROWN AND HARCO BLACK LAYERS: AN EXPERIMENTAL APPROACH

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Abstract

The Shika brown layer is a Nigeria indigenous hybrid bred to solve the problem of adaptability to the local weather condition of the exotic layer strains (Isa brown and Harco black). Data were collected from the experiment conducted using 117 point of lays obtained from the three genotypes. Costs incurred on inputs such as feeds and drugs along with income generated from eggs produced including the returns from the sale of spent layers were considered for comparative economic analyses. Analysis of variance (ANOVA), profitability and productivity analyses were employed in data analysis. The ANOVA showed significant differences ($p<0.05$) in the average body weight and egg production of Shika brown, Isa brown and Harco black. Shika brown had the highest gross margin and a profitability index of 0.38 compared to Isa brown and Harco black. The results showed that the three layer strains are all good converters of feed to eggs, though Isa brown seems to be more productive. Shika brown had the lowest mortality of 10.3 % compared to that of Isa brown and Harco black of 23 % and 26 % respectively, thus, showed hardy and less susceptibility distinctiveness to diseases. The need to give increased preference to Shika brown chicken based on its adaptability and profitability indices is recommended.

Key words: *shika brown, adaptability, economic analysis, egg production, layer strains*

INTRODUCTION

Poultry production is important to the biological needs, economic and social development of the people in any nation [16]. The Nigerian poultry industry has been rapidly expanding in recent years and is therefore one of the most commercialized subsectors of Nigerian agriculture [1, 22]. Poultry is strategic in addressing the animal protein intake of man because of its high fecundity, growth rate, short gestation period and unparalleled competence in nutrient transformation to high quality animal protein [7]. The demand for poultry egg in Nigeria has risen from 500,000 metric tonnes in 1980 [10] to about 1, 500,000 metric tonnes in 2012 [8]. Commercial layer strains produce eggs for food and processing industries. As a commercial enterprise, the success depends largely on the total number and weight of eggs produced. Despite the strategic role of poultry in addressing animal protein intake shortage in human, there is strong evidence that there are genetic differences in growth rate between strains of chickens [5]. Empirically, there are climatic factors militating against the survival of the poultry industry [4, 13, 20, 15]. The commercial layer strains reared in Nigeria are majorly exotic breed [18]. There are unfavourable tropical weather conditions which impact negatively on the productivity of all domestic animals including poultry and also the problem of adaptability to the local weather conditions with these imported strains, scarcity of feed ingredients and high costs of other poultry equipment [9]. Harco black and Isa brown are among the most popular exotic laying chickens in Nigeria. The climatic variation which affects the productivity of the exotic breeds leads to the innovation of an indigenous breed (Shika brown) with high resistance to adverse climatic conditions. However, due to climatic

variations, these exotic breeds of layers in the country are susceptible to local diseases and heat stress thereby inhibiting them from expressing their full genetic potentials which consequently result to low productivity [17].
Studies have been conducted on these strains [2, 3, 14] with none on the comparative analysis of the economic performance of the strains managed under the same housing and environmental condition to examine that which is most profitable as an outcome of egg production and as culled birds. This economic question was addressed through the application of experimental method, thus, the research gap filled by the study.

MATERIALS AND METHODS

The birds used for the study were reared at Ilorin, Kwara state, North Central, Nigeria, using private poultry facilities. Ilorin has a co-ordinate of 8°30' 0" North, 4°33' 0" East. It lies on an altitude of 305m, 1001' above sea level; with annual rainfall, relative humidity and day temperature of 600-1,200 mm, 65-80 % and 33-37^{0}C respectively. Hens were reared on battery cage system and intensively housed in separate pens. The average feed consumption rate for both Shika brown and Harco black was 1.4 kg/day while that of the Isa brown layers was 1.2 kg/day. Water was given to the layers *ad libitum* fortified with vitamins and micronutrients. They were dewormed at three months interval. Antibiotics and vaccines against Newcastle diseases were administered on regular basis. Daily recordings of egg production were taken on breed basis and this continued until the birds were one year in lay. The study was carried out between March 2015 and March 2016. Data on 117 Shika brown, Isa brown and Harco black commercial layer strains were collected for the study. This included cost of inputs such as feeds, drugs, veterinary services, and sales from eggs produced. These costs and revenue generated were computed separately for the three strains in order to compare the efficiency and net returns.

Analytical Technique

Budgetary Technique

The profitability of layer production was examined using the budget analysis as adopted by [6]. It is expressed as:

Gross Margin = Total Revenue –Total Variable Cost ..... (1)

where:
Total Revenue is the total value of crates of eggs laid (₦);
Total Variable Costs are costs on feeds, veterinary services and drugs (₦)

Net Profit = Total Revenue –Total Cost ..... (2)

Total Cost = Total Fixed Cost + Total Variable Cost ..... (3)

where:
Total fixed costs are the deprecation value on cage.

Productivity Ratio

Productivity of layer production was examined through the average productivity of the inputs used in production. Two indicators were used to assess feed and drugs and veterinary services productivities. These productivities are estimated as;
Feed productivity: the ratio of egg produced per feed consumed. It is expressed as:

Quantity of egg produced / Quantity of feed consumed ..... (4)

Drugs and veterinary services productivity: the ratio of egg produced per drugs and veterinary services provided. It is expressed as:

Quantity of egg produced/Costs on drugs and veterinary services ..... (5)

RESULTS AND DISCUSSIONS

Body weights of Shika brown, Isa brown and Harco black hen

The result of the body weight of the three breeds (Shika brown, Isa brown and Harco black) at the pullet stage is presented in Table

1. A statistical difference ($p<0.05$) in the body weight of Shika brown, Isa brown and Harco black was observed at week 19 and week 21. The results showed that Harco black was significantly higher ($p<0.05$) in body weight than both Shika brown and Isa brown at 19 and 21 weeks of age.

Table 1. Body weights of Shika brown, Isa brown and Harco black pullets (17–21 weeks old)

Weeks	Breeds (N=39 Replicates)	Mean	SEM	F	Sig
WEEK 17	SHIKA BROWN	1.425	0.0174	1.116	0.331
	ISA BROWN	1.391	0.0161		
	HARCO BLACK	1.414	0.016		
WEEK 18	SHIKA BROWN	1.475	0.020	1.510	0.225
	ISA BROWN	1.520	0.021		
	HARCO BLACK	1.478	0.019		
WEEK 19	SHIKA BROWN	1.593	0.022	16.852	0.000
	ISA BROWN	1.592	0.023		
	HARCO BLACK	1.764	0.028		
WEEK 20	SHIKA BROWN	1.762	0.025	0.788	0.457
	ISA BROWN	1.730	0.022		
	HARCO BLACK	1.773	0.027		
WEEK 21	SHIKA BROWN	1.781	0.025	3.497	0.034
	ISA BROWN	1.810	0.022		
	HARCO BLACK	1.866	0.023		

Source: Data Analysis, 2017.

Egg weights of the Shika brown, Isa brown and Harco black hens

The mean weekly egg weights of the Shika brown, Isa brown and Harco black hens result is presented in Table 2.

Table 2(a). Mean weekly egg weights of Shika brown, Isa brown and Harco black hens

WEEK	MEANS			F	Sig.
	SHIKA BROWN	ISA BROWN	HARCO BLACK		
1	14.833 [a]	5.8733 [a]	15.280 [a]	2.170	0.127
2	31.466 [a]	29.413 [a]	7.426 [b]	105.600	0.000
3	33.080 [c]	31.913 [c]	24.366 [b]	5.041	0.011
4	32.773 [a]	33.293 [a]	40.426 [b]	4.771	0.014
5	37.623 [a]	34.553 [b]	46.300 [c]	44.364	0.000
6	38.060 [a]	37.333 [a]	48.193 [c]	12.622	0.000
7	38.633 [b]	38.120 [b]	54.153 [a]	51.527	0.000
8	40.313 [a]	38.807 [a]	51.046 [b]	7.097	0.002
9	44.253 [c]	41.980 [c]	52.406 [a]	10.178	0.000
10	47.940 [b]	45.286 [b]	56.560 [c]	21.971	0.000
11	51.160 [a]	49.453 [a]	57.573 [b]	10.564	0.000
12	54.093 [c]	54.440 [c]	50.820 [c]	1.100	0.342
13	58.073 [b]	55.880 [b]	56.373 [b]	0.961	0.391
14	60.800 [a]	57.120 [a]	57.206 [a]	2.817	0.071
15	63.300 [b]	58.380 [c]	57.706 [c]	9.278	0.000
16	66.633 [a]	60.300 [b]	56.380 [b]	28.659	0.001
17	65.000 [a]	49.913 [b]	58.193 [c]	4.932	0.000
18	66.046 [b]	57.953 [bc]	55.233 [c]	1.318	0.012
19	59.540 [c]	56.326 [c]	57.513 [c]	0.970	0.279
20	57.080	59.233 [b]	58.226 [b]	1.073	0.388

[a,b,c] is the significance differences as gotten from ANOVA test of significance
Source: Data Analysis, 2017.

The result therefore, shows that there exist a significant difference among the breeds in most of the weeks and where significant differences were observed, treatment means were subjected to Duncan's Post Hoc Test and considered significance at $P<0.05$. The results

showed that Harco black eggs weighed most and there were significance differences (P<0.05) at week 19 and 21 which is followed by Shika brown then Isa brown layers. Hence, the weight of the egg influences the egg price since there is a direct relationship between the size of egg and the price of egg sold.

Table 2(b). Mean weekly egg weights of Shika brown, Isa brown and Harco black hens

WEEK	MEANS			F	Sig.
	SHIKA BROWN	ISA BROWN	HARCO BLACK		
21	60.446 [a]	58.906 [a]	61.153 [a]	0.910	0.351
22	61.266 [c]	59.673 [c]	60.666 [c]	1.042	0.410
23	57.233 [a]	60.873 [a]	59.893 [a]	1.769	0.362
24	58.080 [b]	60.980 [b]	58.493 [b]	17.038	0.183
25	65.020 [c]	59.773 [a]	61.380 [a]	28.659	0.000
26	62.573 [a]	57.113 [b]	60.666 [a]	9.302	0.000
27	67.046 [c]	60.413 [ac]	52.006 [a]	5.088	0.011
28	57.453 [a]	55.466 [a]	63.693 [b]	7.056	0.002
29	57.453 [b]	45.986 [a]	55.186 [b]	2.872	0.068
30	57.500 [b]	47.846 [c]	60.606 [b]	11.376	0.000
31	58.873 [b]	51.526 [c]	57.360[bc]	4.024	0.025
32	58.426 [a]	55.086 [a]	56.260 [a]	1.002	0.376
33	57.313 [c]	48.520 [b]	56.586 [c]	3.435	0.042
34	59.746 [b]	51.626 [a]	60.626 [a]	7.825	0.001
35	59.240 [b]	56.993[ab]	60.273 [b]	3.787	0.031
36	57.140 [a]	57.806 [a]	59.886 [a]	1.228	0.303
37	56.980 [c]	56.360 [c]	59.186 [c]	1.913	0.160
38	55.926 [b]	57.093[ab]	59.746 [a]	5.629	0.007
39	54.693 [b]	57.126 [b]	60.200 [b]	16.864	0.000
40	57.200 [c]	56.886 [c]	57.886 [c]	0.212	0.810

[a,b,c] is the significance differences as gotten from ANOVA test of significance
Source: Data Analysis, 2017.

Table 2(c). Mean weekly egg weights of Shika brown, Isa brown and Harco black hens

WEEK	MEANS			F	Sig.
	SHIKA BROWN	ISA BROWN	HARCO BLACK		
41	56.533 [a]	54.286 [a]	57.3600 [a]	1.058	0.356
42	55.686 [c]	54.320 [c]	56.260 [c]	0.02	0.741
43	55.986 [b]	56.026 [b]	56.586 [b]	0.060	0.942
44	58.266 [c]	58.000 [c]	60.626 [c]	2.225	0.121
45	57.620 [c]	57.566 [c]	60.273 [c]	3.134	0.054
46	57.720 [a]	56.340 [a]	59.886 [a]	2.897	0.066
47	57.306 [a]	56.620 [a]	59.186 [a]	1.897	0.163
48	58.073 [b]	57.140 [b]	59.746 [b]	2.309	0.112
49	56.793 [a]	56.900 [b]	60.200 [c]	10.064	0.000
50	56.700 [b]	56.433 [b]	57.886 [b]	0.436	0.650
51	56.846 [c]	57.280 [b]	60.200 [a]	8.638	0.001
52	56.813 [a]	57.093 [a]	57.886 [a]	0.202	0.818

[a,b,c] is the significance differences as gotten from ANOVA test of significance
Source: Data Analysis, 2017.

Egg production in laying hens

From the results in Table 3, there is a significant difference between the rate of egg production of Shika brown, Isa brown and Harco black layers {F (2, 465= 18.375, p= 0.000}. Table 3 and Fig. 1 clearly demonstrates that Isa brown layer strain records higher egg production than the Shika brown and Harco black layer strains for almost all weeks. The mean weekly egg production for the Isa brown layer is 175.3 while it is 163.3 and 145.7 for the Shika brown and Harco black layer strains respectively. The findings of this study correspond with the results of [19, 11, 12]. They all observed that there exists a

significant difference in the laying pattern of various breeds of commercial layers.

Table 3. Effect of breed on 52-week egg production in laying hens

SOURCE	Sum of Squares	Df	Mean Square	F	Sig
BETWEEN BREEDS	5924.543	2	2962.271	18.375	0.000
WITHIN BREEDS	74963.122	465	161.211		
TOTAL	80887.665	467			

Source: Data Analysis, 2017.

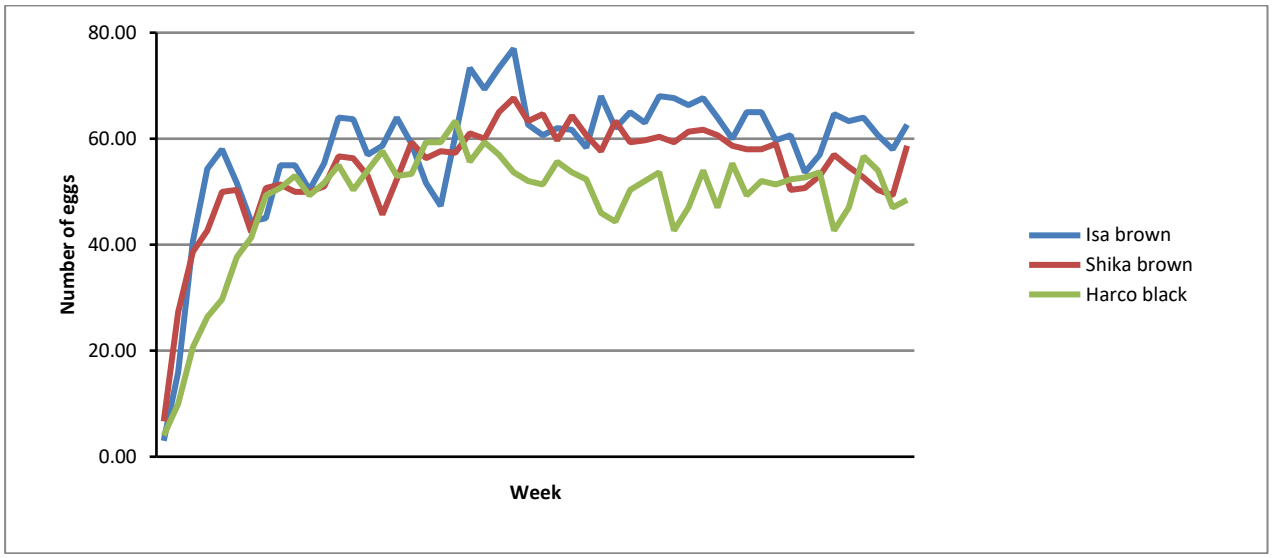

Fig. 1. Trend in the egg production of Shika brown, Isa brown and Harco black layers
Source: Data Analysis, 2017.

Productivity analysis of Shika brown, Isa brown and Harco black layers

The estimate of productivity for the three different layer strains is presented in Table 4. The partial productivities revealed higher productivities for Isa brown layers as compared with the Shika brown and Harco black layers. Isa brown layer had a productivity difference of 1.38 and 1.78 than Shika brown and Harco black respectively in their feed to egg conversion ratio. Nevertheless, it can be said that the three breeds are good converters of feeds to eggs because Harco black and Shika brown produce bigger eggs while Isa brown had the highest number of eggs laid.

Table 4. Estimated Productivities for Shika brown, Isa brown and Harco black layers

Productivity	Shika brown	Isa brown	Harco black
Veterinary services and drugs (number of eggs/₦)	1.16	1.25	1.03
Feed (number of eggs/total quantity of feed in kg)	6.17	7.55	5.77

Source: Data Analysis, 2017.

Profitability analysis of Shika brown, Isa brown and Harco black layers

The result of the costs and returns of the different layer strains is presented in Table 5. It showed that Shika brown has the highest gross margin of ₦56,542.52 followed by Isa brown with ₦52,788.79. The variation observed despite Isa brown producing the higher numbers of egg stem down to Shika brown producing bigger eggs and egg size influences the price. Harco black had the least gross margin (₦48,177.25). Expectedly, considering the gross margin value, the profitability index shows that the Shika brown layer is the most profitable of the different strains of layers. This is in tandem with the findings of [21] who reported a significant

($p<0.01$) effect of breed on the gross margin of black and brown commercial layer strains.

Table 5. Cost and Returns for Shika brown, Isa brown and Harco black layers (₦) at 52 weeks

ITEMS	SHIKA BROWN	ISA BROWN	HARCO BLACK
Total Revenue	186,515.34	180,173.01	₦178,150
Less variable cost			
Cost of feed	122,684.32	120,095.72	122,684.32
Cost of drugs and veterinary services	7,288.5	7,288.5	7,288.5
Gross margin	56,542.52	52,788.79	48,177.18
Less fixed cost			
Cost of layers	6,240	5,850	5,850
Depreciation value of cage	12,000	12,000	12,000
Net Returns	38,302.52	34,938.79	30,327.18
Profitability index	0.38	0.36	0.33

Source: Data Analysis, 2017
Mortality Rate in Percentage; 0.10, 0.23, 0.26 for Shika brown, Isa brown and Harco black respectively.

Harco black recorded highest percentage of mortality rate of 26% which occurred mostly during the dry season due to their inability to withstand the harsh weather condition. Isa brown had mortality rate of 23% while Shika brown recorded the least percentage mortality of 10.3% because they could adapt to the change in weather condition.

CONCLUSIONS

In all, the analysis revealed that Shika brown layers are more profitable but all the breeds are good converters of feed to eggs. The results on mortality showed that Shika brown has more resistance to weather and diseases and also that Isa brown has the lowest production cost. The result on profitability analysis showed that Shika brown layers are the most profitable breed while egg production showed that Isa brown has the highest number of eggs compared with Shika brown and Harco black. Shika brown recorded the highest net profit compared with Isa brown and Harco black. From the results of the study, profitability and survivability was highest in the Shika brown than in the other two strains. The study therefore recommended the need to give increased preference to Shika brown chicken based on its adaptability and profitability indices. This could be achieved by educating the farmers on the different kinds of layer. More so, stakeholders and policy makers should lend a hand in making Shika brown available in all parts of the country.

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