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PERFORMANCE OF LAYING CHICKENS FED DIETARY LEVELS OF RED SORGHUM VARIETY (*Sorghum bicolor (L.)*)

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ABSTRACT

A four week experiment was conducted to evaluate the performance and economics of egg production using red sorghum variety in the diets of Isa Brown layers. The experiment was conducted at the Teaching and Research Farm of Abubakar Tafawa Balewa University, Bauch, between June and August 2014. Three hundred (300) layer birds were allotted to five dietary treatments in a completely randomized design (CRD), the birds were randomly distributed into the five dietary treatments replicated three times of twenty (20) hens per replicate and sixty (60) per diet. In the experimental diets, red sorghum variety replaced maize at 0, 25, 50, 75 and 100% respectively coded as diets 1,2,3,4, and 5 respectively. The results showed that daily feed intake-DFI (121.22 - 148.92g), hen day-HD (59.80 - 70.25%), hen housed -HHP (57.50 - 67.83%), feed conversion ratio-FCR (2.29 - 2.70), egg grading: grade 1 eggs (37.78 - 61.11%), and grade 2 eggs (38.89 - 62.22%) were not affected by the dietary treatments. The cost benefit analysis showed that feed cost in ₦/Kg egg weight was lowest in treatment 3 (50% red sorghum) with a cost saving of ₦39.04 per kg of feed. It is therefore concluded that red sorghum can completely replace maize (in the diets of Isa Brown layers with no adverse effects on performance and cost of egg production, however, 50% replacement level was most economical.

Key Words: Red Sorghum, Laying Chickens, Performance, Economic Analysis.

INTRODUCTION

Poultry production is beneficial to man through the provision of meat, egg and other poultry products. The poultry industry has suffered more than any other livestock industry as a result of inadequate supply and high cost of feed (Lepleaideur, 2004). Cereals grains constitute the major sources of energy in poultry diets in the tropics (Oluyemi and Roberts, 2000). However, maize has remained the chief energy source in compounded diets and constitutes about 50% of poultry ration (Ajaja *et al*., 2002). According to Bamgbose *et al*. (2004) maize accounts for about 45 to 55% of poultry feed. It also served as the major stable foods for a good proportion of Nigerians. Thus, its ever-increasing demand for human consumption, livestock feed and industrial uses have continuously raised its market price there by increasing the cost of animal feed. Therefore, there is need to find a substitute for maize that will give a similar or better performance in laying hens, which is cheaper and readily available such as sorghum.

Sorghum is a drought resistant cereal that is produced worldwide. It is mostly used as a cereal grain energy source and is a good feedstuff for both monogastric and ruminant animals. Maunder (2002) consider sorghum as a traditional crop in Africa and Asia and an introduced and hybridized crop in the western hemisphere. Abdoulaye *et al*. (2006) reported that in Africa and India sorghum is a staple food used secondarily as feed. Sorghum grain is higher than maize in protein content but lower in fat content (NSP, 2014). The crude protein content in sorghum grain ranges from 9 to 13 % DM and is slightly higher than that of maize, though it can varies, depending on growing conditions (Jacquie, 2014). Sorghum has high nutritional value of protein, fibre and minerals like phosphorus, calcium and iron (Siddique, 2013). Sorghum benefits from an

ability to tolerate drought, soil toxicities and temperature extremes effectively than other cereals (Etuk *et al*., 2012). It is cheaper than maize and abundantly available in most parts of northern Nigeria (Abubakar *et al.*, 2006). Therefore, this experiment was conceived to determine the performance and cost benefit of egg production of laying chickens fed dietary levels of red sorghum.

MATERIALS AND METHOD

Site description

The experiment was carried out at poultry section of the Teaching and Research Farm of Abubakar Tafawa Balewa University, Bauchi, Bauchi state. The temperature ranges from 21 – 35^0C with annual rain fall of 700mm to1300mm per annum (BSGP, 2010). . Geopolitically, Bauchi lies between Latitude 10^0 33^1N and longitude 9^0 31^1E of the Greenwich meridian. It is located in the North Eastern part of Nigeria. Bauchi is bordered by seven states, Kano and Jigawa to the North, Taraba and Plateau to the South, Gombe and Yobe to the East and Kaduna to the west. It occupies a total area of 49,259.01Sq Kilometers, representing about 5.3% of the total land mass of Nigeria. The state falls within guinea savannah zone. Source of Test Ingredient and Experimental Birds

Source of test ingredient and experimental birds

The red sorghum used in formulating the diets was obtained from market in Bauchi metropolis. A total of three hundred (300) Isa Brown layer birds at point of lay (22 weeks old) were purchased from Dumi village in Bauchi local government, Bauchi state.

Experimental design and management of birds

Five(5) treatment diets (17 - 18% CP) were formulated in which red sorghum variety replaced maize at 0, 25, 50, 75 and 100% levels coded as diets 1, 2, 3, 4 and 5 respectively. The red sorghum replaced equivalent proportion of maize in the diets. The sorghum was crushed and mixed with other ingredients.

The 300 Isa Brown layers were used for the experiment which lasted for 14 weeks (June to August). The birds were allowed to acclimatized with the environment and the experimental diets for six weeks before proceeding on data collection. During the experiment, anti-stress and antibiotics were provided whenever needed.

The birds were randomly allotted the five dietary treatments in a completely randomized design (CRD), each treatment was replicated three times with twenty (20) hens per replicate making a total of sixty (60) hens per treatment. Feed and water were offered *ad-libitum* the birds were raised on deep litter. Data on daily feed intake was determined by weighing the left over feed and subtracting the value obtained from the total quantity of feed given to the birds initially. Feed conversion ratio was determined by collecting eggs from each replicate weighed and the quantity of feed consumed was divided by the number and dozens of eggs produced. Record of mortality was taken as they occurred, the number of eggs laid by the hens per replicate was recorded daily and percentage hen day (HDP) was calculated as number of eggs produce divided by number of hens present multiplied by hundred using the formulae:

$$\text{HDP (\%)} = \frac{\text{Total eggs produced}}{\text{Number of live birds}} \times 100$$

Percentage hen housed production (HHP) was also calculated as the number of eggs produced divided by initial number of hens housed multiply by 100.

$$\text{HHP (\%)} = \frac{\text{Total eggs produced}}{\text{Initial number of birds housed}} \times 100$$

Feed conversion ratio (FCR) was calculated for each replicate as the ratio of the feed consumed to the total number of dozens of eggs produced.

$$\text{FCR} = \frac{\text{Feed intake (kg)}}{\text{Dozens of egg produced}}$$

Towards the end of the experiment, eggs laid during last two weeks of the experiment were used for egg grading. Eggs were classified into three grades based on size. 1^{st}

grade(jumbo, > 60g), 2nd grade (large to extra-large, 50-60g), and 3rd grade (small to medium, < 50g). The grading was done by weighing the eggs one after the other on electrical weighing scale and then manually graded based on weight.

The economic analysis of egg production using red sorghum was computed using prevailing market prices of feed ingredients as at the time of study.

Data collected were subjected to analysis of variance (ANOVA), and where significant difference between means was observed, Duncan multiple range test (Duncan, 1955) was used to separate them.

RESULTS AND DISCUSSION

Table 1: Ingredients and percentage composition of dietary levels of Red sorghum variety fed to laying hens

	Diets				
Ingredients	**1(0%)**	**2(25%)**	**3(50%)**	**4(75%)**	**5(100%)**
Maize	50.00	37.50	25.00	12.50	0.00
Sorghum	0.00	12.50	25.00	37.50	50.00
Roasted soya bean	13.00	13.00	13.00	13.00	13.00
Groundnut cake	5.00	5.00	5.00	5.00	5.00
Wheat offal	19.30	19.30	19.30	19.30	19.30
Fishmeal	2.00	2.00	2.00	2.00	2.00
Limestone	7.00	7.00	7.00	7.00	7.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methonine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein (%)	16.80	17.10	17.30	17.60	17.80
ME(kcal/kg)	2653	2641	2628	2616	2602.
Crude fibre (%)	4.15	4.06	3.98	3.89	3.80
Ether Extract (%)	5.05	4.88	4.70	4.53	4.35
Calcium (%)	3.74	3.74	3.74	3.74	3.74
Phosphorus (%)	0.98	0.98	0.98	0.98	0.98
Methionine %	0.77	0.78	0.79	0.79	0.80
Lysine %	0.28	0.28	0.26	0.26	0.25

***Vitamin-mineral Premix-** contain the following per 2.5kg: vit. a, 10,000,000 iu; vit. d_3 2,000,000iu; vit. e 12,000mg; vit. k_3 2,000mg; vit. b_1 1,500mg; vit. b_2 4,000mg; vit.b_6 1,500mg; niacin 15,000mg; vit. b_{12} 10mcg; pantothenic acid 5,000mg; folic acid 500mg; biotin 20mcg; choline chloride 100,000mg; manganese 75,000mg; zinc 50,000mg; iron 20,000mg; copper 5,000mg; iodine 1,000mg; selenium 200mg; cobalt 5000mg; antioxidant 125,000mg.*

The performance of laying chickens fed red sorghum diets are presented in Table 2. The initial weights of all the birds at the commencement of the experiment were similar and ranged from 1560.00g to 1573.33g. The daily feed intake ranged between 121.22g to 148.92g in layers fed diet 1(control) and 5(100% red sorghum) respectively. However, the daily feed intake observed across the dietary treatments was similar. The Percentage hen day production was 60.07, 59.80, 70.25, 64.17 and 63.89% for bird fed diets 1 to 5 respectively. The hen day production was not affected by the

dietary levels of red sorghum s a. There was no significant difference (p>0.05) across the dietary treatment in percentage hen housed production. The values obtained ranged from 57.50 to 67.83% for diet 3 and 5 respectively.

The feed conversion ratio (FCR) varied from 2.29 to 2.70 in diets 3 and 5 respectively. There was no significant difference observed on feed conversion ratio among the 5 treatments. However, all the eggs recorded for grading were within the 1st and 2nd grades. First grade eggs (>60g) were similar across the dietary treatments. The results obtained ranged from 37.78% to 61.11% for diets 1 to 5 respectively. The grade two eggs (50 – 60g) showed no significant difference (p>0.05) across the treatment. The third grade (<50) category of the eggs recorded no eggs during the experiment. There were some mortalities among the various dietary treatments at the time of the experiment. The values ranged from 1 to 6 for treatments 1 to 5 respectively.

The daily feed intake (DFI) varied from 121.22 – 148.92g in layers fed diets 1 (0% RSV) and 5 (100% RSV) respectively. The DFI values observed in this study were within the range of 120 – 150g recommended for layers (Olomu, 1995). Chickens generally eat to satisfy their energy requirement because decrease in metabolizable energy (ME) leads to increase in the total feed consume, therefore this may have been responsible for the hens eating more to meet their energy requirement. Ani and Okeke, 2003), as sorghum is lower than maize in metabolizable energy. The birds ate more feed and produced more eggs as the sorghum inclusion level increases. This result is similar to that of Salissou (2009) who reported that feed intake and egg production tended to be greater in layers fed sorghum based diets.

The results of percentage hen day production (PHDP) varied from 59.80 - 70.25% and did not differ across the dietary treatment. The results was in line with earlier reports by different researchers, that egg production remained unaffected with sorghum in diet at 500g per kg (Thakur *et al*., 1985), and 743g per kg (Rama Rao *et al*., 1995). In those experiments, sorghum was used at a single level to replace maize part per part. Similarly, the present results agreed with the findings of Gowda *et al*.(1984) that egg production did not decrease when layers were fed diets with sorghum at 32 to 50% of their diets or when sorghum was the sole cereal in the diet (Ambula *et al.,* 2003). In addition, the values obtained for PHDP in the this study were similar to 54.83 – 67.43% reported by Esiegwu *et al.* (2003) for layers fed graded levels of garcinia kola seed meal.

Similarly, Issa *et al*. (2007) reported a 57% egg production for layers fed sorghum compared to 47% for birds fed a corn-based diet. The results of percentage hen housed production (59.80 – 70.25) were similar to 67.8 – 73.3 reported by Isika *et al*. (2006) for percent hen day production of layers fed palm oil and animal fats. Feed conversion ratio (FCR)was similar among the five treatments (p>0.05). This result is in agreement with the findings of Salissou (2009) who reported no significant differences (p>0.05) in average egg weight and feed conversion ratio among birds fed corn and sorghum based diets. Similarly, feed conversion ratio was reported to be unaffected by inclusion of sorghum in the diets of layers (Thakur *et al*., 1985; Rama Rao *et al*., 1995).

In another experiment, Freitas *et al.* (2014) replaced corn with sorghum in the diets of Japanese quails and found that feed intake, feed conversion ratio and egg production were not influenced by the dietary treatments. The numbers of mortalities recorded in the course of the current study (1 to 6) were within the average mortality rate of 20 to 25 percent per year for laying birds reported by FAO (1997). The results of egg grade is similar to the findings of Ambule *et al.* (2003) which reported a non-significant difference (p>0.05) in egg sizes of layers fed diets containing high tannin sorghum and use of bentonite.

Table 2: Performance of Laying Chickens Fed Dietary Levels of Red Sorghum Variety

	Diets					
Parameters	**1**	**2**	**3**	**4**	**5**	**SEM**
Initial weight (g)	1563.00	1560.00	1573.33	1566.66	1570.00	-
Daily feed intake (g/bird)	121.22	123.30	127.00	124.29	148.92	8.30^{NS}
HDP (%)	60.07	59.80	70.25	64.17	63.89	4.51^{NS}
HHP (%)	57.92	59.16	67.83	62.92	57.50	4.78^{NS}
FCR	2.56	2.66	2.29	2.38	2.70	0.22^{NS}
Grade 1 eggs (%)	37.78	37.78	41.11	38.89	61.11	9.09^{NS}
Grade 2 eggs (%)	62.22	56.67	58.89	61.22	38.89	9.19^{NS}
Mortality(number)	2	4	1	1	6	-

SEM= Standard error of mean; **NS**= Not significant, **HDP**= Hen day production; **HHP**= Hen housed production; **FCR**= feed conversion ratio

Table 3 shows the economic analysis of egg production in laying chickens fed red sorghum variety. The values obtained for total feed intake ranges from 8.48 to 9.26kg. The Feed cost naira per kilogram was the same for all the five treatments, because the maize and the sorghum were bought at the same price ₦76/kg at the time of the experiment. The values recorded for total feed cost were ₦628.07, ₦658.62, ₦675.77, ₦728.12 and ₦703.76 for diets 1 to 5 respectively.

The total egg weight was similar among the treatments, which ranges from 2.57 to 3.07kg. for treatments 1 and 3 respectively. The Feed cost in naira per kilogram (₦/kg) egg produced were ₦250.77, ₦251.30, ₦211.30, ₦238.70 and ₦247.80 for diets 1 to 5 respectively. There were cost savings of (₦/kg egg) of ₦ 39.04, ₦12.07 and ₦ 2.97 for treatments 3, 4 and 5respectively (Table 3).

The Feed cost naira per kilogram (₦/kg) was the same for all the five treatments, because maize and sorghum were bought at the same price throughout the period of the experiment. There was a cost saving of 39.04, ₦12.07 and ₦2.97 recoded for diets 3, 4 and 5. However, treatment 2 did not record any cost savings but an increase in feed cost per kg eggs compared to the control diet. The present study is also consistent with the findings of Reddy *et al*. (2005) that feed cost per production of an egg was low in sorghum diets compared to maize control diet.

Table 3: Cost benefit of Egg Production Using Red Sorghum

	Diets				
Parameters	**1**	**2**	**3**	**4**	**5**
Total feed intake (kg)	8.48	8.63	8.56	8.70	9.26
Feed cost (₦/kg)	76.00	76.00	76.00	76.00	76.00
Total feed cost	628.07	658.62	675.77	728.12	703.76
Total egg weight (kg)	2.57	2.61	3.07	2.77	2.84
Feed cost ₦/kg egg	250.77	251.30	211.30	238.70	247.80
Cost saving ₦/kg egg	-	-0.53	39.04	12.07	2.97

CONCLUSION AND RECOMMENDATION

The experiment can be concluded that Red sorghum variety can completely replace maize in the diets of Isa Brown layers with no negative effects on performance and cost of egg production. The lowest feed cost per kg egg weight of ₦39.04 was obtained in diet 3. Red sorghum can be used as sole energy source in the diets of Isa Brown layers without compromising productive performance. It is therefore recommended for farmers and feed millers to replace maize with red sorghum at 50% level of replacement since it was most economical and provide cost saving of ₦39.04 on each kg of feed.

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