EVALUATION OF THE PRODUCTIVE AND ECONOMIC EFFICIENCIES OF COWPEA HULL AND MAIZE OFFAL INCLUSION IN LAYERS' RATION

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ABSTRACT

Two types of agricultural wastes (cowpea hull and maize offal) were used as substitutes for maize as energy sources in layers' ration. Their productive and economic values were evaluated in 'complete randomised designed' experiment, with a view to curtailing the escalating cost of poultry feed production in Nigeria. The layers' rations were made cheaper by the partial replacement of the expensive maize component of the diet with maize offal and cowpea hull up to 30% level of inclusion. Egg weights (g) per bird were significantly improved ($P < 0.05$), while average egg production per bird and percent day production were also improved, though not significantly ($P > 0.05$). Addition of 5% level of palm oil to some of the rations to boost their energy content proved economically disadvantageous. Since the 30% level of inclusion of the test ingredients reduced the cost per dozen eggs (N) and showed relatively no adverse effects on the birds' performance indices, both cowpea hull and maize offal are, therefore, highly recommended as replacements for maize, as energy sources in layers' ration.

Key words: Cowpea hull, Maize offal, Layers' ration.

INTRODUCTION

The egg production enterprise has been an attractive venture but for the cash flow problems which are minimised once the birds come into lay. But the tremendous upsurge in the prices of layers' ration occasioned by the demand for eggs locally and across the Nigerian borders have kept egg prices up. These price increases are a reflection of the difficulties manufacturers are having with the availability of various feed

ingredients. The non-availability of several grains and protein concentrates for poultry feeding and keen competition between man and animals for same has been the major obstacles in poultry development in Nigeria (PAN, 1985; Ologhobo, 1992). The future for efficient and profitable poultry production would therefore depend on finding cheaper and alternative energy and protein sources to conventional feed ingredients.

A large number of alternative feedstuffs with promise as poultry feed ingredients abound in Nigeria (Ologhobo, 1992). Such include industrial by-products and agricultural wastes, like maize offal and cowpea hull, whose composition and potential nutritive values are just becoming known (Longe, 1987). Fetuga and Tewe (1984), however, stated that there was no reliable production statistics for same because of scattered processing centres. Nevertheless, rational use of these ingredients (where available) in diets that meet nutrient specifications for efficient egg and meat production would result in considerable reduction in the current high price of livestock feed. The purpose of this study therefore was to find a suitable substitute for maize, as energy source, in layers' rations in order to curtail the escalating cost of poultry feed which is a deterrent to expansion of poultry production in Nigeria.

MATERIALS AND METHODS

Diets:

The experimental diets (1,2,3,4,5 and 6) were formulated to supply 18.12, 19.95, 18.89, 17.78, 20.07 and 19.17% crude protein respectively on a dry matter basis (Table 1). These diets can be grouped into two. The first group consisted of diets 1, 2 and 3. Diet 1 had no source of dietary fibre while diets 2 and 3 consisted of maize offal and cowpea hull substituted at 30% levels

TABLE 1: PERCENTAGE COMPOSITION OF RATIONS FED TO LAYING HENS DURING THE 12 - WEEK STUDY.

INGREDIENTS	RATIONS					
	1	2	3	4	5	6
Yellow Maize	61.70	29.50	31.00	55.20	24.20	24.20
Fish Meal	3.50	3.50	3.50	3.50	3.50	3.50
Groundnut Cake	23.00	25.20	23.50	23.80	25.50	25.50
Cowpea Hull	-	-	30.00	-	-	30.00
Maize Offal	-	30.00	-	-	30.00	-
Palm Oil	-	-	-	5.00	5.00	5.00
Oyster Shell	7.00	7.00	7.00	7.00	7.00	7.00
Bone Meal	4.00	4.00	4.00	4.00	4.00	4.00
Vit. Min. Premix*	0.30	0.30	0.30	0.30	0.30	0.30
Salt	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100	100
Calculated Analysis:						
Crude Protein (%)	18.12	19.95	18.89	17.78	20.07	19.17
ME (KCal/kg)	2781	2430	2400	2900	2570	2500
Vit. Min. Premix* -	Contributed the following to each kilogram of diet: Zn, 60ppm; Mn, 50ppm; Vitamin A, 10,000 I.U.; Vitamin E, 22 I.U.; Vitamin D3, 1828 I.C.U.; Vitamin D, 1.76mg; Vitamin B ₁₂ , 13.2ug; Riboflavin, 8.8mg; Niacin, 39.6mg; Pantothenic acid, 17.6mg; and Choline chloride, 1498mg.					

respectively. The second group consisted of diets 4, 5 and 6. Diet 4 has no source of dietary fibre while diets 5 and 6 consisted of maize offal and cowpea hull substituted at 30% levels respectively. The only difference between this group and the former was the addition of palm oil at 5% level to diets 4, 5 and 6 so as to boost the energy content of the feeds.

Feeding Trial:

Seventy-two black Hacco layers obtained from the Teaching and Research Farm, University of Ibadan were randomly distributed into 6 dietary treatments of 12 birds each, using the Complete Randomised Design. Step stair cages having individual cage compartments were prepared and used. Each bird was housed in the individual compartments. The birds were fed with layers' mash (commercial) prior to the period of the experiment. The experiment lasted twelve weeks. All birds were fed and watered *ad libitum*. Eggs were collected everyday between the hours of seven and ten in the morning.

Chemical analyses:

Test ingredients, diets, dried and ground excreta samples were analysed for crude protein, crude fibre, ether extract and ash contents according to A.O.A.C. (1990). The energy determination of

the samples was carried out using Gallenkamp Ballistic Oxygen Bomb Calorimeter. Apparent metabolisable energy of diets corrected to zero nitrogen balance was calculated.

Statistical analyses:

All performance data were subjected to analysis of variance according to the procedure described by Steel and Torrie (1980). The treatment means were separated at the 5% level of probability by Duncan's Multiple Range test (Gomez and Gomez, 1985).

RESULTS

The proximate chemical composition of the experimental diets and of the test ingredients are shown in Tables 2 and 3, respectively. Data on performance characteristics are presented in Table 4. The mean feed intake, feed efficiency, egg production per bird, percent hen-day production and cost per dozen eggs showed no significant differences ($P>0.05$) between treatments. However, mean values for body weight changes and egg were significant ($P<0.05$) between treatments. The highest mean feed intake (112.00g) was obtained on diet 3, while the least value (106.14g) was recorded on diet 1. Each bird consumed on the average,

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TABLE 2: PROXIMATE CHEMICAL COMPOSITION OF RATIONS FED TO LAYING HENS DURING THE 12-WEEK STUDY.

CONSTITUENTS(%)	RATIONS					
	1	2	3	4	5	6
Dry Matter	91.08	92.14	91.69	92.94	92.01	92.19
Crude Protein	20.31	22.00	22.80	19.85	22.35	22.89
Crude Fibre	3.97	4.58	5.55	3.89	4.46	4.48
Extract	1.90	1.32	1.54	5.60	4.30	5.55
Extract Ash	4.19	4.88	3.46	5.60	4.93	3.34
Nitrogen Free Extract (NFE)	69.63	67.22	66.65	65.06	63.96	64.74
Metabolizable Energy (KCal/g)	2.60	2.53	2.29	2.79	2.67	2.44

TABLE 3: CHEMICAL COMPOSITION OF TEST INGREDIENTS

CONSTITUENTS (%)	TEST INGREDIENTS	
	COWPEA HULL	MAIZE OFFAL
Dry Matter	91.73	91.98
Crude Protein	9.26	12.28
Crude Fibre	11.15	9.96
Ether Extract	7.80	1.48
Ash	3.93	4.66
Nitrogen Free Extract	67.86	71.62

between 106.14 and 112.00g of feed per day. A feed efficiency of 2.73 was obtained on diet 2, while a value of 2.96 was obtained on diet 4; thus the better feed efficiency was obtained on diet 2. Birds fed diets 1 and 3 gained a mean weight of 0.274 and 0.11kg, respectively, while birds fed diet 2 lost weight (0.05kg). The mean weight

gain of birds fed diet 4 was 0.403kg while those fed diet 5 and 6 weighted 0.288 and 0.155kg respectively. Treatments 1, 2 and 3 had relatively higher egg production values per bird than birds fed diets 4, 5 and 6. It was also observed that the average egg weight for birds fed diets 2, 3, 5 & 6 differed significantly ($P < 0.05$) with birds fed diets 1 and 4. The percent hen-day production ranged from 59.64 - 66.67; with birds fed diet 2 being the best. Diets 2 and 3 which contained 30% maize offal and cowpea hull respectively proved to be economically advantageous as regards to the production of dozen eggs per bird.

DISCUSSION

Maize offal and cowpea hull inclusion in ration 2 and 3 respectively at 30% level caused a dilution of the energy component of the rations thus

TABLE 4: EFFECT OF DIETARY MAIZE OFFAL AND COWPEA HULL ON THE PERFORMANCE OF LAYING BIRDS.

PARAMETERS	RATIONS						SEM
	1	2	3	4	5	6	
Feed Intake(g/bird/day)	106.14	110.71	112.00	109.70	110.14	110.14	0.732
Average Initial BodyWeight (kg)	1.65	1.69	1.65	1.58	1.65	1.65	-
Average Final BodyWeight (kg)	1.92	1.86	1.76	1.98	1.94	1.81	-
Average Body Weight Gain (kg/Bird)	0.27 ^b	-0.05 ^a	0.11 ^a	0.40 ^{bc}	0.29 ^b	0.16 ^{ab}	0.059
Average Egg Production/Bird	43.5	46.67	44.03	42.08	41.75	43.00	0.066
% Hen Day Production	62.14	66.67	62.97	60.20	59.64	61.43	0.939
Average Egg Weight(g/bird)	60.98 ^a	61.86 ^b	62.43 ^{bc}	59.78 ^a	61.07 ^{ab}	63.17 ^c	0.447
Feed Efficiency(kg Feed/kg Egg)	2.83	2.73	2.86	2.96	2.90	2.88	0.029
Eggs/Dozen Eggs (g)	32.77	24.46	25.61	36.01	27.93	27.20	1.665

a, b, c Means within a row with different letter superscripts differed significantly ($P < 0.05$).

making the birds to consume more feed in an attempt to meet their energy requirements for body maintenance and egg production. This is in consonance with the findings of Abdelsamine *et al* (1983). The depression effect of fibre at certain critical level on appetite reported by El-Kotoury *et. al.* (1971) and Nwokolo *et. al.* (1985) was not observed in this study. It is probable that the level of inclusion of fibre in this study was not high enough to bring about such response. Furthermore, chemical analysis showed that maize offal and cowpea hull respectively contain only 9.96 and 11.15% crude fibre (Table 3) and could not have been highly limiting in energy content. And generally, the calculated ME (Kcal/kg) for all the diets fall within the recommendations for layers in the humid tropics (ARC, 1975; Obioha, 1992; Devegowda, 1992).

The presence of oil in diets 4, 5 and 6 may be responsible for the lower mean feed intake per day per bird since the oil would have increased the caloric density of the diets (Joshi and Sell, 1964). The increased weight gain observed in the same birds could be due to the presence of fat in their diet. Thus, it may be said that such added fat had a sparing effect that resulted in higher efficiency of utilization of dietary calories derived from carbohydrate and protein. Furthermore, fat is known to have lowest heat increment in its class of nutrients and its associative dynamic effects reduced the heat increment of the entire diets and may have resulted in further improvement of energetic efficiency of the diets far greater than would be anticipated from using the sum of individual energetic values. This is in agreement with the findings of Degroote (1969) and Hillco and Annison (1974) while the loss in weight experienced in birds fed birds fed diet 2 suggests that better egg production may be attained by lighter birds as earlier indicated by Oluyemi and Roberts (1979).

The inclusion of 30% level of either maize offal or cowpea hull in the diets improved egg size significantly ($P < 0.05$).

This is in agreement with the finding of Abdoul-seoud *et al* (1970). This significant improvement may probably be due to some unidentified egg-size factors such as reported by Uko *et al* (1990) which may be present more in maize offal and

cowpea hull than in maize grain. Laying hens on diet 4 produced the lightest egg ($P < 0.05$). This could be due to the increased weight gain observed in birds on this diet. According to Hill and Dansky (1954) and Mark and March (1988), energy requirement is reported to be initially met before other needs are considered. Inclusion of maize offal and cowpea hull at 30% in the layers' rations had no effect on hen-day production as previously reported by Deaton *et al.* (1977). In conclusion, dietary inclusion of maize offal and cowpea hull at 30% improved average egg production/bird, egg weight (g/bird), percent hen-day production and feed efficiency. In addition, it is cheaper to produce dozen egg per bird using diet 2 and 3.

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