

# THE VALUE OF DRIED AFRICAN LOCUST BEAN PULP FOR THE FOWL

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## SUMMARY

Locally obtained dried pulp of the fruit of African locust bean (*Parkia filicoidea*) was included at the rates of 2.5, 5.0, 7.5, 10.0 and 15.0%, at the expense of maize, in the diets of chicks and of pullets whose basal diets contained 25.5% and 18.0% respectively. The chicks were White Rock X Cornish (WRXC) and the Nigeria indigenous (Ind.).

The six week body weights of the chicks were reduced to 648.2g (WRXC) on 2.5% and 425.3g (Ind.) on 5.0% dietary pulp. Beyond these respective dietary levels of pulps, the body weights of the strains were significantly ( $P < 0.05$ ) depressed. The feed conversion ratio (2.8—3.1), mortality (1.7—2.5%), nitrogen retention (59.7—69.5%) of the chicks and the metabolizable energy of the diets, (12.1—12.9 MJ/kg., ME) were not significantly ( $P > 0.05$ ) affected by dietary treatments. However, the better values with these traits were associated with the basal diets and were in respect of the WRXC chicks.

The hen day production, egg weight and liveweight gain of the layers were significantly ( $P < 0.05$ ) depressed when dietary pulp attained 7.5% (50.8%), 10.0% (53.5g) and 10.0% (132.1g) respectively. The yolk colour score (9—14) was significantly ( $P < 0.05$ ) improved at 7.5—15.0% dietary pulp while feed conversion ratio (2.7—4.9) and Haugh Unit (76.1—78.1) were not significantly ( $P > 0.05$ ) affected by dietary treatment. The price of the pulp in relation to that of maize suggested that it was economic to replace maize to at least 2.5% and 5.0% in the diets of chicks and of the layers respectively.

## INTRODUCTION

The scarcity of grains has promoted research interest in grain substitutes for poultry diets. The availability of local feed ingredients is, moreover, essential for lowering the costs of poultry feed. The locust bean tree (*Parkia filicoidea*) growing wild in Savannah Zones of Nigeria yields the locust bean seed, which, when processed to remove the testa, is cherished in all parts of Nigeria as a soup ingredient and is produced commercially.

The seeds are embedded in a bright yellow pulp which has a sweetish flavour and it is known locally as 'dorowa.' The objective of this study is to investigate the effects of this pulp in the diet of the domestic fowl.

## MATERIALS AND METHODS

### Birds and their Management:

Day old male chicks of White Rock X Cornish and of the Nigerian indigenous fowl, each strain totalling 600 were used in the first study and 1200 floor reared Babcock pullets, 18 weeks old, in the second. The chicks were maintained in electrically heated tier brooders for the four weeks before being transferred to deep litter. Brooder temperature started with 32.2°C and was reduced by about 0.16°C daily until environmental temperature (27°C) was reached. The open sides of the brooder house were covered up to reduce draught, during the first week, when a 24 hour artificial lighting was provided. Subsequently the chicks were exposed to only natural day length of about 12 hours. The floor of the open sided deep litter house was littered with wood shavings and divided into 1.5 × 3.0m<sup>2</sup> compartments in which different replicate groups of chicks were placed.

The pullets were housed at eighteen weeks of age, in cages placed in an open sided building and at the rate of two birds per compartment having 25cm front width, 45cm front height and 42cm depth.

### Experimental diets:

The basal experimental chick starter diet and a layer's diet were composed as in

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Tables 1 and 2 to contain 25.5% and 18% crude protein respectively. The other experimental diets contained 2.5, 5.0, 7.5, 10.0 and 15.0% locust bean pulp at the expense of maize.

TABLE 1

Composition of the basal broiler starter diet

Ingredient	%
Maize.....	45.31
Groundnut cake.....	29.45
Palm Oil.....	5.00
Fish meal.....	7.50
Milk Powder.....	3.00
Dried yeast.....	2.00
Blood meal.....	1.00
Rice bran.....	2.50
Dicalcium phosphate.....	2.00
Bone meal.....	0.50
"Luru" <sup>1</sup> .....	1.00
Salt.....	0.30
Feed additives <sup>2</sup> .....	0.44
<i>Analyses:</i>	
Crude protein (%).....	25.5
Crude fibre (%).....	5.5

1. Dried leaves of *Adansonia digitata* Jacq. was used as green feed.

2. Containing:

(a) Vitamins estimated to supply the following per kg. diet: Vit. A, 6,000 I.U.; Vit. D<sub>3</sub>, 1,320 I.C.U.; Riboflavin, 4.4mg; Niacin, 22mg; Ca pantothenate, 8.8mg; Choline, 440mg; Vit. B<sub>12</sub>, 5mcg.

(b) Mineral estimated to supply the following per kg. of diet: Mn. 52.4mg; Fe 20.2mg; Cu 8mg; Zn, 50mg; Co 0.5mg.

(c) Antioxidant (Butylated hydroxytoluene).

(d) Coccidiostat (Amprolmix).

TABLE 2

Composition of the basal layer's diet

Ingredient	%
Maize.....	58.32
Groundnut cake.....	21.86
Fish meal.....	2.58
Rice bran.....	3.00
'Luru'.....	4.00
Oyster meal.....	4.90
Bone meal.....	4.60
Salt.....	0.35
Feed additives <sup>1</sup> .....	0.39
<i>Analyses:</i>	
Crude protein (%).....	18.0
Crude fibre (%).....	4.5

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<sup>1</sup>Vitamin-mineral premix supplying the following per kg. diet %:—

Vit. A, 10,000 I.U.; Vit. D<sub>3</sub>, 1,400 I.U.; Riboflavin, 3mg; Pantothenic acid, 3mg; Niacin, 10mg; Choline chloride 400mg; Vit. B<sub>12</sub>, 8mcg; Zinc Bacitracin, 10mg; Manganese, 80mg; Zinc, 50mg; Iodine, 1.2mg; Cobalt, 200mg; Copper, 2mg; and Iron, 25mg.

The pulp was available in large quantities on a commercial poultry farm near Ibadan which served as the source of the pulp and its costing for this experiment. Ten samples from different consignments of the pulp, as supplied by the farm had the following composition: 3.08% crude protein, 0.97% ether extract and a gross energy of 3.78 Kcal/kg. The values from the different consignments were close.

### Experimental:

**Experiment 1:**— The experimental design was a 2×2×6 factorial with strain, replicate and diets as the respective factors. With 600 chicks per strain, this resulted in 100 chicks of each genotype per dietary group and 50 per replicate. The chicks were fed *ad libitum* from day old to six weeks of age.

Three chicks close in body weight were then selected in each dietary regime, replicate and genotype. The birds were assigned at random to individual cages of a metabolic unit having a water trough, a feed trough and a dropping board for each compartment.

The first seven days in cages was for adjustment and were followed by another seven days when records of feed consumption and of droppings were obtained in accordance with Lewis and Morgan (1963): Polythene sheets were placed on dropping boards for the collection of the droppings. Contaminants like feathers and scales were removed from the feed remnant in each trough and to this remnant any spilled feed was added after being dried (if in water trough). The remnants were weighed. Droppings were also

freed of contaminants before being weighed.

A sample amounting to 10g of each diet was taken on any occasion that feed was supplied and bulked with others in air tight containers. The droppings of each bird were collected every 24 hours also bulked in air tight container. The droppings and the feed were deep frozen and stored for not more than seven days.

The dropping for each bird were dried in forced draught oven at 65°C for five days. They were then ground in an electric grinder three times to ensure thorough mixture. Chemical analyses were in accordance with (AOAC, 1970). The metabolizable energy of the diets corrected for nitrogen retention was determined as:—

$$ME = \frac{(\text{gross energy in feed } X) - (\text{gross energy in droppings } X)}{(\text{feed intake (g)} - \text{droppings (g)})}$$

Nitrogen retention was determined as:—

$$NR = \frac{\text{total N consumed} - \text{total N in excreta}}{\text{total N consumed}} \times 100$$

### Experiment 2:

The experiment used a 2×6 factorial design with replicate and diet as the respective factors. At 20 weeks of age, the pullets were placed on the experimental diets and for a subsequent period of six months, feeding was *ad libitum*. Records per replicate comprised of the percentage hen day production, egg size, yolk colour and Haugh Unit. Yolk colour determination was by objective method of using a yolk colour, with scores from 0—24.

Data were analysed by variance analyses in accordance with Steel and Torrie (1960) and Duncan's (1955) multiple range test was used to determine whether differences among the means were significant.

## RESULTS

### Chicks:

The data on the performance of the WRXC and indigenous chicks were

presented separately (Table 3) because the two strains of chicks differed significantly ( $P < 0.05$ ) in their six-week body weights. However, both strains suffered depressions in their six-week body weights and the higher the level of dietary pulp, the lower appeared the body weights. This depression was significant when the pulp level attained 5% in case of WRXC and 7.5% in case of indigenous chicks.

Feed conversion ratio tended to increase with the inclusion of the pulp in the diet, especially when the level of inclusion

reached 5%. It was difficult to establish a trend in mortality, on the basis of dietary treatment. Nevertheless, the least mortality rate occurred on the control diet and with the lowest dietary level of the pulp.

Neither the nitrogen retention nor the metabolizable energy were significantly ( $P < 0.05$ ) affected by treatment. However, their higher values tended to be associated with the basal diet. In all performance traits, the indigenous were inferior to the WRXC chicks.

TABLE 3  
The effect of dietary treatments on the performance of broiler chicks

Diet (% pulp)	Effect on:									
	Average body Wt. (g)		ME (MJ/kg)		Nitrogen retention (%)		Mortality (%)		Feed conversion Feed (g)/Liveweight gain	
	WRXC	Ind.	WRXC	Ind.	WRXC	Ind.	WRXC	Ind.	WRXC	Ind.
0	653.2 <sup>a</sup>	430.1 <sup>a</sup>	12.9	12.6	69.5	60.4	1.7	1.8	2.8	2.9
2.5	648.2 <sup>a</sup>	431.7 <sup>a</sup>	12.8	12.5	68.9	60.4	1.8	2.0	2.8	2.9
5.0	602.4 <sup>b</sup>	425.3 <sup>a</sup>	12.7	12.4	68.9	59.8	2	2.5	2.9	2.9
7.5	590.6 <sup>b</sup>	389.3 <sup>b</sup>	12.7	12.3	68.4	59.9	1.8	2.2	2.9	3.0
10	586.1 <sup>b</sup>	377.7 <sup>bc</sup>	12.7	12.2	68.1	59.7	2.0	2.0	3.1	3.0
15	516.3 <sup>c</sup>	361.2 <sup>c</sup>	12.6	12.1	68.3	59.7	2.2	2.3	3.1	3.0

**Layers;**

The average monthly production percentages of the pullets were not significantly ( $P > 0.05$ ) different among groups fed either the basal diet or diets with 2.5% or 5% pulp (Table 4). The egg size of the pullets was not significantly ( $P > 0.05$ ) depressed by the inclusion of the pulp in the diets until 10% inclusion was attained.

A significantly ( $P < 0.05$ ) brighter yellow of yolk was obtained with a level of 7.5% of the pulp in the diet than with lower levels. Dietary treatments had no significant ( $P > 0.05$ ) effect on the Haugh Unit of the eggs. The efficiency of converting feed to eggs was depressed by the dietary pulp levels of 7.5% and above.

The body weight gain, during the experimental period, was significantly ( $P < 0.05$ ) lower for the pullets with the 10%

pulp in the diet than those on the basal diet. The remaining groups were not significantly ( $P > 0.05$ ) different from the control. There was no definite trend in the mortality rate of the birds.

**DISCUSSION**

The better performance of the White Rock X Cornish than the indigenous chicks was evidently due to the genetic improvement of the crossbred chicks and appeared based on the greater ability of these birds to metabolize energy and retain nitrogen. The genetic difference between the chicks might also be reflected in the levels of dietary pulp above which the diet tended to lower performance. In case of the layers, dietary pulp levels of 7.5—15.0% were beneficial only in terms

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of improved yolk colour which is of negligible nutritional importance (Romanoff and Romanoff, 1949).

As the pulp was lower in crude protein than maize, the substitution of maize on

weight basis, with the pulp would result in a slight decrease in crude protein in the diet. The reduced performance of the birds on the diets could be attributed to this factor.

TABLE 4

The effect of dietary treatments on the hen-housed egg production of laying pullets

Diet (% pulp)	Egg production	Egg weight (g)	Yolk colour (objective score: 0—24)	Haugh Unit	Feed conversion ratio (kg feed per doz. egg)	Mortality (%)	Liveweight gain (g)
0	58.0 <sup>a</sup>	55.1 <sup>a</sup>	9 <sup>b</sup>	76.5	2.7	5.1	150.4 <sup>a</sup>
2.5	55.8 <sup>a</sup>	54.7 <sup>a</sup>	10 <sup>b</sup>	78.1	2.7	4.5	147.1 <sup>ab</sup>
5.0	56.9 <sup>a</sup>	54.1 <sup>a</sup>	12 <sup>ab</sup>	76.1	2.7	5.1	141.1 <sup>ab</sup>
7.5	50.8 <sup>b</sup>	53.8 <sup>a</sup>	14 <sup>a</sup>	76.6	3.1	5.7	135.5 <sup>ab</sup>
10.0	36.1 <sup>c</sup>	53.5 <sup>b</sup>	14 <sup>a</sup>	77.1	4.5	5.6	132.1 <sup>b</sup>
15.0	32.9 <sup>c</sup>	52.7 <sup>b</sup>	14 <sup>a</sup>	76.1	4.9	5.1	139.5 <sup>ab</sup>

Figures in the same vertical column differently superscripted are significantly different (P. 0.05).

There appeared a slight increase in feed consumption with higher levels of the pulp. This was probably not due to the improved palatability of the diets as chickens have poorly developed taste buds. All the same, this coupled with the poorer growth rate of the chicks or egg production of the layers accounted for the lower feed efficiencies of the birds fed the higher levels of the pulp.

The cost of the pulp, at the time of the experiment was 16 kobo/kg as compared with 26 kobo/kg for maize. This suggests that the replacement of maize, to at least 2.5%, for chicks and 5.0% for layers, with this pulp, was likely to be economical. However, the commercial use of the pulp in poultry diets might increase its price. Information appears scarce on the yield per pod of the locust bean and on the possibility of improving this yield to enhance pulp production from locust bean processing.

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