Effect of substitution of groundnut cake with *Anthonotha macrophylla* seed meal on layer performance and quality of chicken egg.

C.S. Durunna, C.M Ezeagu, C.G Anene and N.J. Okeudo

Department of Animal Science and Technology, Federal University of Technology, Owerri, Nigeria

Abstract

Five layer diets were formulated containing 0, 5, 10, 15 and 20% *Anthonotha macrophylla* seed meal which replaced equivalent proportion of groundnut cake. One hundred and eighty Babcock brown layers already 3 months in lay were randomized into 5 groups and each group was fed one of the experimental diets for 84 days. The hens were examined for performance using body weight, feed intake, hen-day egg production, egg weight and feed conversion ratio. The interior quality of eggs were also assessed. Total feed intake ranged from 9.27 to 10.97kg, average daily feed intake, from 110.32 to 130.54 g/bird/day, hen-day egg production, from 48.88% to 79.11% and feed conversion ratio, from 1.81 to 2.15. Statistical analysis showed that total feed intake, average daily feed intake and hen-day egg production were similar across the dietary treatments up to the 15% level of inclusion, but were significantly depressed ($P < 0.05$) at the 20% inclusion level. However, diet had no significant effect on final body weight and average egg weight and feed conversion ratio ($P > 0.05$). Similarly results on egg quality showed no significant effect ($P > 0.05$) on albumen index, yolk index, yolk colour, Haugh unit and shell thickness. Based on these results, it was concluded that *Anthonotha macrophylla* seed meal can be incorporated into layer diets up to 15% inclusion level without incurring a depression in performance. Layer diets containing this novel ingredient had no deleterious effect on egg quality.

Key words:- *Anthonotha macrophylla*, seed meal, hens, egg quality

Introduction

Poultry production yields profitable benefits to man through the provision of meat, eggs and other such products as poultry litter and feathers. Poultry feeding as reported by Durunna *et al* (2000) and Olomu (2003) constitute the greatest recurrent cost (70- 80%) in poultry production. The poultry industry in Nigeria has suffered more than any other livestock enterprise as result of rising costs and short supply of essential raw materials such as maize, groundnut cake and soya bean.

The resultant effects include low production level, narrow profit margin and collapse of the once prosperous poultry industry. High cost of available feedstuffs (protein-supplying feed materials and energy giving ingredients) has necessitated the search for suitable alternative feedstuffs that are cheap to purchase. In the present time, the choice of feed is determined to a larger extent, by price rather than by quality of feed (Ubosi and Sekura, 2000). This development has also contributed to the indiscriminate appearance of new commercial

feeds in the market. The quality of such commercial feeds, is doubtful because no quality grading system is in place. Since efforts made so far to increase production of commercial feed sources and thus reduce cost, have not yielded required dividend. Animal farmers and livestock feed researchers in the developing countries, therefore must relentlessly continue to research into the use of non- conventional feedstuffs. *Anthonotha macrophylla* is abundant in the Eastern states of Nigeria. It is a leguminous shrub (1.80 to 4.20 meters tall). The shrub withstands the slash and burn system of agriculture practiced in the area. It bears white flowers in November/ December months which later turn yellowish in colour. The seeds (3-4 in number on the average) are borne in a pod which disperse them by explosive mechanism between February and March (Beauv, 1964). Rodents and wild birds have been observed nibbling off bits of the seeds. No work is known to have been done on it, except that by Durunna *et al* (2005) (Table 1). Their report indicated that broiler chicks reared on feed containing *Anthonotha*

macrophylla seed meal performed significantly ($P<0.05$) well in feed intake, weight gain and feed conversion ratio at 5 and 10% inclusion as the broiler chicks placed on feed formulated with soya bean meal at 23% level of inclusion. This present study investigated the effect of partial replacement of groundnut cake in layer diets with *Anthonotha macrophylla* seed meal on layer performance and the interior quality of eggs.

Materials and Methods

Anthonotha macrophylla seeds were collected from the wild at Amaulu Mbieri in Imo State of Nigeria, washed to desilt, chopped and milled with a hammer mill and sieved through a mesh of 5mm to produce the meal which was sun dried for 3 days. The meal was incorporated in the test diets of laying hens to replace groundnut cake at 0,5,10, 15 and 20% levels of inclusion. The study lasted for 84 days. One hundred and eighty (180) Babcock layer hens already 12 weeks in lay were used for the experiment. They were divided into 5 groups of 36 hens each and each group was weighed to obtain the initial average weight. Each group was further subdivided into 3 replicates of 12 hens each. All the birds were fed and offered water *ad libitum* under identical environment and management conditions in a two-tiered battery cage unit. The performance of the hens was determined using final body weight, body weight change, feed intake, hen-day lay, egg weight, feed conversion ratio and cost of feed production. Egg quality characteristics were determined using the following parameters:- egg weight (measured by the use of Hana weigh machine), albumen index (determined by using micrometer screw gauge to obtain the height and the width of the albumen); yolk index (obtained as ratio of the height to the width of the yolk using Vernier sliding caliper), yolk colour (realized by matching

Table 1: *Proximate composition of
Anthonotha macrophylla seed meal.

** Nutrients	Values(%)
Moisture content	15.60
Dry matter (DM)	84.40
Crude protein	21.11
Crude fibre	5.03
Ether extract	1.90
Nitrogen free extract	54.36
Minerals	
Calcium	0.60
Phosphorus	0.14
Potassium	0.12
Magnesium	0.03
Sodium	0.10
Iron	0.50

* Source: Durunna *et al* (2005)

** Values are expressed on dry matter basis

the colour of the yolk with Roche yolk colour fan); Haugh unit (measured by the use of spherometer screw gauge and applying the formular $100 \log (H + 7.57 - 1.7 W^{0.37})$ where H is the observed albumen height in millimeter and W is the observed weight of egg in gramme (Haugh 1937), and shell thickness (measure with a micrometer screw gauge). The cost per kilogramme of each test feed, was determined by summing up the money spent on the ingredients used for compounding each group's feed and dividing the sum by the total kilogramme of the feed produced for each group.

All the parameters assessed were subjected to analysis of variance (ANOVA) for the Completely Randomised Design according to Snedecor and

Cochran (1978). Where significant treatment effects were detected from the ANOVA, means were compared using Duncan's New Multiple Range Test (Steel and Torrie 1980).

Results and Discussion

Composition of the experimental diets is shown on Table 2 while the effect of the test material on the performance of the hens, is shown on Table 3 and Table 4 shows the effect of *Anthonotha macrophylla* seed meal on the quality of eggs. The hens on 20% *Anthonotha macrophylla* seed meal diet showed significant ($P < 0.05$) lower performance in total and average daily feed intake, hen-day egg production than the rest of the hens in the other trial groups (0, 5, 10 and 15% inclusion levels). However, in all parameters, no group (0, 5, 10 and 15%) showed superior

Table 2. Composition of the experimental diet for layer (%)

Ingredients	Dietary levels of <i>Anthonotha macrophylla</i> seed mill (%)				
	0	5	10	15	20
Maize	50.00	50.00	50.00	50.00	50.00
Groundnut cake	20.00	15.00	10.00	5.00	00.00
<i>Anthonotha macrophylla</i>	00.00	5.00	10.00	15.00	20.00
Brewers' dried grain	4.00	4.00	4.00	4.00	4.00
Wheat offal	9.00	9.00	9.00	9.00	9.00
Fish meal	2.00	2.00	2.00	2.00	2.00
Palm kernel cake	3.00	3.00	3.00	3.00	3.00
Bone meal	5.60	5.60	5.60	5.60	5.60
Oyster shell	5.40	5.40	5.40	5.40	5.40
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
* Premix	0.25	0.25	0.25	0.25	0.25
CALCULATED ANALYSIS					
Crude protein	16.89	16.69	16.49	16.47	16.09
Crude fibre	4.81	4.67	4.61	4.73	4.70
Ether extract	8.78	8.55	8.62	8.65	8.64
AST	14.49	14.62	14.55	11.47	14.57
Nitrogen free extract	56.23	55.80	55.77	55.67	55.88
Phosphorus	1.85	1.83	1.79	1.66	1.77
Calcium	4.37	4.25	3.97	3.89	3.99
ME kcal/kg	2793	2692	2766	2801	2825

* To provide the following: per kg feed: Vitamin A: 3,400.00 i.u Vitamin D₃ 600,000.00 i.u.; Vitamin E 4000.00mg; Vitamin K₃ 400.00mg; Niacin: 6000.00mg Vitamin B₂: 1,800.00mg; Vitamin B₆: 100.00mg; Vitamin B₁₂ 6.00mg; Panthothothenic acid: 1800.00mg; Folic Acid: 240.00mg; Choline 100,000.00mg; Cobalt: 80.00mg; Copper 1200.00mg; Iodine 400.00mg; Iron: 8,000.00mg; Manganese 16000.00mg; Selenium: 80.00mg; Zinc: 12000.00mg.

Effect of *Anthonotha macrophylla* seed meal on layer performance

Table 3: Effect of *Anthonotha macrophylla* seed meal on performance of laying hens.

Parameters	Dietary level of <i>Anthonotha macrophylla</i> seed meal					SEM*
	0	5	10	15	20	
** Av. initial body weight (kg)	1.55	1.51	1.57	1.52	1.54	
Av. final body weight (kg)	1.70	1.65	1.80	1.64	1.80	0.05
Av. body weight gain (kg)	0.25	0.14	0.23	0.12	0.26	0.04
Total feed consumed (kg)	10.94 ^a	10.97 ^a	10.93 ^a	10.12 ^a	9.27 ^b	
Av. feed intake bird day (g)	130.20 ^b	130.54 ^a	130.11 ^a	120.44 ^b	110.32 ^b	0.03
Hen-day egg production (%)	75.64 ^a	79.11 ^a	77.22 ^a	68.11 ^b	48.88 ^c	4.55
Av. egg weight (g)	60.54	60.61	61.00	61.11	60.86	0.20
Feed conversion ratio	2.15	2.15	2.13	1.97	1.81	0.06
***Cost of feed production (₦/kg)	27.85	21.04	20.69	19.45	18.22	
Cost of feed consumed	304.68	230.81	226.14	196.83	168.90	

Means within the same row with same superscript or no superscript are not significantly different ($P>0.05$)

*SEM means standard error mean.

Av. means average * (₦): Nigeria currency (₦128.00=\$1.00 (2006)

Table 4: Effect of dietary inclusion levels of *Anthonotha macrophylla* seed meal on egg quality

Parameters:	Inclusion Levels of <i>Anthonotha macrophylla</i> (%)					SEM
	0	5	10	15	20	
Egg weight (g)	60.54	60.61	61.00	61.11	60.86	0.13
Albumen index (mm)	0.10	0.10	0.10	0.10	0.10	
Yolk Index (mm)	0.40	0.40	0.40	0.42	0.42	0.01
Yolk Colour	2.26	2.37	2.36	2.41	2.44	0.03
Haugh Unit	76.90 ^b	76.45 ^b	76.35 ^a	78.66 ^b	78.24 ^b	0.47
Shell thickness (mm)	0.33	0.33	0.33	0.36	0.34	0.01

Means within the same row with same superscript or no superscript are not significantly different ($P>0.05$)

SEM= Standard error of mean

significant ($P>0.05$) performance over the other except in hen-day egg production. While the hens in 0, 5, and 10% trial groups revealed 75.64, 79.11 and 77.22% hen-day lay respectively, those in 15 and 20% groups had 68.11 and 48.88%. At 50% hen-day lay, a stock of hens merely breaks even in production. It appears that in economic consideration, while the hens in 0, 5, and 10% trial groups broke even and provided more than 25% profit in hen-day egg production, those in 15% group broke even and provide only 15.11% gain in production. Those

on 20% group neither broke even (48.88%) nor provided additional benefit in egg production even though they had the least feed conversion ratio (1.81).

There were no significant differences ($P>0.05$) in egg weight, albumen index, yolk index, yolk colour, Haugh unit and shell thickness among the different groups. The treatment groups 0, 5, 10, 15 and 20% showed egg weights of 60.54, 60.61, 61.00, 61.11 and 60.86g respectively. These results are similar to the egg weights reported

by Okonkwo and Oketola (1996) and correspond with the findings reported by Adeniyi and Balogun (2002) in their work on flavour treated blood-rumen content mixture fed to layers at varying inclusion levels not exceeding 23%. There were no significant differences recorded among the treatments for albumen index. This indicates that *Anthonotha macrophylla* seed meal does not reduce the albumen index value of eggs. The yolk index ranged from 0.40mm (0.5 and 10%) to 0.42mm (15 and 20% inclusion levels). The yolk index recorded was similar to the reports by Ezieshi *et al* (2001) of eggs collected from laying hens fed palm-kernel-cake-based diet and also similar to the observations by Odunsi *et al* (1996) on eggs from hens fed wild sun flower- meal based diet. There were no significant differences ($P>0.05$) in yolk colour among the different treatment groups. The highest yolk colour (2.44) was recorded by the group on 20% inclusion level and lowest (2.26) for the group on 0% inclusion level. The yolk colour score observed was higher than those reported by Fanimio *et al* (1999). This was because while Fanimio *et al* (1999) fed white maize for energy, yellow maize was used for this work, which may have influenced the superior colour of the egg yolk observed. However increasing yolk colour values were observed as the levels of *Anthonotha macrophylla* seed meal in the diet increased. This implies that the test material had increasing contributory effect on the over all values of the yolk colour. The Haugh unit recorded was higher than those reported by Okonkwo and Oketola (1996) and Adeniyi and Balogun (2002). It ranged from 76.35 to 78.66. According to the United States of America Department of Agriculture (USDA), a Haugh unit score of 72 and above (Score AA) is acceptable to connote freshness in egg (Card and Nesheim, 1972). The Haugh unit values obtained from all the groups indicated that eggs produced by hens fed dietary levels of *Anthonotha*

macrophylla seed meal were fresh and were of standard quality. The results on shell thickness were 0.33, 0.33, 0.36, 0.34 and 0.33mm for 0.5, 10, 15 and 20% inclusion levels of *Anthonotha macrophylla* seed meal respectively. This level of shell thickness is of economic advantage as the eggs will not crack easily during transportation. The shell thickness values indicate that eggs produced by hens fed *Anthonotha macrophylla* seed meal have shell of adequate thickness.

The calcium and phosphorus content of *Anthonotha macrophylla* (Table 1), in addition to those derived from other feed ingredients provided enough calcium and phosphorus for deposition on the eggs. It was observed that there was an increasing trend of shell thickness as the level of *Anthonotha macrophylla* seed meal increased. This peaked at 10% inclusion level and thereafter, shell thickness started to reduce in size, though the reduction was of no statistical significance ($P>0.05$).

Decreasing feed production cost (₦/kg) (27.85, 21.04, 20.69, 19.45 and 18.22 naira) was observed as inclusion level of *Anthonotha macrophylla* seed meal increased from 0 to 20%. Similarly, cost of feed consumed by each test group followed the same decreasing trend (₦304.68, ₦230.81, ₦226.14, ₦196.83 and ₦168.90 for 0.5, 10, 15 and 20% inclusion levels respectively (Table 3)

Conclusion

It was therefore concluded that *Anthonotha macrophylla* seed (Durubean) meal can be used to substitute groundnut cake meal up to 20% dietary inclusion without loss in performance of the hens and in quality of eggs. Further investigation is needed beyond 20% to determine the optimal inclusion level of *Anthonotha macrophylla* seed meal in layer diet.

References

- Adeninyi, A.A. and O.O Balogun, (2002)** Utilization of flavour treated blood-rumen content mixture in the laying hens. *Nig. J. Anim. Prod.* 29 (1):34-39
- Beauv, P (1964).** Nigerian Trees. R.W.J. Keay, C.F A. Anochie and D.P. Standfield, eds. Federal Department of Forestry and Research. Ibadan,
- Card, L.E. and M.C. Nesheim, (1972).** Poultry Production. Lea and Febiger, Philadelphia USA
- Durunna, C.S. Udedibie, A.B.I and G. A. Anyanwu, (1999).** Combination of maize/sorghum based dried brewers' grain, cocoyam corn and cassava tuber meal as substitute for maize in the diets of laying hens. *J. Agric. Biotech. Environ* 2:1-7.
- Durunna. C.S. Udedibe, A.B.I and M.C.Uchegbu, (2005).** Effect of dietary inclusion of *Anthonotha macrophylla* seed meal on performance of broiler starter chicks. *Nig. J. Anim. Prod.* 32 (2): 268 – 273.
- Ezieshi E.V. Omoregie, A. and J.M. Olomu, (2001).** Performance and some physical and internal qualities of eggs of laying chickens fed palm kernel cake based diet. *Proc. of the 26th Annual Conference of the Nig. Soc. Anim. Prod.* Vol 26: 199–201.
- Fanim, A.O., Aina, A.B. J. and E. B. Oguntona, (1999).** Effect of different Levels of *Tridax procumbens* on the performance of layers. *Nig. J. Anim. Prod.* 26:53 – 56.
- Haugh, R.R. (1937).** The Haugh unit for measuring quality of egg. *U.S. Egg and Poultry Magazine* 43:552-555.
- Odunsi, A.A., Farimu, G.O. and J.O. Akinola, (1996).** Influence of dietary wild sun flower (*Tithoria diversifolia*) leaf meal on layer performance and egg quality. *Nig. J. Anim. Prod.* 23 (1):28-32.
- Okonkwo, A.C and A. Oketola, (1996).** Effect of dietary level of unprocessed and dehulled sun flower seed meal on the performance of laying hens. *Nig. J. Anim. Prod.* 23 (1): 24-27.
- Olomu, J.M. (2003).** Poultry production. Ajachem Publication. Benin. Nigeria.
- Ubosi, B.O. and A.M. Sekura, (2000).** Effect of varying levels of full – fat soya bean and groundnut cake on the performance of broilers in hot dry environment. *Proc. of 25th Annual Conf. Nig. Soc. Anim. Prod.* 19-22
- Snedecor, G.W. and W.G.Cochran, (1978).** Statistical Methods, 6th ed. State University Press. Ames, Iowa, U.S.A.
- Steel, R.G.D and J.H. Torrie, (1980).** Principles and Procedures of Statistics. 2nd ed. McGraw-Hill Book Company. New York, U.S.A

(Received 29th Dec. 2004; Accepted 18th January 2007);