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# Evaluation of Neem (*Azadirachta indica*) Leaf Meal in the Diets of Black Leghorn Laying Hens for Protein Sustaininability and National Development

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**Abstract** Feeding trials were conducted for eleven weeks to evaluate the nutritive value of Neem (*Azadirachta indica*) leaf meal on egg production, Performance and economics of production of black leghorn laying hens. Fresh green neem leaves were harvested within the University community, air-dried to become crispy and milled to produce neem leaf meal (NLM,) then subjected to proximate analysis according to AOAC (1995). The Proximate analysis of the leaf meal contained–high crude fibre (15.56%) and moderate crude protein (18.10%). The neem leaf meals was included in the layers diets at 0,2.5,5.0,7.5 and 10% designated as $T_0$, $T_{2.5}$, $T_{5.0,}$ $T_{7.5}$, and $T_{10}$ respectively and all dietary treatments were iso caloric and iso protein. Black leghorn laying hens at 10 weeks of laying life were used for the trial. They were divided into 5 groups and housed in a pen measuring 1½ x 2m. at 6 birds per replicate. Feed and water were provided *ad libitum*. Each treatment group was randomly assigned to one of the experimental diets in a completely randomized design (CRD). The hens were weighed at the begining and at the end of the trial.
At the end of the trial feed intake of the laying hens increased with increase in the dietary leaf meal inclusion and became significant ($P < 0.05$) as from 5% dietary level. Hen-day egg production picked up as from 5.0% level. Egg weight increased steadily as the dietary level of the leaf meal increased ($P<0.05$). Egg yolk pigmentation increased with increase in dietary leaf meal and scored highest (6.86) at 10% dietary level. Egg yolk and albumin indices as well as Haugh unit and egg shell thickness were not affected by treatments ($P > 0.05$)

**Key words:** Neem leaf meal, performance, laying hens, egg production, cost of production.

## Introduction

One of the problems facing most developing tropical countries is the scarcity of food for the teaming human population and feed for the dwindling livestock industry. The conventional feed ingredients (maize, soybean,

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groundnut, etc) have become very expensive, thereby creating need for alternatives. There is need therefore for the evaluation of the nutritive value of neem leaves for egg production, performance and economics of production in laying hens.

South Eastern Nigeria is highly endowed with browse plants which goats in the region feed upon. Leaf meal from some of these plants have been shown to serve as sources of protein, vitamins and minerals for non-ruminants (D' Mello *et al.*, 1987). This has been demonstrated with leaf meals from *leucaena leucocephala* (Mateo *et al*. 1970), *Cajanus cajan*, (Udedibie and Igwe, 1989), *Gliricidia sepium* (*Ose*i *et al.*, 1990), and *Alconia cordifolia* (Udedibie and Opara, 1996), *Lucaena leucocephala*, *Trifolium alexandium* crustacean and *Cajanus cajan* have also been reported as sources of carotenoids to laying hens ( Udedibie and Igwe, 1989). Maiddendorf *et al.* (1980) also reported yellow maize and alfalfa as sources of carotenoids. Proximate analysis of the neem leaf meal used in this study shows - high crude fibre (15-56%) and moderate crude protein (18.10%) as reported for Jacaranda (Okorie, 2006;), with relatively high crude fibre content. The metabolizable energy must be low even though its gross energy content was high (4.16 kcal /g).

Neem is a large evergreen tree with a wide trunk, which can grow 12 – 24 meters tall. The leaves are bright green with 9 – 15 leaves, oblique at the base or slightly curved, coarsely toothed, with a pointed tip (Shodini, 1997). *A indica* grows rapidly 4-7meters in its first five years of growth and 5-11 meters for the following five years. It bears fruit within three years and reaches a maximum fruiting yield of 50kg seed /year, ten years after planting, (Jacobson, 1989). Medically all parts of the plant have been used including the fruits, seed, oil (extracted from the seed) leaves, roots and bark, but its utilization in poultry diet has not been fully exploited. A methanol extract of the leaves exert antipyretic effect in male rabbits (Okpanyi and Ezeukwu, 1981). A study conducted by Obikaonu *et al.* (2011b) on the haematological and serum biochemical indices of starter broilers fed neem (*Azadirachta indica*) leaf meal suggested that neem leaf meal can be included in the diets of young broiler chicks up to 10% without any deleterious effects on their haematological and serum biochemical constituents. The study also showed that neem leaf diets reduce blood cholesterol and tend to maintain the integrity of both the kidney and liver. In a 14 - day oral toxicity studies with 29g/kg body weight, no lethal effect was observed with no apparent change in relative organ weight, haematological parameters, enzyme levels and histo-pathology of several organs (Kausik *et al.*, 2002). The work of (Obikaonu *et al*., 2011a) with starter broilers also reflected an overall outstanding performance at $T_{5.0}$ in most of the parameters measured. The objective of this study therefore is to evaluate

the nutritive value of Neem (*Azadirachta indica*) leaf meal on egg production, Performance and economics of production of black leghorn laying hens for protein sustainability and National development.

## Materials and methods

***Study Site***. The study was carried out during the dry season in the Poultry Unit of the Teaching and Research Farm of the School of Agriculture and Agricultural Technology and Animal Science Laboratory of the Federal University of Technology, Owerri, Imo State, Nigeria. Imo State lies between latitude 4˚4' and 6˚3' N and longitude 6˚15' and 8˚15' E. Owerri is about 100m above sea level. The climatic data of Owerri as summarized in Ministry of Lands and Survey Atlas (1994) of Imo State is as follows: mean annual rainfall, 2500mm; temperature range, 26.5 – 27.5˚C and humidity range of 70 – 80%. Dry season duration (i.e. months with less than 65mm rainfall) is 3months. The annual evapo-transpiration is 1450mm and the soil type is essentially sandy loam with average pH of 5.5.

***Source and processing of Neem leaves***

Fresh green neem leaves used for the experiment were harvested within the University community in batches. Each batch of collection was air dried to become crispy to touch. They were then milled with 2mm sieve, to produce neem leaf meal (NLM). Samples of the leaf meal were subjected to proximate analysis according to AOAC (1995).

***Experimental Diets***

Five (5) experimental laying diets were formulated such that they contained the leaf meal at 0.00, 2.50, 5.00, 7.50 and 10.00% levels, respectively. The diets were formulated to meet the nutrient requirements of laying bird (NRC 1978). The ingredient composition of the experimental diets is shown in Table 1.

***Experimental Birds and Design***

Black leghorn laying hens at 10 weeks of laying life were selected from a flock and used for the trial. They were divided into 5 groups of 24 birds each and each group housed in a pen measuring 1½ x 2m. at 6 birds per replicate. Feed and water were provided *ad libitum*. Each treatment group was randomly assigned to one of the experimental diets in a completely randomized design (CRD). The hens were weighed at the beginning of the trial and at the end of the trial.

Data collected were subjected to analysis of variance. Where analysis of variance indicated significant treatment effects the means were separated using Duncan's New Multiple Range Test as described by Steel and Torrie (1980).

## Results and Discussion

The Proximate composition of the neem leaf meal contained 18.10% crude protein, 15.56% crude fibre, 2.50% ether extract, 5.26% ash and 58.22% nitrogen free extract. The leaf meal displayed same characteristics as leaf meals from other tropical browse plants – high crude fibre and moderate crude protein content as reported for *Jacaranda mimosifolia* (Okorie, 2006) , with relatively high crude fibre content, (15.56%), the metabolizable energy must be low even though its gross energy content was high (4.16 Kcal/g).

The performance of the experimental birds is summarized in table 2

There was no significant difference ($P<0.5$) between the final body weight of the control group and the groups on neem diets. This result is in agreement with the work of (Udedibie and Igwe, 1989) who observed similar body weight changes in their trials with laying hens.

Feed intake increased as the level of neem leaf meal increased. The reason for the increase in feed intake could be traceable to the high fibre content of the leaf meal, so the birds ate more to make up for the low metabolizable energy. Obikaonu (2012) also observed similar results in her work with finisher boiler. The mean hen-day egg production increased as the level of neem leaf meal increased ($P<0.05$). This trend had earlier been observed by Azubuike (2003) while working with (*Microdesmis puberula*) leaf meal on laying hens. The egg weight remained statistically the same ($P>0.05$) in all the treatments although the egg weights increased with increase in dietary inclusion of neem leaf meal with $T_{10}$ recording the highest value (Udedibie and Igwe, 1989). Feed conversion ratio increased as the level of neem leaf meal inclusion increased. Similar trend was also recorded by Obikaonu (2012) and Akpan (2007). The egg yolk pigmentation also increased with increase in dietary neem leaf meal. This is in agreement with the work of Okorie (2006) who reported that egg yolk colour was significantly increased ($P<0.05$) as the level of leaf meal inclusion increased. Mortality was recorded in $T_{2.5}$ and $T_{10}$ but it was as a result of soldier ant attack.

The cost analysis of the feeding trial is shown in table 3. Feed cost decreased as the level of leaf meal inclusion increased ($P<0.05$) with $T_{10}$ having the least cost.

**Table 1.** Ingredient Composition of Layer Experimental Diets

| | Dietary Levels of NLM(%) | | | | |
|---|---|---|---|---|---|
| **Ingredients (%)** | **$T_{0.00}$** | **$T_{2.50}$** | **$T_{5.00}$** | **$T_{7.50}$** | **$T_{10.00}$** |
| White maize | 54.00 | 53.00 | 51.00 | 50.10 | 49.00 |
| Neem leaf meal | 0.00 | 2.50 | 5.00 | 7.50 | 10.00 |
| Soybean meal | 16.00 | 16.00 | 16.00 | 16.00 | 16.00 |
| Wheat offal | 10.00 | 8.50 | 8.00 | 6.50 | 5.00 |
| Palm kernel cake | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 |
| Fish meal | 2.50 | 2.50 | 2.50 | 2.50 | 2.50 |
| Bone meal | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Limestone | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 |
| Common salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Vitamin/vit. Premix * | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| L-Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| L-Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| **Calculated analysis (% DM)** | | | | | |
| Crude protein | 17.37 | 17.20 | 17.20 | 17.60 | 17.50 |
| Crude fibre | 4.81 | 4.69 | 4.48 | 4.56 | 5.49 |
| Ether extract | 3.63 | 3.68 | 3.72 | 3.81 | 3.90 |
| Calcium | 3.44 | 3.44 | 3.44 | 3.44 | 3.78 |
| Phosphorus | 1.01 | 1.00 | 1.00 | 1.00 | 1.20 |
| L-methionine (cal) | 0.32 | 0.32 | 0.32 | 0.32 | 0.33 |
| L-Lysine (cal) | 0.85 | 0.85 | 0.86 | 0.86 | 0.87 |
| **ME (Kcal/kg)** | **2698.44** | **2698.44** | **2678.56** | **2674.56** | **2691.44** |

*Each kg of feed contains: Vit.A, 2,000,000 i.u; vit. $D_3$ (100 iu), vit.E, 8g ; vit.K, 0.4g ; vit.$B_1$, 0.3g ; vit.$B_2$,1.0g ; vit.$B_6$, 0.6g ; vit.C, 2.40g, vit.$B_{12}$, 40g ; Mn, 160g ; Fe, 8.0g ; Zn, 7.2g; Cu, 0.3g ; Iodine, 0.25g ; Co, 36.0mg ; Se, 16.0mg.
NLM: Neem Leaf Meal

**Table 2.** Performance of black leghorn laying hens fed graded levels of neem leaf meal

| | Dietary levels of neem leaf meal inclusion (%) | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **$T_0$** | **$T_{2.5}$** | **$T_{5.0}$** | **$T_{7.5}$** | **$T_{10}$** | **SEM** |
| Initial weight (g) | $1811.04^a$ | $1813.01^a$ | $1815.25^a$ | $1814.25^a$ | $1810.12^a$ | 2.91 |
| Av. final body weight (g) | $1919.75^a$ | $1802.38^b$ | $1690.10^c$ | $1954.03^a$ | $1788.13^b$ | 33.65 |
| Av. body weight changes (g) | $108.7^a$ | $-10.63^b$ | $-125.15^c$ | $129.27^a$ | $-21.99^b$ | 32.84 |
| Av. daily feed intake (g) | $125.01^a$ | $122.91^a$ | $136.87^b$ | $139.79^b$ | $142.75^b$ | 3.22 |
| Mean hen day egg production (%) | $70.22^a$ | $60.09^b$ | $64.24^b$ | $64.31^b$ | $68.28^a$ | 1.61 |
| Egg weight (g) | $60.42^a$ | $60.00^a$ | $61.02^a$ | $61.49^a$ | $61.77^a$ | 1.95 |
| Feed conversion ratio (g feed/g egg) | $2.06^a$ | $2.05^a$ | $2.24^a$ | $2.27^b$ | $2.31^b$ | 0.03 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Egg yolk pigmentation | 1.12[a] | 3.08[b] | 4.83[b] | 5.25[c] | 6.86[c] | 0.69 |
| Mortality | - | 1 | - | - | 5 | |

[a b c] Means within the same row with different superscripts are significantly different ($p < 0.05$)

**Table 3.** Economics of production of laying hens fed graded levels of neem leaf meal

| | Dietary level of leaf meal inclusion (%) | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **$T_0$** | **$T_{2.5}$** | **$T_{5.0}$** | **$T_{7.5}$** | **$T_{10}$** | **SEM** |
| Feed conversion ratio (FCR) (Kg feed/Kg egg) | 2.06[a] | 2.05[a] | 2.24[b] | 2.27[b] | 2.31[b] | 0.03 |
| Feed cost (₦/kg feed) | 50.05 | 49.48 | 48.74 | 48.17 | 47.60 | - |
| Feed cost per kg body weight gain (₦) | 103.10 | 101.43 | 109.18 | 109.35 | 109.96 | - |

[a b] means within the same rows with different superscripts are significantly different ($P < 0.05$)

## Conclusion

The result of the trial has revealed that inclusion of neem leave meal in layers diet has the capability of increasing hen day egg production, egg weight and egg yolk pigmentation which are very important quality for increasing protein sustainability which also enhances National development.

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