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Nutritional and Economic Value of Leaf Meal (*Tephrosia bracteolata*) in Diet of Laying Hens

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Abstract: The performance, egg qualities, costs and dry matter turn-over of *Tephrosia bracteolata* leaf meal (TLM) were investigated in diets of egg type chickens. The experiment involved 40, 25 weeks old Nera black layers in a 70 day feeding trial. There were 4 dietary treatments. Diets 1 was the control with 0% TLM while diets 2, 3 and 4 contained 2.5, 5.0 and 7.5% levels of TLM, respectively and were arranged in one way analysis of variance in a completely randomized design. Feed intake decline with progressive inclusion of TLM and significantly depressed ($p<0.05$) at 7.5% inclusion of TLM. However, egg production, egg weight, body weight gain and feed conversion ratios were not significantly different ($p>0.05$) across the treatments. Similarly, egg quality parameters including shell thickness, albumen and yolk weight were not affected ($p>0.05$) except for the yolk colour that greatly intensified ($p<0.01$) with progressive inclusion of the leaf meal. While, dry matter turn-over of TLM was about 30% on as fed basis, egg output and revenue generated showed that control, 2.5 and 5.0% TLM dietary treatments were comparable and that control was significantly better than the 7.5% TLM treatment. It is suggested that TLM may be safely included up to 5.0% in layers' diet in situation of shortage and or high cost of grains and protein ingredients with impressive yolk colouration. Improvement in the utilization of the leaf meal portends better economic returns.

Key words: Cost, turn-over, egg quality, performance, *Tephrosia* leaf meal

INTRODUCTION

The use of cereal grains and oil seed meal form the basis of non-ruminant feeding system in most African countries including Nigeria. World production of these farm crops decline with each succeeding year due to factors such as decreasing yield, increased costs of agrochemical input and its associated threat to ecosystem, government decision to limit importation and higher demand by human and livestock due to population growth. The effect of this is evident in regional shortage of feedstuffs and rise in cost of feed. The shortage was more severe for non-ruminant that depends to a large extent on compounded feed (Longe and Fagbenro-Byron, 1989). Sequel to this, the cost of feed for poultry remained a single factor claiming 70-80% of the total cost of production (Oruseibio, 1996; Nworgu *et al*., 1999).

The need to curtail the incessant rise in feed cost and to forestall threat to the future of livestock has encouraged exploitation of various alternatives to conventional feedstuffs (Preston, 1992, Odunsi *et al*., 2002; D'Mello *et al*., 1987). Despite many proposed alternatives, the increasing rise in cost of feed is worrisome. Protein from plant leaves source is perhaps the most naturally abundant and cheapest source of protein such that there has been growing realization in the use of leaf meal in diets of poultry. Leaf meals are bulky and contain high moisture when freshly collected. The overall use in ration formulation for non- ruminant feeding system is an issue of concern. Various studies have delved into aspect of use of *Leucaena leucocephala* (Natanman and Chandiasekerani, 1996); *Amaranthus* (Fragas *et al*., 1993) while Nworgu, (2006) assessed *Centrosema pubescens* leaf meal in poultry diets. Information on Tephrosia plant leaf in diet of poultry is in short supply. *Tephrosia* plant has over 300 species in Africa (Dutta, 1979). Its crude protein ranges from 20-26% that is comparable to 25% in *Gliricidia* and 25.3% in Leucaena (Ayoade *et al*., 1988; Babayemi *et al*., 2002). Without fortification in the diets, its mineral content was reported to be high enough to meet the requirement for non-ruminant animals (Babayemi *et al*., 1999). Hence, the purpose of this study is to evaluate the performance, egg quality characteristics of laying hens, dry matter yield and economic value of *Tephrosia bracteolata* leaf meal for laying hens-an attempt to evaluate the overall potential of leaf meal for laying birds.

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MATERIALS AND METHODS

Study area: The experiment was carried out at the Teaching and Research Farm of the University of Ibadan located in the derived savannah ecological zone of Nigeria.

Sample collection and preparation: Fresh and blooming leaves of *Tephrosia bracteolata* plant were harvested green from the bush and fallow sections of Ogbomoso town premises. The fresh leaves were collected in batches in labelled bags. The leaves were spread on open floor to sun dry for three days until it became crispy. For dry matter determination, two samples of 2 kg each were taken from each bag. The fresh weight was determined, spread on clean concrete floor and carefully monitored while sun drying to prevent loses to wind blow. The final constant sun dried weight was determined and recorded as dry matter yield. The dried leaves were grinded in a hammer mill with sieve size 2 mm to produce the leaf meal. The milled product represents the test material and was included at 3 different levels in diets of experimental birds.

Diets preparation: There were four dietary treatments. Diet 1 was the control with 0% TLM while diets 2, 3 and 4 contained 2.5, 5.0 and 7.5% levels of TLM, respectively (Table 1). All diets were iso-nitrogenous formulated to supply about 17.40% crude protein. Forty Nera black layers of 25 weeks of age were randomly divided into 4 treatment groups, each group containing ten birds of 5 replicates per treatment. Each group is allotted a diet. The birds were housed in a battery cage system. Experimental diets were introduced to the birds with a 7 day adjustment period before data collection commenced. The birds were fed *ad libitum* with free access to portable water. Record for egg quality parameters lasted for 5 weeks. Cost analysis was determined by pulling costs accrued from harvesting, transporting and milling the leaf.

Experimental parameters measured: Feed intake and hen day egg production were determined on daily basis. The latter was calculated using the formula given by North and Bell (1990). Egg weight was measured with a sensitive weighing balance (± 0.1 g). Feed conversion ratio and egg output were computed. The formal was determined as ratio of kilogram egg laid per week and kilogram feed consumed per week while the latter by multiplying egg number per week by mean egg weight. For internal egg qualities, four eggs per treatment were randomly picked from total eggs collected per week for four weeks. The eggs were broken and shell thickness after removing the inner membrane was measured with a micro-metre screw gauge. Yolk was separated from albumen using a plastic egg separator Yolk colour was assessed with Hoffman-la- Roche yolk colour fan rated 1-15 with colour intensity ranging from pale yellow to deep orange.

Table 1: Composition (percent) of diets

Ingredients	T_1 (0% TLM)	T_2 (2.5% TLM)	T_3 (5.0% TLM)	T_4 (7.5%TLM)
White maize	43	43	43	43
Soyabean meal	9.5	9.5	9.5	9.5
Ground nut cake	6.9	6.3	5.8	5.2
Dry brewer grain	8.1	6.2	5.2	2.3
Tephrosia leaf meal	0	2.5	5.0	7.5
Palm kernel cake	15	15	15	15
Wheat offal	4.8	4.8	4.8	4.8
Fish meal	2.0	2.0	2.0	2.0
Oyster shell	8.0	8.0	8.0	8.0
Bone meal	2.0	2.0	2.0	2.0
*Premix	0.25	0.25	0.25	0.25
Methionine	0.20	0.25	0.25	0.25
Salt	0.25	0.20	0.20	0.20

*Supplied per kg diet: Biotin = 40 gm, Zn = 58 mg, Fe = 5800 mg, Vit A = 1,000,000 i.u, Folic acid = 500 mg, Se = 120 mg, 1 = 60 mg, Nictotinic acid = 2800 mg, Cu = 700 mg, Mn = 4800 mg, Vit k = 1,500 mg, Riboflavin = 500 gm, Co = 300 g

Table 2: Proximate composition of *Tephrosia bracteolata* leaf meal (percent)

Nutrient	Composition
Dry matter	87.0
Crude protein	20.3
Crude fibre	17.0
Ether extract	4.65
Ash	8.85
Nitrogen free extract	36.3
Calcium	1.30
Phosphorous	0.53
Metabolizable energy, MJ kg^{-1}	10.1*

*Calculated figure (MJ kg^{-1}) using ME = 37× %CP +81.8× %EE +35.5× %NFE

Analytical procedures: Sample of the leaf meal was subjected to proximate analysis to determine the nutrient levels of the meal using standard methods (AOAC, 1995). The Mineral elements calcium was read at 422 nm with the use of an Atomic Absorption Spectrometer (AAS) while phosphorous concentration was estimated by vanado molybdate method. Data obtained were subjected to one way analysis of variance in a completely randomized design as proposed by Steel and Torrie (1980) and the means were separated by least significant difference designed by Fisher R.A as outlined by Wahua (1999).

Table 2 shows the proximate, mineral and energy composition of test material (*Tephrosia bracteolata* leaf meal, TLM). The leaf meal contained 13% moisture as fed, other values are as indicated in the Table 2.

The dry matter turn-over, performance and egg qualities and cost analysis are presented in Table 3-5, respectively.

Table 3: Dry matter turn-over of *Tephrosia bracteolata* leaves on as fed basis

	Sample				
Parameter	1	2	3	4	5
Fresh weight (g)	2000	2000	2000	2000	2000
Sun dry weight (g)	609.3	615.4	623.1	605.4	592.7
Dry matter turn-over % (as fed)	30.50	30.80	31.20	30.30	29.60
Dry matter (%)	26.54	26.80	27.14	26.36	25.75

Table 4: Performance and egg quality characteristics of experimental birds fed different levels of TLM based diets

Parameter	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 7.5%)	SEM
Feed intake (g d^{-1})	115.50^a	112.53^a	111.51^a	100.20^b	2.99
Average egg number/wk	5.03	4.76	4.67	4.61	0.08
Egg weight (g)	56.92	55.65	56.45	55.27	0.34
Body wt changes (g)	44.5	49.8	38.5	35.0	2.92
Egg output g $week^{-1}$	286.31^a	265.08^{ab}	263.62^{ab}	254.70^b	5.98
Feed efficiency (kg feed/dozen egg)	1.93	1.99	2.00	1.83	0.03
Feed efficiency (kg feed kg^{-1} egg)	2.82	2.77	2.76	2.75	0.01
Shell thickness (mm)	0.322	0.312	0.309	0.311	0.005
Albumen weight (g)	35.52	33.88	35.71	35.70	0.40
Yolk weight (g)	14.75	14.88	14.20	14.88	0.14
Yolk colour	1.00^d	3.92^c	5.50^b	6.70^a	1.07

$^{a\,b\,c\,d}$means with different superscripts on the same row are significantly different ($p<0.05$)

Table 5: Cost analysis of tephrosia leaf meal based diets for laying hens (Naira -#)

Parameters	T_1 (0%)	T_2 (2.5%)	T_3 (5.0%)	T_4 (7.5%)	SEM
Feed cost kg^{-1}	35.63	35.45	35.30	35.12	0.10
Cost of feed consumed/bird /wk	28.74	27.88	27.54	24.64	0.79
Cost of TLM kg^{-1}	10	10	10	10	
Unit price of egg	12	12	12	12	
*Feed cost/tray egg	166.37	178.77	177.11	163.35	3.43
Feed cost/kg egg	100.25	98.06	97.37	96.61	0.70
Revenue/ tray egg	258.69^a	240.69^{ab}	240.17^{ab}	237.09^b	4.38
**Value of output/wk	61.34	56.79	56.48	54.57	1.28
Gross profit	91.63^a	61.92^b	63.06^b	73.74^b	6.15

*A tray of egg = 30 pieces of eggs, ** Taking average egg weight of 56.07 to cost #12

Fresh leaves of *Tephrosia bracteolata* contained approximately 30% dry matter on as fed basis. Feed intake of hens on 0, 2.5 and 5.0% were similar and significantly higher ($p<0.05$) than those on 7.5% levels TLM. Body weight gain, Hen day production, feed efficiency and feed cost per kilogram egg were not affected significantly ($p>0.05$). Similarly, egg quality parameters including shell thickness, albumen and yolk weight were not affected ($p>0.05$) except for the yolk colour that became greatly intensified ($p<0.01$) with progressive inclusion of the leaf meal.

Cost analysis: All parameters measured are statistically ($p>0.05$) similar except for revenue generated and profit which showed that control, 2.5 and 5.0% TLM dietary treatments were comparable and that control was significantly better than the 7.5% TLM treatment.

DISCUSSION

To get one tonne of Tephrosia leaf meal, about three and half tonnes of fresh leaves must be gathered. The leaves are too bulky, waste stream generation is high in terms of moisture content which tend to limit its usage in compounded diets. The bulkiness explains the reason for the cost of #10.00 for the leaf meal, which accrued from labour costs on harvesting, transportation and milling. Cost implication should be an integral factor to note in evaluating the potential of leaf meal as feed ingredient for non-ruminant feeding system. This is often omitted in many reports on leaf meal. The observation of a decline in feed intake of experimental birds is line with several works on leaf meals which revealed that feed intake declined in a linear fashion with progressive inclusion of leaf meal (Odunsi, 2003; Ekenyem and Madubuike, 2006). Higher levels of leaf meal will cause a dilution of the energetic component of the diet as noted in its bulkiness. This was expected to result in higher consumption in an attempt to meet their energy requirements for body maintenance and egg production. However, the depression in feed intake may be caused by unpalatability and probable presence of toxic factor inherent in the leaf (D'Mello, 1995).

The results of egg production, egg weight, body weight gain and feed efficiency indicate that the leaf meal at different levels of inclusion could support performance of laying chickens. This result differ from reports of Ekenyem and Madubuike (2006) and Nworgu, (2006) who assessed potential of *Ipomoea asarifolia* and *Cetrosema pubescens* leaf meals and found significant differences in body weight changes. There appear to be performance limiting factor in the leaf meal as clearly shown in a linear fall in egg output. Critical examinations of numerical fall in both egg production and body weight changes as Tephrosia leaf meal inclusion increased may further elucidate possible presence of limiting factors in the leaf meal. Since shell thickness, albumen and yolk weight were not really affected, the experimental diets were presumed to have supported egg quality of the experimental birds. Yolk colour that became greatly intensified ($p<0.01$) with progressive inclusion of the leaf meal revealed that *Tephrosia bracteolata* leaf meal would be an effective pigmenting agent in poultry industry with a value of 6.7 at 7.5% inclusion. Usually, a Roche colour fan of 7-8 will be accepted for grade A eggs in most areas (Leeson and Summers, 1997). Although, leaf meal was cheaper than many of the ingredients used in poultry diet formulation, there was no significant difference in cost of experimental diets. Costs accrued from harvesting; transport, drying and milling should be a vital factor that determines the overall exploitation of leaf meal in diet of poultry, which was overlooked in many reports. The cost of feed in relation to output indicated that at higher inclusion rate, TLM could reduce production cost because it is relatively cheaper than many organic feed ingredients. Revenue generated from control was comparable to 2.5, 5.0% and significantly higher ($p<0.05$) than 7.5% dietary treatments. Similarly, profit margin of control treatment was better than other 3 treatments. This could be traced to higher output (egg number and egg weight) obtained with control over other treatments.

It is recommended that TLM may be safely included up to 5.0% in layer diet in situation of shortage and or high cost of grains and protein ingredients not only as a cheaper and abundant non-conventional ingredient but also as a good pigmenting agent. It is suggested that further investigation should be carried-out on the ways of improving the utilization of the leaf meal, as increase inclusion portends better economic returns.

REFERENCES

AOAC, 1995. Association of Official Analytical Chemists. Official Method of Analysis. 15th Edn. Washington D.C.

Ayoade, J.A., P.O. Ogebe, A.J. Okwori and J.O. Ogbeide, 1988. Nutritional Potential of *Tephrosia bracteolata* Leaves as a Sole Feed for Goat. In: Oduguwa, O.O., A.O. Fanimo and OA. Osinowo (Eds.) Animal Agriculture in West Africa. The sustainability question. Proceedings of Silver Anniversary Conference of the Nigeria Society of Animal Production, pp: 53-54.

Babayemi, O.J., A.O. Akinsoyinu, O.A. Isah, A.A. Adeleye, M.A. Bamikole and M.K. Adewunmi, 1999. Effect of magnesium supplement on performance characteristics of lactating West African dwarf goats. Trop. Anim. Prod. Investment. 2: 61-68.

Babayemi, O.J., M.A. Bamikole, I.O. Daniel, A. Ogungbesan and A. Babatunde, 2002. Growth, nutritive value and dry matter degradability of three *Tephrosia* species. Nig. J. Anim. Prod., 29 (2): 199-206.

D'Mello, J.P.F., T. Acamovic and A.G. Walker, 1987. Evaluation of *Leucaena leucocephala* leaf meal for broiler growth and pigmentation. Trop. Agric. (Trinidad), 64: 33-35.

D'Mello, J.P.F., 1995. Leguminous Leaf Meals in Non-Ruminant Nutrition. In: Tropical Legumes in Animal Nutrition. 1st Edn. Wallingford, Oxon, A.B. Int., pp: 247-280.

Dutta, A.C., 1979. Botany of degree student. Calcutta, Oxford University Press, pp: 728.

Ekenyem, B.U. and F.N. Madubuike, 2006. An assessment of *Ipomoea asarifolia* leaf meal as feed ingredient in broiler chick production. Pak. J. Nut., 5 (1): 46-50.

Fragas, I.M., N. Ramos, M. Venerco, R.O. Martines and M. Sistatchs, 1993. Amaranthus forage in diets of broiler. Cuba J. Agric. Sci., 27: 193-198.

Leeson, S. and J.D. Summers, 1997. Commercial Poultry Nutrition. 2nd Edn. University Books, Guelph, Ontario, Canada, pp: 35-38.

Longe, O.G. and Fagbenro-Byron, 1989. Composition and physical characteristics of some fibrous wastes and by products for pig feed in Nigeria. Beit Trop. Landwirtsch Vet. Med., 28: 199-205.

Natanman, R. and Chandiasekarani, 1996. Leucaena leaf meal as protein supplement for broilers. Ind. Vet. J., 73(10): 1042-1044.

North, M.O. and O.O. Bell, 1990. Commercial Chicken Production Manual. 4th Edn. Van Nostrand, Reinhold, New York, pp: 686.

Nworgu, F.C., E.A. Adebowale, O.A. Oredein and A. Oni, 1999. Prospects and economics of broiler production using two plants protein sources. Trop. J. Anim. Sci., 2 (1): 159-166.

Nworgu, F.C., 2006. Centrosema (*Centrosema pubescens*) leaf meal as protein supplement for broiler chicks. Proc. 32nd Ann. Conf. Nig. Soc. Anim. Prod., pp: 338-341.

Odunsi, A.A., T.O. Akande, A.S. Yusuph and R.I. Salami, 2002. Comparative utilization of high inclusion rates of four Agro-industrial by-products in the diets of egg type chickens. Archivos de Zootecnia, 51 (196): 465-468.

Odunsi, A.A., 2003 Assessment of *Lablab purpureus* leaf meal as a feed ingredient and yolk colouring agent on the diet of layers. Int. J. Poult. Sci., 2 (1): 71-74.

Oruseibio, S.M., 1996. Effect of restricted feed on broiler chicken growth performance. Paper presented at the 21st Annual Conference of Nig. Soc. Anim. Prod., Uyo, Nigeria.

Preston, T.R., 1992. Alternative non-cereal diet for poultry. Livestock Res. Rural Dev., 4 (3).

Steel, R.G.R and J.H. Torrie, 1980. Principles and procedures of statistics. MC-Graw Hill book New York.

Wahua, T.A.T., 1999. Applied Statistics for Scientific Studies. Africa Link Books, Abia State, Nigeria, pp: 129-161 Netherlands). 239(3-4): 304-308.