

EFFECT OF FEEDING HEAT TREATED SOYBEAN (*Glycine max*) AND PIGEON PEA (*Cajanus cajan*) AS MAJOR SOURCES OF PROTEIN ON LAYER PERFORMANCE

LEO N. AGWUNOBI

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ABSTRACT

The feeding value of heat-treated soybean and pigeon pea rations were compared with a standard ration using one hundred and twenty point-of-lay pullets. The performance of layer on these diets were monitored for 56 days. It was observed that egg production, egg weight, feed intake and feed efficiency for egg production were poorest ($P < 0.01$) for pigeon pea ration while soybean gave the same level of performance as the standard ration. There were no significant ($P > 0.05$) differences between the rations on Haugh Unit (albumen quality) and shell thickness. It was concluded that pigeon pea, unlike soybean cannot alone supply the protein need for optimal layer performance.

KEYWORDS: Heat-treated, Soybean, Pigeon pea, Protein sources, Layers' performance.

INTRODUCTION

Protein sources for animal feed are scarce and highly prized in the Tropics. The popular fish meal is almost out of market but where available, its cost is prohibitive. The high demand for groundnut cake for human food makes it less available for livestock feed. The high fibre contents of palm kernel cake and gossypols in cotton seed cakes limit their uses as protein sources. There is, therefore, the need to research into other alternative protein sources for poultry.

Soybean and pigeon pea are among leguminous seed which are yet to suffer serious competition between man and livestock for food in the Tropics. Soybean and pigeon pea are short time maturing and high yielding crops. They are erect legumes and therefore lend themselves easily to mechanization. A lot of feeding trial experiments with poultry have been done with soybean (Carver, *et al.*, 1944, Rogler *et al.*, 1963) but not with pigeon pea. The few reports available on growth and digestibility in rats and man respectively indicate that the nutritive value of pigeon pea is lowest when compared with Bengal gram (*Cicer arietinum*) and Soybean (Rao and Desikachar, 1964). Better performance was also observed with other beans (Mango, Paayap and Tapolan) than with the pigeon pea in trials with pigs (Sevilla-Eusebio *et al.*, 1968). Pigeon pea and soybean seeds like other legumes contain anti-pituitary factors. However, Braham *et al.* (1965) observed that autoclaving for 20 minutes improved their nutritive value.

The objective of the study is to compare the feeding value of pigeon diet with the standard diets judging by the performance of laying chicken.

MATERIALS AND METHODS

The experiment was carried out in the Teaching and

Research Farm, University of Ibadan, Nigeria. The soybean and pigeon pea used in this experiment were obtained from International Institute for Tropical Agriculture, Ibadan, Nigeria. The rest of the feed ingredients were supplied by the Teaching and Research Farm Unit, University of Ibadan.

The pigeon pea and the soybean were separately ground to pass through 4mm mesh in a Willey mill. The aim was to increase the surface area of the beans in contact with moist heat from the autoclave. The soybean and pigeon pea meals were separately autoclaved at 6.8kg pressure and 121°C for 30 minutes (Braham *et al.*, 1965). The resulting materials were spread on a flat clean board to cool down.

Three rations similar in composition, except for the total replacement of groundnut cake, fish meal and blood meal in the control with either soybean meal or pigeon pea meal, were prepared. That is, pigeon pea and soybean formed the major sources of protein in the test rations while groundnut cake, fishmeal and blood meal formed the major sources of protein in the control ration as shown in table 1. The rations were made iso-nitrogenous and iso-caloric. The protein content of pigeon pea ration was increased to meet the same level with soybean and standard rations by including high proportion of pigeon pea in the ration (Table 1). The energy content of pigeon pea ration was increased to equal those of soybean and standard rations by adding 2% of palm oil (Table 1).

One hundred and twenty point-of-lay birds, Hubbard strain, of average weight (1.5kg) were randomly allotted in groups of 40 to the three different rations. Each group was replicated twice such that each replicate had 20 birds. They were fed and watered

ad libitum for eight weeks. The birds were managed and maintained under cage system. Egg numbers, egg weights and feed intakes were recorded daily

while eggshell thickness and albumen height were measured weekly for each treatment. The experiment lasted for 56 days excluding 7 days preliminary period of stabilization. The shell thickness was measured with a micrometer screw gauge in millimeter. The shell was measured at three places – the equatorial region, broad and narrow ends. The average of the three was recorded as the average thickness of the shell. The albumen height and egg-weight were used to determine the Haugh Unit by the method of Brants et al (1951). The albumen height was measured using the Spherometer and the Haugh unit calculated as follows: $\text{Haugh Unit} = 100 \log H + 7.57 - 1.7W^{0.37}$ where H = albumen height; W = egg weight.

Data were subjected to analyses of variance and least significant difference was used to evaluate the significance between treatment means (Steel and Torrie, 1960). The experimental design was the Completely Randomized Designed. The rations were subjected to proximate analysis (Table 2) using the standard method of analysis by A.O.A.C. (1970).

Table 3: The Composition of the rations (%)

	Soybean ration	Pigeon pea ration	Control ration
Maize	56.0	26.0	64.6
Groundnut cake	-	-	11.5
Blood meal	-	-	4.6
Fish meal	-	-	2.3
Soybean meal	27.0	-	-
Pigeon pea meal	-	55.0	-
Brewer's dried grain	7.0	7.0	7.0
Bone meal	3.0	3.0	3.0
Oyster shell	6.0	6.0	6.0
Mineral vita. Pre	0.5	0.5	0.5
Methionine	0.1	0.1	0.1
Salt	0.4	0.4	0.4
Palm oil	-	2.0	-
	100	100	100

RESULT AND DISCUSSION

The effect of feeding heat-treated soybean and pigeon pea as major sources of protein on layers performance is shown in Table 3. Egg weight, Feed intake, Hen-day production and feed efficiency: egg production were significantly ($P < 0.01$) affected by the rations. The birds on pigeon pea consumed significantly ($P < 0.01$) less feed and produced by far fewer eggs (39.7%) than those on either the control (75.5%) or soybean ration (7

Table 2: Proximate Composition of the Soybean meal, Pigeon meal and the rations (% dry matter)

	Soybean meal	Pigeon Pea Meal	Soybean Ration	Pigeon pea ration	Control ration
Dry matter	92	91	90.5	90	91.5
Ash	6	8	12.2	13.6	10.9
Crude Fibre	8	10	11.8	11.4	5.6
Ether Extract	25	11.3	9.9	9.3	6.4
Crude Protein	39	23	16.5	10.1	16.7
Nitrogen Free	14	38.7	40.1	41.9	50.6

Table 3: The Response of Layers to the Various Rations

	Soybean ration	Pigeon peas ration	Control ration	L.S.D
Average Daily Feed intake (g/bird)	95.00 ^a	83.50 ^b	96.50 ^a	1.9
Average Hen-day Production (%)	76.00 ^a	39.70 ^b	75.50 ^a	1.2
Average daily Egg weight (g) per bird	42.00	23.00	42.00	7.0
Average feed Efficiency (kg Feed/kg egg)	2.3 ^a	3.6 ^b	2.3 ^a	1.12
Average Haugh Unit	76.50	76.30	75.30	N/S
Average Egg shell Thickness (mm)	0.39	0.39	0.38	N/S

Foot note: ab Means with the same superscript in the same column are not significantly different at 1%

L. S. D. - Least Significant Difference
N/S - Not Significant.

The pigeon pea ration also gave the poorest feed efficiency. Unlike the pigeon pea ration, soybean ration compared favourably with the control ration in all the parameters measured. The reason for the poor performance of birds on pigeon pea could be attributed to lower intake and poorer utilization of the ration than either soybean or the control ration. It has been reported that pigeon pea contains high level of tannins (1141mg/100g DM) compared to chick pea (165mg/100gDM) black gram (836mg/100g DM) and green gram (612mg/100g DM) (Rao and Deosthale 1982). Tannin causes growth depression low protein digestibility, increased faecal nitrogen, damage to the intestinal tract, interference in iron absorption, toxicity after absorption from the gut and also has a carcinogenic effect in animals (Liener 1989)

Also from Table, 2, the low crude protein of pigeon pea meal (23%) warranted high level of inclusion of pigeon pea meal in the formulation of pigeon pea rations so as to make it iso-nitrogenous with other rations (soybean and standard rations) as well as to meet up the protein requirement of laying chicken. Owing to this high level of inclusion (which is out of proportion when compared to other rations - soybean and standard rations) any inherent deficiency in pigeon pea (like amino acids, or anti-nutritional factors) will tend to be more pronounced when pigeon pea is used as sole source of protein than when it complements other protein sources. Similar inherent deficiency was observed in pigeon pea when it caused poorer growth in rats (Rao and Desikachar, 1964) and pigs (Sevilla-Eusebio *et al* 1968) than Bengal gram (*Cicer arietinum*) and soybean.

However, Haugh unit (albumen quality) and egg shell thickness were not significantly ($P > 0.05$) affected by the various rations. This is in agreement with the findings of Combs and Helbacka (1960); Wisman and Beane (1965) and Pepper *et al* (1968) who reported non significant differences in Haugh unit and shell thickness when layers were fed different protein sources and levels.

It is concluded that pigeon pea as a major source of protein has a poorer feeding value judged by layers performance than either the control or soybean

ration. Pigeon pea as a major source of protein cannot sustain efficient performance in laying hen as soybean.

REFERENCES

- A. O. A. C., 1970 Official methods of analysis, 11th ed. Association of official Analytical Chemists, Washington, D. C.
- Braham, J. E., Maddaleno, V. R. Bressani, R. and Jarquin, R. 1965. Effect of Cooking and amino acid supplements on the nutritive value of protein of the pigeon pea (*Cajanus indicus*) Arch. Venezol. Nutrition 15: 19-32.
- Brant, A. W.; Otte, A. W., Norris, K. H 1951. Recommended Standards for Scoring and measuring opened egg quality. Food Technology 5: 356-361.
- Carver, J., Brant, A. W., and Evans, R. J 1944. Soybean oil meal in the laying ration. V. Circular 15. Washington Agricultural Experiment Stations.
- Combs, G. F. and Helbacka, N. V. 1960. Studies with laying hens (1) Effect of dietary fat, protein levels and other variables in practical rations Poultry Sci. 39: 371-279.
- Liner, I. E. 1989 Anti-nutritional factors in legume seeds: state of the art In: Recent advances of research in antinutritional factors in legume seeds: J. Huisman. AFB van der poel and I. E. Liener. (Eds) P. UDOC. Wageningen. 6- 14.
- Pepper, W. F., Summers, J. D and McConachie, J. D 1968. The Effect of high levels of calcium, Fish - quality and sodium bicarbonate on egg shell quality. Pout. Sci. 47: 224-229.
- Rao, P. V. S. and Desikachar, H. S. R 1964 Indigestible residue in pulse diets. Indian J. Exp. Biol. 2: 243-244.
- Roa, P. U. and Deosthale Y. G 1982 Tannin contents of pulses varietal differences and effect of germination and cooking. J Sci, Food Agric 33: 1013-1016.
- Rogler, J. C and Carrick, C. W. 1961. Studies with unextracted soybeans for chickens and turkeys. Feedstuff 33 (4): 26.
- Rogler J. C., Hill, F. W. and Renner, R. 1963 Effect of heat treatment on the metabolizable energy value of soybean flakes for the hen, J. Nutr. 80: 375-380.
- Sevilla-Eusebio, J.; Marnil, J. C. Eusebio, J. A. and Gonsales, R. R. (1968). Studies on Philippine Leguminous seeds as protein foods. 1. Evaluation of beans based on their amino acid patterns. The Philippines Agric., Vol. III (4): 211-217.
- Steel, R. G. D., and Torrie, J. H. 1960. Principles and Procedures of Statistics. McGraw-Hill Book Co., Inc. London.
- Wisman, E. L and Beane, W. L. 1965. Utilization of hatchery by-products meal by the laying hen. Poutl. Sci. 44: 1332-1333