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Research Article
Effects of Incorporation of Roasted Soybeans on the Performance of Laying and the Financial Profitability of Laying Hens

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Abstract

Objective: The test was conducted to determine the effect of the use of roasted soy in the Isa Brown hens breed feeding on egg laying performance and financial profitability. **Methodology:** Two hundred and eighty Isa Brown hens were divided into four groups and received during 14 weeks of rations at different rates roasted seed of soy "Soja Nyo": 0, 10, 15 and 20%. Each ration was randomly assigned to a batch of 80 hens of 31 weeks old. **Results:** The incorporation of roasted soy "Soja Nyo" allows an increase in fat and improving energy level schemes. The averages of different rations on the laying rate, using egg weight and feed consumption were significantly different. **Conclusion:** The best laying rate was obtained with the ration 20%. But the incorporation of roasted soybeans was more efficient at 15% in diets for laying hens according to differential margin.

Key words: Laying performance, egg, differential margin, Soja Nyo, Isa Brown

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Livestock products consumption has increased rapidly in developing countries in recent decades. Thus, per capita consumption has almost doubled for milk has more than tripled for meat and for eggs has increased five fold[1]. The increased production of eggs or meat is due to the success of the poultry industry in developing countries through advances in feed and poultry nutrition. Today, mastering the poultry nutrition techniques is one of the best ways to improve the quantity and quality of the livestock products (meat and eggs). The improvement of livestock products is possible through an increase in the production of raw materials (cereals, oilseeds) that provide protein and energy needed by poultry. Thus, in the range of raw materials, the soybean is an excellent source of protein and energy in the poultry feed. Soy is used as meal after oil extraction or as whole seed.

But the whole raw grain contains certain anti-nutritional factors, the most important is the trypsin inhibitor that reduces the performance of poultry. Before its incorporation, soybeans must be pretreated either by modern or traditional techniques to reduce anti-nutritional factors. In developed countries, soybean use in the avian diet is common[2] while in developing countries it is only paltry compared with dried cassava leaves, baobab and alfalfa[3,4]. Few studies have evaluated the incorporation of whole seed soy in the diet of broilers and laying hens[5-7]. In Togo soybean production and its use in poultry feed are only just beginning. To increase the use of soy beans in poultry feed, the OIC-TOGO NGO has promoted the production and used of soy called "Soja Nyo"[8].

This study aims to determine the effects of the use of roasted "Soja Nyo" at 5, 10 and 15% rates in feed rations on the performance of laying and the financial profitability of laying hens.

MATERIALS AND METHODS

Study area: Notsè has provided the framework for this study. Notsè is the biggest city in the Haho province. Notsè, located 200 km North of Lomé in Togo has a tropical climate of Sudanese type characterized by four seasons, two rainy seasons and two dry seasons. The seasons, spanning periods are as follow: The long rainy season (mid-March to mid-July), the short dry season (mid-July to mid-September), the small rainy season (mid-September to mid-November) and the long dry season (mid-November to mid-March). The relative humidity remains consistently high throughout the year (60-90%). The annual average temperature is about 25°C.

Animals and breeding conditions: Two hundred and eighty, 31 weeks laying hens strain Isa Brown from the farm of the OIC- TOGO NGO were used for this study. The experiment was conducted in a mixed laying building (Soil+grating). This building was sectioned into five compartments, four of which were used in the creation of experimental batches. Each test chamber was equipped with 3 plastic troughs, 4 linear feeders and nests shelf with up to 27 individual nests.

Experimental device and unit: The experimental units consist of 4 lots of hens (L0, L10, L15 and L20). Each lot includes 31 weeks older 70 laying hens. Each lot received one of the four experimental diets having respectively 0, 10, 15 and 20% roasted whole seed "Soja Nyo". The diets compositions are shown in Table 1. Before the beginning of the actual experiment, a period of adaptation of 2 weeks was observed. The composition and nutritional characteristics of the 4 feed rations are shown in Table 2. Feed distribution was carried out twice a day at regular times and for water, 2 washes per day were carried out.

Table 1: Composition of roasted soy Soja Nyo

Parameters	Values
Dry matter (%)	94.83
Minerals (%)	5.34
Fat (%)	16.88
Crude protein (%)	40.40
Lysine (%)	2.44
Methionine (%)	0.53
Total carbohydrates (%)	32.21
Crude fiber (%)	10.98
Metabolizable energy (kcal kg^{-1})	4420.00
Antitrypsic activity (IU g^{-1})	8930.00

Table 2: Nutritional composition and characteristics of experimental diets

	Lots			
Raw material (%)	L0	L10	L15	L20
Corn	65.00	59.00	56.00	51.00
Roasted soy Nyo	-	10.00	15.00	20.00
Groundnut meal	10.00	-	-	-
Bran	-	5.00	5.00	7.00
Fish powder	6.00	7.00	5.00	3.00
Brewer's yeast	5.00	5.00	5.00	5.00
Leucaena	5.00	5.00	5.00	5.00
Oyster shell	7.50	7.50	7.50	7.50
Prémix	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
Theoretical batch rations nutrients				
Metabolizable energy (kcal kg^{-1})	2765.50	2795.50	2827.00	2821.30
Crude proteins (%)	17.12	17.50	18.16	18.82
Methionine (%)	0.37	0.35	0.34	0.32
Lysine (%)	0.78	0.90	0.93	1.08
Fats (%)	3.61	5.65	6.45	7.25
Cellulose (%)	3.26	3.24	3.47	3.94
Calcium (%)	3.08	3.12	3.08	3.20
Total phosphorus (%)	0.46	0.60	0.53	0.54

Measured parameters: The eggs were collected, counted and calibrated every 2 h from 8-18 h. The amount of feed ingested was calculated by the difference between the quantity of feed distributed and the daily leftover feed. This allowed to calculate the laying rate, average egg weight and amount of feed ingested per week (the 33rd-44th week of age).

The laying rate was calculated using the equation proposed by Sauveur[9]:

$$IP = \frac{Q \times 100}{n_1+n_2+...+n_k}$$

Where:

Q = Total number of eggs laid in the house in k days

$n_1+n_2+ ... +n_k$ = Sum of daily numbers since day 1 until k. Here k = 7

IP = Laying intensity or rate of lay

The mean egg weight was calculated by the equation:

$$PMO = \frac{P1+P2+...+P7}{Q}$$

Where:

P1+P2+...+P7 = Sum of the daily egg weight from day 1 through day 7

Q = Total number of eggs in the chicken coop in 7 days. The moisture content of the litter was determined at the end of the experiment and this in view to detect possible risks from diarrhea or runny droppings that are related to the incorporation of roasted soybeans

The economic evaluation was prepared on the basis of the cost of different feeds as follows:

$$\text{Rations cost (CR)} = Ti \times SPi$$

Where:

Pi = Price of the ingredient considered CFA kg^{-1}

Ti = Quantity or level of the ingredient in the ration considered in kg:

$$\text{Cost of feed consumed (CAC)} = \frac{q \times 70 \times CR\ 84}{1000}$$

Where:

q = Average amount consumed per day in g hen^{-1} day^{-1}

CR = Feed costs in CFAF kg^{-1}

70 = Number of hens per lot

84 = Test duration in days

1000 = Correction number bringing q in kg:

$$\text{Gross revenue (RB)} = \Sigma\ Qi \times Pi$$

Where:

Qi = Total number of eggs obtained per category and per lot

Pi = Price of each category:

$$\text{Gross margin (MB)} = \text{RB-CAC additions}$$

$$\Delta Ca = Ci-Co$$

Where:

ΔCa = Additional cost caused by the inclusion of roasted soy rate i%

Ci = Cost of feed consumed in relation to the ration i% roasted soybean

Co = Cost of feed consumed in connection with the operation to 0% roasted soybean

a = {1, 2, 3}:

$$\text{Additional products } (\Delta Pa) = Pi-Po$$

ΔPa = Additional product caused by the inclusion of roasted soy rate i%

Pi = Product in relation to the ration i% roasted soybean

Po = Product in relation to the ration at 0% roasted soybean

i = {10, 15, 20} level of incorporation of roasted soybean

Data analysis: Data analysis was performed by comparing the average and variance analysis. There is a single factor: The level of incorporation of roasted Soja Nyo at three levels: 10, 15 and 20%. If the ANOVA revealed a significant difference between the means, we will proceed to discrimination or classification of this medium through Duncan test used to compare the means two by two. These comparisons are made at the 5% significance level.

RESULTS

Animal performance: The average of the various parameters studied are presented in Table 3. The averages of different rations on the laying rate, using egg weight and feed consumption were significantly different. The overall performance of 33rd-44th weeks of feed consumption and average egg weight were lower for the control compared to the treated groups. In contrast, the average in the control group (L0) are greater than the group receiving 10% soybean (L10) for the laying rate and feed efficiency. The inclusion of

Table 3: Effects of soy roasted Nyo on laying performances of the 33rd-44th week

	Lots			
Performances	L0	L10	L15	L20
Laying rate (%)	57.28±8.06[a]	56.46±13.15[a]	62.55±8.56[b]	63.23±7.78[b]
Feed consumption (g hen^{-1} jour^{-1})	90.65±10.01[a]	96.28±8.70[b]	98.10±8.95[bc]	99.11±7.50[c]
Average egg weight (g)	56.41±1.58[a]	57.23±1.47[ab]	58.30±2.07[b]	58.38±1.51[b]
Feed efficiency	2.83	3.11	2.73	2.72
Mortality*	2	2	0	1
Humidity (%)	35.93[a]	33.94[b]	32.99[c]	32.97[c]

*Number of dead chickens batch of 70 chickens over a period of 84 days, [a-c]On the same line, the numbers are significantly different ($p<0.05$)

Table 4: Assessment of the cost of the feed consumed during 84 days by 70 laying hens

	Lots			
Performances	L0	L10	L15	L20
Feed consumed (g hen^{-1} jour^{-1})	90.64	96.28	98.10	99.11
Average egg weight (g)	56.41	57.22	58.30	58.38
Feed costs (FCFA kg^{-1})	130.40	133.30	141.05	147.90
Total quantity of feed consumed (kg)	532.96	566.13	576.83	582.77
Cost of consumed feed (FCFA)	69498.40	75464.65	81361.59	86191.21

Table 5: Gross revenues

		Lots			
Category		L0	L10	L15	L20
25 FCFA*	Q[$]	30.00	52.00	43.00	25.00
	RB	750.00	1300.00	1075.00	625.00
1200 FCFA[#]	Q	864.00	752.00	602.00	638.00
	RB	34560.00	30080.00	24080.00	25520.00
1300 FCFA[#]	Q	1404.00	1414.00	1549.00	1461.00
	RB	60840.00	61273.33	67123.33	63310.00
1400 FCFA[#]	Q	865.00	884.00	1091.00	1039.00
	RB	40366.67	41253.33	50913.33	48486.67
1500 FCFA[#]	Q	88.00	128.00	236.00	209.00
	RB	4400.00	6400.00	11800.00	10450.00
1600 FCFA[#]	Q	100	100.00	100.00	100.00
	RB	5333	5333.00	5333.00	5333.00
Total des RB		140970.00	140360.00	155045.00	148445.00

*Price of recoverable broken egg, [#]Price of egg box "30 eggs", [$]Q: Quantity of eggs/category/lot and RB: Gross revenue/category/lot

Table 6: Differential margins

Lots	Gross product (FCFA)	Cost (FCFA)	Gross margin (FCFA)	ΔC (FCFA)	ΔP (FCFA)	ΔP-ΔC (FCFA)
L0	140970	69498.40	71471.60	0.00	0.00	0.00
L10	140360	75464.65	64895.35	5966.25	-610.00	-6576.25
L15	155045	81361.59	73683.41	11863.19	14075.00	2211.81
L20	148445	8691.21	62253.79	16692.82	7475.00	-9217.87

"Soja Nyo" has an effect on the percentage of moisture in the litter (Table 3). The moisture content rate is inversely correlated to the soybean content rate. It is 35.93% for the L0 and 33.94, 32.99 and 32.97%, respectively for L10 batches L15 and L20.

Financial profitability: This objective is not to evaluate the financial profitability of laying hens, but we wanted to evaluate the effect of the incorporation of roasted soy in the diet on the laying hens. Indeed, the incorporation of roasted soy in the diet creates an additional cost. For this, we will see if the induced additional product helps offset the additional costs and if it leads to additional gain. Therefore, limit to the law of comparative yields. Data on cost calculations, revenues and incremental margins were reported in Table 4-6.

DISCUSSION

A well-balanced feed made from quality raw materials is essential to the success of the breeding. A laying hen can produce the amount of expected eggs only if she finds every day in its diet the nutrients it needs. These needs range from feed energy, protein, minerals, trace elements and the vitamins. Feed rations for our test takes account of these needs. In general, the energy-rich feeds must therefore also be more concentrated in protein essential amino acids to meet nutritional needs. To increase the availability of fat and improve the energy value (3300-3900 kcal kg^{-1} of dry matter), soybeans should be used after heat treatment for animal feed.

The incorporation of roasted soybeans in feed rations of laying hens gave varying results depending on the level of incorporation. In recent years, the literature has reported that the addition of fat seems to have a specific effect on the performance of the production parameters of Isa Brown[10]. Numerous tests carried out on the use of soybeans in the diet of laying hens have given different results depending on the processing method of the seed. Thus, raw soybeans have given unsatisfactory results even in the presence of methionine (www.asa-europe.org).

This study was conducted on animals aged over 30 weeks for which growth is completed to strictly explore the potential effects of adding soy in the diet on laying performance and weight maintenance, such as adult studies with phytase[11-13].

Best spawning rate and means of eggs weight were obtained with the L20 and L15 rations. From the analysis of variance there is a statistically significance difference between the average rate of egg laying for L15 and L20 rations compared to the control (L0) at the 5% significance level. This means 15% roasted "Soy Nyo" in poultry diet improve production parameters. The results obtained are contrary to those of Benabdeljelil[6] who found that the control (0% extruded soybean) parameters are higher than those form the batches containing 5, 10 and 15% of extruded soy in the diet. However, Mateos[14] did not find a significant difference for laying hens subjected to increasing levels of extruded soybean seeds (0, 6, 12 and 18% of seeds).

Laying rate of our experiment are lower than those (96, 25-97.74) by Michel *et al.*[15] on the same breed of laying hens in France. There was also an improvement in litter's moisture even though relative humidity remains consistently high throughout the year (60-90%). The low mortality (Table 3) and good digestibility are due to low litter moisture. According to Mateos and Salado[5] there are factors in soybean that improve the digestibility of other nutrients in the diet.

The financial return is calculated on the basis of DP-DC to determine ration's production that covers generated additional costs. The additional cost incurred by incorporating roasted soybeans to 15% in a laying ration is largely compensated by the induced additional production. The results of this study show that the incorporation of 15% roasted soy in laying hens diet increases the financial profitability.

CONCLUSION

The incorporation of roasted "Soja Nyo'' in feed rations of laying hens Isa Brown at increased rates has significant benefits. Parameters such as the laying rate, the mean egg weight and litter moisture are improved progressively as the rate of soybean in the ration increases. Positive gross margin is obtained at 15% (maximum rate) roasted "Soja Nyo" in poultry diet.

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REFERENCES

1. FAO., 2009. La Situation Mondiale de L'alimentation et de L'agriculture. Food and Agriculture Organization, Rome, ISBN 978-92-5-206215-8, Pages: 186.
2. Benabdeljelil, K., 1999. Le Soja Graine Entiere. American Soybean Association, Brussels, Belgium, Pages: 86.
3. Al-Shami, M.A., M.E. Salih and T.E. Abbas, 2011. Effects of dietary inclusion of different levels of alfalfa leaf meal on laying hens' performance and egg quality. Res. Opin. Anim. Vet. Sci., 1: 748-753.
4. Houndonougbo, M.F., C.A.A.M. Chrysostome and V.P. Houndonougbo, 2012. Performances de ponte et qualite des oeufs des poules pondeuses ISA brown alimentees avec des rations a base de feuilles sechees de manioc (*Manihot esculenta*, Crantz). Int. J. Biol. Chem. Sci., 6: 1950-1959.
5. Mateos, G.G. and S. Salado, 1999. Derniers developement dans l'utilisation du soja graines entieres dans les regimes destines a la volaille. Actualites Techniques 1, American Soybean Association, pp: 1-16.
6. Benabdeljelil, K., 2001. L'utilisation du soja, Graines entieres extrudees dans l'alimentation des poules pondeuses. Effets sur Les Performances de Ponte et la Qualite de L'oauf, Actualites Techniques, Janvier 2001, American Soybean Association (ASA), pp: 1-12.

7. Van Eekeren, N., A. Maas, H.W. Saatkamp and M. Verschuur, 2006. L'elevage des Poules a Petite Echelle. 4th Edn., Agromisa Foundation, Wageningen, Netherlands, ISBN: 9789085730651, Pages: 97.
8. Du Breuil, M.P. and A. de Romemont, 2007. Promotion D'entreprises de services et organisations de producteurs (ESOP). Regoverning Markets Innovative Practice Series, IIED, Londres.
9. Sauveur, B., 1988. Reproduction des Volailles et Production D'oeufs. INRA., Paris, Pages: 433.
10. ISA., 2011. Guide nutritionnel des poules pondeuses commerciales. A Hendrix Genetic Company, The Netherland, pp: 1-23.
11. Keshavarz, K., 2000. Reevaluation of nonphytate phosphorus requirement of growing pullets with and without phytase. Poult. Sci., 79: 1143-1153.
12. Keshavarz, K., 2003. Effects of continuous feeding of low-phosphorus diets with and without phytase during the growing and laying periods on performance of two strains of Leghorns. Poult. Sci., 82: 1444-1456.
13. Mellef, J., A. Dridi, A. Agrebi and O. Belhaj, 2011. [Effects of the dietary added phytase on the laying performances of hens]. Revue Med. Vet., 162: 304-309.
14. Mateos, G.G., 1988. Alimentcion de gallinas ponedoras en base a raciones con soja integral. I Congreso Europeo Sobre Perspectivas del Haba de Soja en Alimentacion Animal, American Soybean Association, Madrid, Espana, pp: 151-179.
15. Michel, L., H.J. Marc, C.A. Marie, B. Joel and T. Angelique *et al*., 2005. [Effect of field bean vicine and convicine content on production performances of laying hens and the quality of the egg]. Proceedings of the Sixiemes Journees de la Recherche Avicole, March 30-31, 2005, St. Malo, France, pp: 174-178.