PROFITABILITY OF QUAIL BIRD'S PRODUCTION FED VARIOUS LEVELS OF PROTEIN USING SOYBEAN MEAL AS THE MAIN PROTEIN SOURCE

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Abstract

The study was on the profitability of quail production in Vom, Plateau State. Data were collected on daily feed consumption and weekly weight gain of the quail birds. Five (5) different levels of protein feed made up of 18, 20, 22, 24 and 26 percent were used as treatments for feeding from day old to 7 weeks old. Four production function equations were fitted to the data, namely Cobb-Douglas, semi-log, exponential and linear to determine which one was suitable for analyzing the data based on economics, econometric and statistical criteria. Profitability of the quails produced was determined by Gross margin analysis technique. The R^2 value of 87 percent showed that, 87 percent of the quails weight gain was accounted for by carbohydrate and protein sources of the feed, while only 13 percent was accounted for by the joint action of other variables not included in the model. Based on the values obtained, the 24 percent protein feed gave the highest profit of N24.84/bird. The least profit made in the treatments was the 18 percent protein treatment which is N7.13/bird. Based on the least cost analysis of the carbohydrate and protein feed sources, the least cost was N1, 982.80. The study concluded that the most profitable level of inclusion is 24% crude protein based on the inputs combination. Quail production is low input demanding phenomenon that generate profit and it should be encouraged in the evolving transformation of the poultry industry in Nigeria.

Key words: Quail production, profitability, poultry, protein sources, feeding

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Introduction

Japanese quail (Cortunix cortunix Japonica) belongs to the order Galiformes and the family phasianidae. Like the chicken, intensive production of Japanese quails started in the 1920s in Japan, and the first egg lines were than developed by selection (Wakasugi, 1984). Japanese quails were successfully introduced from Japan to America, Europe and the near Middle East between the 1930s and the 1950s. Extensive research on Japanese quail carried out at that time showed that Japanese quail was a valuable animal for avian research and it produced the technical information needed to start production of quail's worldwide (Wilson *et al*., 1973). Quail rearing started in Nigeria since 1992 (Haruna *et al*., 1996) and has been on the increase in the country, being a cheap source of cholesterol – free meat and containing low fat content.

Nigeria like other developing countries, is faced with shortage and high cost of conventional feed stuffs for poultry (Uchegbu *et al*., 2008). The unprecedented increase in the cost of conventional feed ingredients used in formulating feeds has necessitated intensive investigation into the use of agricultural and agro-based industrial by products. Although the nutritional value of the non conventional feedstuffs used mostly in these countries have been extensively reviewed (Aletor, 1986), they are incorporated at levels which results in poor quality feeds of lower energy, low protein and or high fibre. This therefore calls for formulation of optimum protein level that is required for quail's production using locally available feed sources that are also cheap.

According to Apata and Ojo (2000), the high cost of compounded feed is derived largely from the exorbitant prices of feed ingredients, increasing competitive demand for them by man and animals and scarcity of conventional ingredients of between 60-70 percent total costs of their production. Effort would be geared toward evaluating alternative feed ingredients which are readily available in this case maize and Soybean as energy and protein sources respectively for quail diet production. According to Atteh and Ologbenla (1993), such alternatives should have comparative nutritive value but cheaper than the conventional protein sources and should also be in large quantities. More importantly, the effect of the alternative feed ingredients on the output (in this case quail birds) would also be a concern for consideration as an alternative for attaining maximum marketing weight within the shortest possible time.

Production Function:

According to Olayide and Heady, (1982), production function stipulates the physical or technical relationship between inputs and output in any production process. In mathematical terms, this function is assumed to be continuous and differentiable. Its differentiability enables us to establish the rate of return in production process. The purpose of production function is to identify and measure how variable inputs are used to explain the variability in output. The greater the extent to which the variable inputs are able to explain the variability in output, the larger is the influence which the variable inputs have on the output.

Production function can be understood as a constraint on the activities of producers that is imposed by the existing technology. Economists therefore use production function in conjunction with marginal productivity theory to provide explanation of factor prices and the levels of factory utilization. It generally affects the "best practice" use of the available input and output combination.

Farm Profitability

Profit according to Amaechi, (2007) is the monetary value computed as net income while profitability emphasizes the resources used to produce the profit. Cost and return analysis usually form the basis for farm profitability analysis. The procedure involves itemizing the various costs and returns of production and using them to arrive at such estimate as the return to one unit of the resources used, the gross margin as well as the gross net returns (Iheanacho, 2000; Jellason and Sani, 2007).

In production process where fixed cost is negligible portion of the farming enterprise as in the case of small scale subsistence agriculture, gross margin analysis is used (Olukosi and Erhabor 2005). Gross margin is referring to the difference between the gross farm income or total revenue and the total variable cost.

Cost minimization versus profit maximization

It is generally assumed that the major goal of a producing unit is profit maximization. One way to maximize profit is to minimize cost. The relevance of marginal rate of substitution in this study is to make possible the application of equimarginal principle. This principle states that cost is minimized or profit maximized when the marginal rate of substitution of factors is equal to the inverse price ratio (Sankhayan 1988). Put differently, the principle states that inputs should be allocated in such a way that the ratio of marginal factor cost is equal for all inputs in all enterprises or marginal cost must equal marginal value.

With information on the rate of substitution between two resources (carbohydrate and protein) and the respective prices of each, the least cost combination of feed can be estimated (Ogungbile *et al*., 1990). The principle of least cost combination states that if two or more factors are applied in the production of a single product, cost is at minimum when the marginal rate of substitution is equal to the inverse of factor prices (Olayide and Heady 1982). In the use of two inputs to produce a single output, the operator has three alternatives open to him. The first is that, he may maximize his output subject to cost constraint; the second alternative is that he may desire to minimize cost of production at a given output and thirdly, he may wish to vary the levels of both cost and output. For the first situation, his equilibrium or optimum combination of inputs is given at the point of tangency where the slope of isocost is equal to the slope of isoquant.

Statement problem

Information on the use of locally available feed sources for quail production is scanty (Whyte, *et al.*, 2000). The dearth of such information has constituted a challenge to prospective quail farmers. It is generally believed, that finding cheaper sources of feed ingredients can minimize cost and improve profit. Soya bean has over the years been proved to be an important source of protein in both human and livestock diets. Ascertaining its suitability for quail production, especially as it affects the cost of production of quails and subsequently profitability could be an important justification for using it as a preferred source of protein in quail feed. The following questions guided the research:

i. What is the least cost combination of the protein and carbohydrate feed sources?
ii. Which level of protein feed served to the quail birds is the most profitable for their production?

Objectives of the study

The general objective of the study was to determine the profitability of Quail bird's production fed various levels of Protein using soybean meal as the main Protein source. The specific objectives were:

(i) evaluate the least cost combination of the carbohydrate and protein feed sources.

(ii) estimate the profit made with each of the protein levels served to the quail birds.

3.2 Materials and design of the experiment

In a completely randomized design, 675 unsexed day old Japanese quail chicks (*Coturnix coturnix japonica*) hatched at National Veterinary Research Institute Poultry Farm Vom were selected on the basis of fitness and uniformity for the feeding trial. They were randomly divided into (5) dietary treatment having (3) replicates of 45 quail chicks each. The dietary treatments were made up of five (5) different levels of protein containing 18% C.P, 20% C.P, 22% C.P, 24% C.P and 26% crude protein

The data used for the study were mainly primary source collected by the researcher made up of the daily feed consumption of the quail birds and their weakly weight gain. Initial weight of the quail birds was recorded at day old before the commencement of the feeding trial. The weight gained by the quail bird was recorded by a random weighing of twenty five (25) quail birds in each replicate. This gave a total of seventy five (75) quail birds randomly selected from each treatment for weighing weekly. Feed consumption of the quail birds was also recorded by subtracting the feed left over from the initial quantity of feed served to the quail birds in each treatment. Both the weight gained and the quantity of feed consumed by the quail birds were weighed in grams.

For determining the total cost of quails produced various cost involved were recorded, like cost of day old quail chicks, cost of feed formulated for each protein level, cost of drugs / medications, cost of labour and the cost of renting the space for rearing the birds for 7 weeks.

Analytical Frame Work

Different analytical tools were used to analyze the data collected in order to achieve the stated objectives.

The analytical tools used were:

(i) Least cost analysis

(ii) Gross margin analysis

Least Cost Analysis

Choosing the least cost of inputs combination is the same thing as choosing the optimum combination of carbohydrate and protein sources that will maximize profit Ogungbile *et al.*, 1990)

From the relationship

Y = f (C, P and e)

C= f (P, y).

Where C = carbohydrate Source

P = Protein

Y = Weight gain in (g)

e = Error term.

$$\frac{MPP_c}{MPP_p} = \frac{p_c}{p_P} \text{ .... } equation\ (1)$$

where,

MPP_c = Marginal Physical Product of Carbohydrate Source

MPP_P = Marginal Physical Product of Protein Source

P_c = Price of carbohydrate source (N)

P_p = Price of protein source (N)

Therefore,

At Least cost $\frac{MPP_P}{MPP_c} = \frac{Pp}{Pc}$ ……………………equation (2)

$MPP_P = \frac{b_P\ .\ W}{P}$ …………………… equation (3)

$MPP_C = \frac{b_c\ .\ W}{C}$ …………………… equation (4)

Where b_p = Regression coefficient of protein source

P = Quantity of protein source in (kg)

C = Quantity of carbohydrate source in (kg)

b_c = Regression coefficient of carbohydrate source

$\frac{MPP_P}{MPP_c} = \frac{b_p\ .\ W}{p} \ /\ \frac{b_c . W}{C}$ ………………...equation (5)

P = Protein source

W = weight gain (g)

C = carbohydrate

$= \frac{b_p\ .\ c}{b_c P}$ ……………………equation (6)

Therefore,

$\frac{P_p}{P_c} = \frac{b_p\ \ c}{b_c p} = \frac{Mpp_p}{Mpp_c}$ …………………equation (7)

Assuming at the average quantity of carbohydrate used, the average quantity of protein will be.

$P = \frac{b_p\ .\ p_c\ .\ C}{b_c\ .\ p_p}$ …………………..(8)

All the terms are as defined above.

At least cost $P_p\ P + P_c\ C$ = Total cost /kg.

This was used in achieving objective iii of the study.

Gross Margin Analysis

This was used to analyzed the profitability of the quails produced using the cost and returns.

GM = TR – TVC ………………..equation (9)

Where

GM = Gross margin (N)/ Average weight of the quail birds in the different treatments.

TR = Total revenue (N)

TVC = Total variable cost (N)

And TR = Q x P

Where Q = weight of quail birds in grams

P = Unit price in (N) /Average weight of the quail birds in the different treatments.

A positive gross margin would indicate that the quail's production is profitable (Olukosi *et. al*, 2005).

Production Function analysis

The result of the multiple regression analysis for the quail birds produced and the posted data which is used in discussing the regression carried out is presented in table 1. The double logarithmic functional form is chosen as the lead equation based on normal economic, econometric and statistical criteria in which the adjusted R^2 value is the highest among the different functional form tried, positive sign of the F-ratio, T-value and the coefficients of the dependent variable (carbohydrate and protein) source used in the feed formulation. The adjusted R^2 value is significant. This shows that weight gain of the quail birds are attributable to the feed inputs of maize and soyabean meal as carbohydrate and protein sources respectively. The T-statistic of the variables of the chosen functional form is also positive.

Table 1: Estimated Cobb-Douglas Production Function for the quail birds fed with maize and soyabean inputs.

Treatments	Coefficient Constant	Regression Coefficient of Carbohydrate	Regression Coefficient of Protein
18%	1.439	0.326	0.647
20%	(20.300)	(1.05)	(2.810)
22%	1.459	0.006	1.011
24%	(14.954)	(1.375)	(2.810)
26%	1.379	0.108	0.931
	(27.952)	(1.134)	(1.366)
	1.465	0.077	0.982
	(67.354)	(1.22)	(0.583)
	1.556	0.246	0.675
	(114.134)	(0.016)	(2.620)
Pooled Data	0.067	0.418	0.730
	(0.178)	(2.810)	(5.053)

Note: In brackets is the *t*-value

Adjusted R^2 value = 86.8, F – ratio = 14.19, significant at 0.05

The regression coefficients are all positive indicating a positive production response of output to increasing consumption of the variable inputs. An adjusted R^2 value of 87 percent shows that the weight gain of the quail birds produced is accounted for by the joint action of the variables (carbohydrate and protein sources) included in the model while the 13 percent was accounted for by the joint action of other variables not included in the model. The coefficient of protein source (β = 0.730) was significant at P=0.05 while the carbohydrate source, though contributing to weight gain was not significant. This implies that weight gain of the quail birds, though positively influenced by the protein and carbohydrate sources, the carbohydrates influence is not statistically significant. The positive sign of the interaction terms of the feed is an indication that the variable inputs used are more productive when used in combination (Heady and Dillon, 1982).

Least cost Analysis

The least cost of the variables inputs combination used for quail production was determined by calculating the ratio of the marginal physical product of the protein feed source to the marginal physical product of the carbohydrate feed source and equating the ratio to the variable input price ratio. Based on the calculation made, the least cost of input combination is presented in table 2.

Table 2: least cost of inputs combination

Variables	Regression coefficient	Mpp	Unit Price in	Qty in (kg)	Cost (N)

		(kg)	N/kg		
Protein source	0.73	2.81	40	31.52	1,260.80
Carbohydrate source	0.418	2.15	25	28. 88	722.00
Total cost	N.A	N.A	N.A	N.A	1,982.80

Key
N.A = Not Available

Based on the computed least cost of inputs combination made, the protein source quantity is 31.52 kg while the carbohydrate source quantity is 28.88kg and their least cost combination was N1, 982.80.

Profitability of Quails Produced

The various cost incurred on the different resources used and the revenue obtained from the sale of the quail birds in each treatment is presented in table 2. It was estimated based on the prevailing market prices of the resource inputs used as at the time of the feed formulation and research work carried out.

The net farm income should have been used to determine the profitability of the quail produced but gross margin analysis was used. This is because the fixed costs are the same for all the treatments and therefore did not change the result significantly, and secondly the production is considered to be under subsistence level.

Table 3: Profitability of Quails Produced

Variables	**18%**	**20%**	**22%**	**24%**	**26%**
Cost of day old quail chicks (N)/6.5g	20.00	20.00	20.00	20.00	20.00
Average cost of feed (N)/bird	26.46	28.02	29.26	27.50	32.15
Cost of labor (N)/bird	1.04	1.04	1.04	1.04	1.04
Cost of rent (N)/bird	2.22	2.22	2.22	2.22	2.22
Cost of drugs/vet services (N)/bird	1.35	1.35	1.35	1.35	1.35
Total variable cost (N)/bird	69.22	70.78	72.04	70.16	75.54
Revenue (N)/bird	75.00	80.00	85.00	95.00	90.00
Profit (N)/bird	5.78	9.22	12.96	24.84*	15.56

**Most profitable*

The total cost incurred in each treatment of the quail birds reared was N9344.7, N9555.30. N9725.40, N9471.60and N10197.90 for treatments served with 18 percent protein, 20 percent protein, 22 percent protein, 24 percent protein and 26 percent protein respectively. The average rate of return for each treatment was 5.8 kobo, 9.2 kobo, 13.0 kobo, 24.8 kobo and 15.6 kobo respectively.

Fixed cost was not deducted from the total revenue made because the production was carried out for only one cycle and under subsistence level thereby fixed cost is considered to be negligible, this is according to (Olukosi and Erhabor, 2005).

The average feed cost was the highest for the variable input used. This is due to the keen competition of man and animal in the use of the same feed components as sources of protein and energy as stated by (Ademosun and Eshiet, 1990; Ijaiyo *et al.*, 2002).

It should be noted that earlier in the analysis, the 22 percent crude protein served to the quail birds was the least cost ratio were the cost of all the variable inputs were not considered but the marginal rate of substitution of the inputs and their price ratio. However, when costs other than those of feed were introduced into the analysis the 18 percent protein feed was the least cost at the same price level. The birds were sold based on their average weight gain in the different treatments and as a result of this, the total gross margin made in the different treatments are N790.30, N1,244.70, N1,749.60, N3,353.40 and N1,952.10 for the 18, 20, 22, 14 and 26 percent protein feeds respectively. This shows that the 24 percent protein feed gave the highest gross margin of N3, 353.40 followed by the 26 percent protein feed with a total profit of N1, 952.10.

Conclusion

The study concluded that the most profitable level of inclusion is 24% crude protein based on the inputs combination. Quail production is low input demanding phenomenon that generate profit as shown from the profitability analysis that was carried out for the research work. The future for quail as of now shows prospect for commercial production. It should be integrated into the mainstream of poultry production in Nigeria owing to its low inputs demanding phenomenon as shown by the profit made in each treatment of this research work.

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