

Resource Use Efficiency of Broiler Enterprises in Cross River State, South Eastern Nigeria

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Abstract: A study was conducted to estimate broiler production functions based on data obtained from broiler enterprises around the Calabar municipality of Cross River State, South Eastern Nigeria. The data were analyzed using the mean difference model as well as the ordinary least square's regression methods to estimate linear, double log, exponential and semi-log functions. The linear model provided the lead equations for the first four and second four weeks, while the double log model provided the lead equation for the entire eight weeks of rearing broilers. The study showed that the mean feed intake per bird, body mass gain and mortality rate of birds in the surveyed area differed ($P < 0.05$) significantly between the first and second four weeks of the rearing periods. The models revealed that 97, 92, and 98% of the total variations in broiler mass gain were selected explanatory variables during the study periods. In addition, feed intake and floor space affected ($P < 0.05$) mass gain positively, while mortality rate had a negative effect. The marginal value product (MVP) was more than the cost of 1kg of feed during the study period. It was concluded, that broilers production in the Calabar municipality required more feed and floor space to optimize mass gain, while the evident higher marginal value product compared to feed cost was indicative of irrational use of feed resource by farmers.

Key words: Resource use, semi-log functions, feed intake, mass gain, broilers

Introduction

The problems of food insecurity and hunger in recent years have continued to attract the attention of experts and Governments worldwide (Babatunde *et al.*, 2007). Several conferences and World Food Summits on human nutrition have brought back to center-stage for debate the issue of eradicating extreme poverty and hunger (FAO, 2003). FAO (1995) asserted that the most critical in the global food basket crises is protein, especially of animal origin. However, Oluyemi and Roberts (2000) and Isika *et al.* (2006) postulated that poultry was strategic in addressing animal protein intake shortage in human nutrition because of its high fecundity, fast growth rate, short generation interval and unparalleled competence in nutrient transformation to high quality animal protein.

In Nigeria, poultry production has evolved gradually as a commercial venture since its introduction in the 1950s. The industry was a huge success as an incentive in augmenting the animal protein shortage occasioned by the fast declining cattle production that use to supply the required animal protein in human nutrition (Idachaba, 2004). The poultry sector initially relied on foreign sources for inputs supply that included the parent stock, day old chicks, feed ingredients, equipment and medications. Although government through its Veterinary

Research Institute in Vom, plateau state introduced a 'free medication programme' for the poultry stock, which enhanced the growth of the industry during the 1960s, this advantage was short-lived as government effort in developing the agricultural sector was jettisoned in the '70s when oil-boom became the main stay of the economy (FOS, 1999). The far-reaching implications were that high cost and irregular supply of feeds, breeding stock and vaccines became the major constraints of the industry (FAO, 1998).

Statistics provided by the CBN (2002) showed that the average annual growth rate of poultry meat in the country, from 1980-2002 was 1.93%, while the human population growth was 2.89%. Invariably the demand for poultry meat increased as the human population increased thereby putting the supply always at a deficit. The earlier surveys conducted (Dada, 1988; FOS, 1999; Okorie, 2002) also indicated some factors militating against the growth of poultry production in different localities of the country to be high mortality and cost of feeds as well as exorbitant cost of day old chicks and drugs (Onoyom-Ita and Abang, 1988). At the moment the available information on the actual predictive functions and models of poultry production in Nigeria is still scanty.

The current study was therefore, aimed at estimating the

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Table 1: Average weekly mass gain (g/bird) for the three rearing periods of broiler production

Weeks	1	2	3	4	1 st	5	6	7	8	2 nd	Entire
					4 wks					4 wks	8 wks
					Mean					Mean	mean
Mean	130.17	138.9	194.0	224.0	171.8*	286.93	318.3	360.4	248.3	303.5**	237.64
SD.	42.29	44.1	57.8	56.8	20.6	90.3	100.0	113.4	106.6	35.97	51.5
CV	32.5	31.7	29.3	25.6	12.0	31.5	31.6	31.5	42.9	11.8	21.6

* = (P<0.05), ** = (P<0.01) . Source: Field data (2005)

production functions of broiler enterprise in the Calabar municipality of Cross River State, South Eastern Nigeria. The study also compared the mass gain, feed intake, and mortality rate during the first and second four weeks of rearing broilers with the view to determining the variables and resource use efficiency by farmers.

Materials and Methods

The primary data were collected by purposively sampling twenty-nine (29) broiler farms in the metropolis of Cross River State, Nigeria using data collection forms for 24 weeks. The information collected were on; type, quantity and price of feeds, the cost of medication, mortality, cost of day old chicks and revenue generated from sales of mature birds and other products of the farm. The data were analyzed using the t-test. The means were in respect to mass gain, feed intake and mortality rate.

An ordinary least square, (OLS) stepwise regression model was also specified. This model states that; the total mass of broiler birds depend on total feed intake, mortality rate and total floor space, all other factors remaining constant, represented implicitly as follows:

$$Y = f (X_1, X_2, X_3, U) \tag{1}$$

Where Y = total mass gain (g)

X₁ = total feed intake (kg)

X₂ = mortality rate (%) as an index of management.

X₃ = total floor space (M²)

U = error term.

The production functions were specified in four functional forms of linear, semi-log, double log and exponential. The lead equation was chosen based on the values of the coefficient of multiple determination (R²) as well as the signs and significance of the regression parameter. Rationality in resource use was determined at the point where the marginal value product (MVP) equals price of the input (Px) this is presented explicitly as follows:

$$MVP = Px, \tag{2}$$

$$MPPX, = dy / dx \tag{3}$$

$$EP= \frac{dy}{dx} \cdot \frac{x}{y} \tag{4}$$

$$MVP = MPP \times Py \tag{5}$$

Where:

EP = elasticity of production

MPPx = marginal physical product with respect to feed

MVP = marginal value product

Py = price of product

X = mean quantity of feed consumed per bird

Y= mean mass gain per bird.

It is expected that feed intake, and floor space per bird will positively influence mass gain per bird, while, mortality will negatively affect mass gain per bird. Comparison was carried out on the mass gain, feed intake and mortality rate during the first four weeks, second four weeks and the entire eight weeks of keeping the broiler birds. Four functional forms were estimated namely; linear, semi-log, double log and exponential for the input-output relationship. The estimations were done for the first four weeks, the second four weeks and the entire eight weeks of rearing.

Results and Discussion

Broiler mass gain: Average weekly mass gain per bird for the three rearing periods in broiler production is as presented in Table 1. The mean weekly mass gain per bird increased from the first week to the 8th week. The average mass gain per bird during the first four weeks was 171.8g, the standard deviation (SD) was 20.6g and co-efficient of variation (CV) being 12.0%. During the second four weeks of rearing, the average mass gain per bird was 303.5g (SD = 35.9g; CV = 11.89%). During the entire eight weeks of rearing the average mass gain was 237.64g (SD=51.5g, CV =21.6%). It was observed that, mass gain per bird during the second four weeks of rearing was higher than that of the first four weeks. This is in agreement with the report of Oluyemi and Roberts (2000) who reported that broiler birds gain more weight during the second four weeks than the first four weeks of rearing. The difference in mass gain per bird between the second four weeks and first four weeks was 131.8g. The difference was statistically significant at 5% level (t-cal. = 17.18 > t – tab. = 2.576).

Broiler feed intake: The average weekly feed intake of the birds for the three rearing periods in broiler production is as shown in Table 2. The table showed that feed intake increased from the first week through to the 8th week. During the first four weeks and second four weeks of rearing, feed intakes were 1498 and 3360 g respectively. These results are comparable to the findings of Eyo (1997) who reported feed intake per broiler of 1720g and 3450g for the first four weeks and second four weeks respectively. Ekpenyong (1992) found the mean feed consumption per broiler housed to be 5430g for the entire eight weeks of rearing. Eyo

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Table 2: Average weekly feed intake(g/bird) for the three rearing periods of broiler production

Wks	1	2	3	4	Total	5	6	7	8	Total	Entire
					4week					4week	8wks
Mean	173	312	449	564	1498*	692	812	895	958	3360	4857**
SD	0.036	0.048	0.072	0.108	0.189	0.103	0.119	0.143	0.157	0.447	0.573
CV	20.8	15.4	16.0	19.1	12.6	14.8	14.7	15.9	16.4	13.3	11.79

Source: Field data (2004) * = (P<0.05) ** = (P<0.01)

Table 3: Mortality rate (%) during the first 4 weeks, second 4 weeks and entire 8 weeks

Period	1 st 4 weeks	2 nd 4 weeks	Entire 8 weeks
Mean	5.3	6.0	5.9
SD	3.2	1.1	4.3
CV	60.4	183.3	72.8

Source: field data (2005)

(1997) found the mean feed intake for the first four weeks, second 4 weeks and entire 8 weeks of rearing to be 1600g, 3200g and 4830g respectively. The difference in feed intake per broiler between the first four weeks and second four weeks was statistically significant at the 0.01% level and 56 degrees of freedom ($t_{cal} = 20.966$, $t_{tab} = 2.576$). The birds consumed more feed in the second 4 weeks than the first 4 weeks.

Mortality rate: Mortality rate for broiler birds were 5.3%, 6.0% and 5.9% during the first four weeks, second four weeks and the entire eight weeks respectively (Table 3). The extremely high values of the estimated coefficient of variation (CV) were due to diseases outbreaks in some farms caused by poor health management practices. Mortality rate during the first four weeks was higher than that of the second four weeks. However, the mean mortality rate of the entire eight weeks of rearing was lower than 9.73%, 10% and 7.3% as reported by Ekpenyong (1992), Eyo (1997) and Bime (2002) respectively. Improved health management practices in the farms sampled could be the reason for the low mortality rate compared to other studies. The difference between the first and second four weeks were statistically significant at 0.01 level with 56 degree of freedom ($t_{cal} = 7.23$, $t_{tab} = 2.576$).

Stepwise regression analysis: The lead equation for the first four weeks, second four weeks and entire eight weeks are presented in Tables 4, 5 and 6 respectively.

Feed intake: Based on the lead equations, the parameters (b_1) feed intake were 0.316, 0.270, and 0.268 for the first four weeks, second four weeks and entire eight weeks of rearing respectively. The calculated t statistics for each of the study periods were 13.325, 7.90, and 8.412 respectively. This shows that, the effect of feed intake was significant at the 0.01 level during the rearing periods. The implication here is that, feed intake was an important determinant of mass gain in each of the rearing periods.

Furthermore, the elasticity of production (0.40, 0.332, and 0.758) showed that feed intake was inelastic during the first four weeks, second four weeks and the entire eight weeks of rearing respectively. The implication being that, a 10% increase in feed intake by broiler birds will lead to increase in mass gain by 4.01%, 3.32%, and 7.58% during the first four weeks, second four weeks, and entire eight weeks of rearing respectively.

Mortality rate: Also from the lead equations, the coefficients for mortality rate (b_2) were -3.536, -30.363, -0.08, -2.82 for the first four weeks, second four weeks and entire eight weeks of rearing respectively. Mortality rate was not significant at the 5 percent level during the first four weeks and second four weeks, but significant at the 1% level during the entire eight weeks of rearing. The signs of the parameters were also negative during all the periods of rearing. The elasticity of production was 0.08, implying that, a 10% increase in mortality rate, will reduce mass gain by 0.8%. The above findings are in conformity with Bime (2002) who reported a negative effect of mortality on mass gain.

Floor space: The parameter estimates for floor space (b_3) during the three rearing periods were 0.934, 0.803, and 0.213 respectively. The parameter was not significant in the second four weeks of rearing. However, it was significant at the 1% level during the first-four weeks and at the 5% level during the entire eight weeks of rearing. The elasticity of production (EP) with respect to feed for the three rearing periods as presented in Table 7 were, 0.401, 0.332 and 0.758, while the MPP were 0.316, 0.270 and 0.268 respectively for the same periods. The marginal value product (MVP) per kg of broiler with respect to feed intake was 55.37 for the entire eight weeks of rearing. The MVP was calculated based on the price of live broiler, which was N400 (given the average live broiler mass of 1936g, therefore, 1kg will sell at N206.6).

Furthermore, given that the price of broiler finisher feed during the study period was N 730.00 per 25kg, 1kg of feed was sold for N29.2. From the above, it shows that, marginal value product of feed in the entire eight weeks of rearing, exceeded the cost of feed. Therefore, the farmers were not rational in their use of feed. In fact, the farmers under utilized feed, and this has implication on the attainment of optimum market mass by the birds.

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Table 4: Estimated linear production function during the first four weeks

Steps	constant	X ₁	X ₂	X ₃	R ²	Adj R ²	F
1	9.358 (8.358)	0.380** (0.015)		0.958	0.957		621.28**
2	16.332 (0.387)	0.387** (0.016)	-1.857 (1.567)	0.960	0.957		315.91**
3+	21.408 (8.522)	0.316** (0.024)	-3.536* (1.375)	0.934** (0.258)	0.974	0.971	313.91**

+ = lead equal * significant at 5% level ** = significant at 1% level, values in parentheses are standard errors.

Table 5: Estimated linear production functions during the second four weeks of rearing

Steps	Constant	X ₁	X ₂	X ₃	R ²	Adj R ²	F
1	32.89 (19.97)	0.296** (0.18)		0.906		0.900	10.461**
2	28.61 (19.45)	0.296** (0.021)	-19.69 (11.49)	0.915		0.909	140.499**
3+	29.39 (18.79)	0.270** (0.034)	-30.36* (12.74)	1.28 (0.75)	0.924	0.915	259.42**

+ = lead equation, * significant at 5% level, ** significant at 1% level, values in parenthesis are standard error.

Table 6: Estimated double log production function during the entire eight weeks of rearing

Steps	Constant	X ₁	X ₂	X ₃	R ²	Adj R ²	F
1	-0.763 (0.205)	0.963** (0.029)			0.976	0.975	1093.7*
2	-0.769 (1.91)	0.986** (0.028)	-0.070 (0.031)		0.980	0.978	631.26**
3+	0.067 (0.369)	0.758** (0.90)	-0.080** (0.028)	0.218* (0.083)	0.984	0.982	513.59**

+ lead equation, *significant at 5% level, ** significant at 1% level, values in parentheses are standard error.

Table 7: Estimated EP, MPP and MVP with respect to feed intake for the three study periods

Production Period	EP	MPP	MVP
First 4 weeks	0.401	0.316	-
Second 4 weeks	0.332	0.270	-
Entire 8 weeks	0.758	0.268	55.37

Source: Field data (2005)

Conclusion and recommendations: The paper concludes that, feed intake and floor space significantly influenced mass gain in broiler production. However, mortality rate negatively affected mass gain. The study also found that, mean mass gain, feed intake and mortality rate in the second four weeks of rearing were significantly greater than those of the first four weeks of rearing. Therefore, more feed will be required for birds, especially during the second four weeks of rearing. The marginal value product of feed, which is higher than the cost of feed also, indicated that, the farmers were not rational in their use of feed resource. Farmers should increase the quantity of feed given to birds for optimal market mass. To reduce mortality rate, farmers need more education on the modern management techniques in broiler production through extension services.

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