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Allocative efficiency constraints in snail *(Archachatina marginata)* production by small scale snail farmers in Cross River State, Nigeria

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Abstract: This study examined constraints militating against the profitability potentials of snail (Archachatina marginata) production by small-scale snail farmers in Cross River State, Nigeria. Data were obtained from a random sample of 120 respondents in the study area by means of structured and semi-structured questionnaire. The first stage involved random selection of three (Ogoja, Ikom and Odukpani) local government areas from eighteen local government areas in Cross River State, Nigeria. This was followed by random selection of three villages (Igoli in Ogoja Local Government Area, Alesi in Ikom Local Government Area and Adiabo in Odukpani Local Government Area) in Cross River State. The respondents were randomly selected from each of the villages, 40 respondents were selected each from three villages, making a total number of 120 respondents. Data collected were analyzed using descriptive statistics and costs-returns analysis. The results indicated that Cobb-Douglas production function had the best fit in explaining the relationship between output of snail and inputs used, the coefficient of multiple determinant (R2=0.60 indicates that sixty percent of the variability in output of snail is explained by the independent variables). Results from the analysis revealed that the marginal value products of farm size, labour, farm management practices and operating costs were N1080, N20.6, N972.8, N 14.84 respectively, there existed allocative in-efficiency, there is a high potential for snail farmers to increase their yields and income. Further analysis of results revealed that net returns on snail is N2,935,000.00 with return on every naira invested of N 0.14 is also positive indicating a profit from the business, with attractive net return on investment. This study shows that snail farmers are faced with several problems in their production activities. These problems or constraints affect the

efficiency of snail production in the study area. Notable among them are high cost of feed supplement , lack of capital, inaccessibility of formal credit source because lack of collaterals, lack of extension agents, lack of medication/vaccines, poor production infrastructures and lack of good farm management practices occupied 15%, 14.17%,11.67%,10%,9.17%,9.17% and 8.33% respectively. The constraints associated with the business as highlighted in this paper if tackled could pave a way to increase profit and this will alleviate poverty in Cross River State. Hence, for efficient production of snail in the study area, these constraints must be drastically reduced to the barest minimum. This can be done through efficient policy formulation and implementation, proper supervision of snail production programme, effective extension services and proper agricultural financing. Snail farmers in the study area should be train by extension agents on how to control some of constraints that militate against the profitability potential of snail production. Beside that snail farmers should form cooperative group (s) in order to obtain loans from bank (s) to increase their capital base for higher output.

Key words: constraints, profitability, potential, Snail farming

Introduction

In Nigeria, successive government had embarked on policies and programme aimed at boosting sustainable macro-livestock and micro/mini-livestock production (Effiong and Onyenweaku, 2006). According to Akinnusi (1998) micro/mini-livestock production refers to species of animals that are associated with small body size, moderate nutrition and management. The small size of these micro/mini-livestock animals is undoubtedly one of their most significant assets since it make it possible to produce and manage on small areas and in cluster (Thys, 2001). Ekanem and Umoh, (1997) revealed that due to their small body size, micro/mini-livestock animal (snail) can be easily handled, transported and managed by children and women with minimum training, thus keeping down production cost. Take off investment (capital for snail production is low due moderate nutrition; manage on small area of farm size and equipment costs). In most cases, housing and equipment requirements can be adequately satisfied by improvisations from local farm products and scraps. It makes production affordable for people with small compound or poor ones. It is possible to feed these micro/mini-livestock animals with household wastes (Ayodele and Asimalowo, 1999). Furthermore, snail growth potentials make it possible to have very good output (Lameed, 2006).

Snail originated from south of the Saharan in East Africa (Thompson and Cheney, 1996; Belot *et al*, 1991; Akinnusi, 1998; Ebenso 2002; Adinya, 2006). There are various species of snail namely: Golden snail (*Pomacea* sp.), African giant edible tropical land snail *(Limicolaria aurora), Achatina fulica, Achatina achatina, Archachatina marginata, Limicolaria flammae, Lymnaea natalensis, Bulinus forskalii, Bulinus globosus Biomphalaria pfeifferi* and Freshwater snail *(Lymnaea acuminata)* (Thompson and Cheney, 1996; Belot *et al.*, l,1991; Akinnusi,1998; Ebenso 2002; Adinya, 2006).

Snail *(Archachatina marginata)* provides an excellent source of protein in the diet of rural and urban poor households in southern, eastern and western Nigeria. In northern Nigeria majority of the Hausas do not eat snail or its product since they believed it originated from ghostly element; hence, snail consumption is abomination or taboo to them. Amusan and Omidiji (1999) revealed that snail consumption is permitted in southern, eastern and western Nigeria on meatless days (Easter festival) by certain religious body (Christians) because to them , snail is neither fish or flesh. Of all the animal protein foods produced and consumed in Nigeria, snail is of importance as it has remained a source of protein in the diet of rural and urban poor households in southern, eastern and western Nigeria which is rich in essential-amino acids (Nwandu, 1999). According to Ekanem and Umoh (1997) snail show great advantages and potential in the areas of nutrition, growth and reproductive biology. African giant edible tropical land snail *(Limicolaria aurora)* has nutritive value of 18.3% protein, 1.3% fat and 1.6% phosphorus (mg/100g) (Ajayi and Tewe,1984). Datuin (1993) revealed that snail have very high rate of reproduction. The golden snail (*Pomacea* sp.) may lay up to 1000 eggs per month.

In Cross River State, the production and marketing of snail products is a thriving business that provides employment to hundred of people. It provides an important source of livelihood for middlemen. Given the importance of snail in the Cross River State economy, one would have expected that the state would have been the largest exporter of snail products to other countries. Furthermore, Cross River State is supposed be the largest producer of snail in world because the state is endowed with human and natural resources and beside that the environmental conditions in state favours snail production. In local markets in Cross River State, there is great gap between production and consumption of snail. Unfortunately, snail production in the state has been inadequate to bridge the demand - supply gap. The Food and Agriculture Organization and World Health Organization (WHO) of the United Nations recommend a minimum of 65 grams of protein per day including 35grams from animal source for an average human adult. However, according to the Nigerian Livestock Perspective Plan for

1991-2005, the daily per capital in animal protein intake in Nigeria is only about 16.36grams which is below the recommended minimum (Otchere,1995; Adinya, *et al.,* 2007). There is problem of protein malnutrition as a result of non-optimal use of resource (snail farmers are inefficient in resource utilization in snail production) and slow in adopting improved technology. Problems cited by farmers as constraints to the production of snail in the study area are insufficient credit, poor wage rate discourages labourers from working hard, non-adoption of recommended practices, lack of processing tools for snail products, lack of educational training, poor storage facilities and stagnant production technology among Nigerian's farming community majority of whom are the small-scale producers (Adinya, 2006).

To increase productivity in the state, sound macro and micro-economic farm policies are needed. These require knowledge of aggregate farm level resource availability and the differences in productivities of these resources in different areas(Adinya *et al.,* 2008a).. In addition to that, snail farmers must learn to use improved technologies and improve in efficiency of resource use in snail production (Adinya, 2006).

Ekanem and Umoh, (1997) revealed that investment risk is very low, returns high and operation flexible these are some of the reasons why Agricultural Credit Guarantee Scheme Fund easily gives credit to snail farmers with out collateral (Adinya *et al.,* 2008a). Adinya (2006) revealed that snail production is associated with rapid returns per unit investment. He further noted that the two most important factors responsible for the phenomenal increase in snail production has been profitability and quick returns on invested capital which encourages commercial banks to provide needed funds more readily for snail production than other agricultural businesses. Ready markets exist for snail from both domestic consumption and export (Ekanem and Umoh, 1997). Paris alone consumes over 100 million snail's product every year (Akinnusi, 1996; Ekanem and Umoh, 1997).

Theoretical framework

Farm Budget Model: The farm budget as a tool of analysis is one of the oldest and simplest, used in farm management and production studies. It has been used in number of economic studies for analyzing the profitability of farm production practice. This method of analysis was used to achieve objective (i) of the study. Different methods of budgeting exist. However, these methods can be subdivided into two major categories: (a) total or complete budgeting and (b) partial

budgeting. A total budgeting is used when contemplating a complete re-organization of the entire farm business, while partial farm budget is used when the action intend to be implemented does not affect the whole farm, for example, introducing a new business or purchasing new equipment for the farm. The choice of any type of budgeting tool depends on the circumstance under which the farm business is taking place, goal achievement objective and convenience. This study used partial budget as an analytical tool. Basically, it involves operations leading to estimates of net revenue and total cost for the same production period. The differences between two parameters are measure of profit or loss or net farm income for that period (Oluwole, 1970; Osifo and Anthonio, 1970; Olayemi and Oni, 1971; Adinya *et al.,* 2008d).The purpose of the model is to identify the costs, returns, profitability or loss per hectare. The total revenue represents the value of the output from the farm (i.e. physical quantity of snail multiplied by the unit price). The total cost on the other hand, is made up of the variables and fixed components. Variables costs also called specific costs vary directly with the level of production and include expenditure on labour and transportation cost etc. Fixed cost known as overhead costs do not vary with the level of output and consists of cash expenses (on repairs and maintenance, interest on loan) etc and non-cash adjustment like depreciation of farm tools, and equipment. The computed returns and costs would be used to derive various measures of profitability including net return and return on capital invested in snail enterprise.

The central objective of farm business management is to increase the efficiency with which farm resources are used in the production of snail such that maximum farm profit is realized (Ogunfowora, 1986). According to Matanmi (1986) the immediate goal of farm management is profit. Efficiency could be measured from a production function or profit function approach. Efficiency of production is a very important factor for productivity especially in areas where resources are limited as in Nigeria (Adinya *et al.,* 2008b). Efficiency of production is achieved through optimal resource allocation such that more output is achieved with the same resource level or the same level of output is achieved using fewer resources. Production function gives the possible output that can be produced from given quantities of a set of inputs (resources) and their quantities can be varied to obtain optimal output. In carry out econometric analysis, production function provides the basis of decision making for snail farmers.

Economic theory identifies three important production efficiencies (Farrel, 1984). These include allocative, technical and economic efficiencies. Allocative efficiency is the ability of the farmer to use the inputs in optimal proportions given their respective prices and the production technology. Technical efficiency

is the measure of the farms success in producing maximum output from a given set of resources (inputs) i.e. ability to operate on the production frontier (Farrel, 1984).

Economic efficiency is the product of the technical efficiency and allocative efficiency. There is evidence that snail farmers in developing country like Nigeria fail toexploit fully the potential of resources and make allocative errors; which results to low yields. Several studies have shown that resources are not efficiently utilized by snail farmers in Nigeria (Akinnusi, 1995; Ayodele and Asimalowo, 1999; Amusan and Omidiji, 1999; Lameed, 2006). Therefore, having established the obvious fact that resources are not efficiently utilized in snail production in other states in Western Nigeria but none in Cross River State where snail is highly consumed because snail meat consumption is not abomination or taboo, it is the aim of this study to examine critically the problems of resource use in snail production. Ultimately, it is hoped that the study will help to bridge the gap between resources availability and efficient utilization in snail production in Cross River State. This study seeks to examine the production efficiency in snail *(Archachatina marginata*) in Cross River State, Nigeria; therefore this paper tried to provide some useful information in policies towards increasing snail production in Nigeria.

In Cross River State, little is known about the profitability of this business engaged by snail farmers. It is against this background that this study attempt to explore, answers to the following fundamental questions; do snail farmers engaged in this business make profit? And what are the constraints they face in snail production. To examine the aforementioned questions the objectives of the study were set as to:

(i) analyze the costs-returns of snail production in the study area.
(ii) determine resource use efficiency (production efficiency/allocative efficiency) in snail production in the study area.
(iii) identify the constraints faced by snail farmers in the study area.

Methodology

The research study was conducted from 9th January, 2008 to 9th January, 2009 in Cross River State, Nigeria. The state occupies an area of about 22,342.176 square kilometers (Quarterly News Letter of the Ministry of Local Government Affairs, Cross River State, 2006). It is located at Latitude 5° 25'N and longitude 25° 00'E (Figure 1).

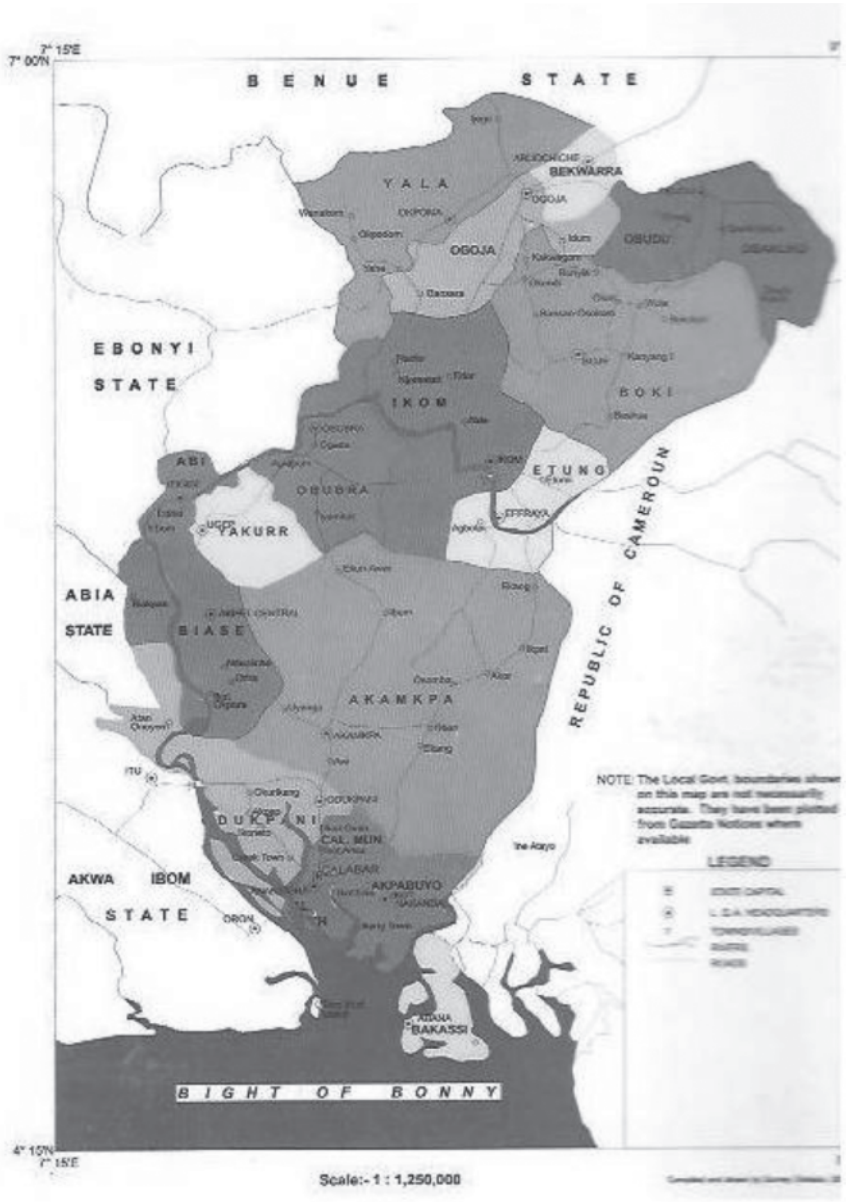

Figure 1 – Map of Cross River State showing study area

The soils of Cross River State are ultisol and alfisol but predominantly ultisol (FAO/UNESCO, 1974). Cross River State is producing milk, honey and snail for the nation and it has the largest rainforest covering about 7,290 square kilometers described as one of Africa's largest remaining virgin forest harbouring as many as five million species of insects(bees, butterfly, mosquitoes, locust, etc), plants and animals (macro-livestock and micro/mini-livestock like snail (MOFINES,2004). There are various species of snail in Cross River State namely: Golden snail (*Pomacea* sp.), African giant edible tropical land snail *(Limicolaria aurora), Achatina fulica, Achatina achatina, Archachatina marginata, Limicolaria flammae, Lymnaea natalensis, Bulinus forskalii, Bulinus globosus Biomphalaria pfeifferi* and Freshwater snail *(Lymnaea acuminata)* (Ebenso, 2002; Adinya, 2006).

Cross River State is located within the evergreen rainforest zone that promotes the growth of snail. The rainfall has a bimodal pattern of distribution giving rise two growing seasons, from late March to the end July. This followed by a short dry spell which starts by August and ends in December. According to Cross River Agricultural Development Program (CRADP 1992b) there are two distinct climate seasons in the area, rainy season from March to October and dry season from November to February. The annual rainfall varies from 2,000 mm to 3,424 mm. The average temperature is around 25 (CRADP, 1992a; CRADP, 1992b). The annual temperature was 25°C -27°C but temperature has increased to 27.76°C because of climatic change (Adinya and Awoke, 2007; LEISA Magazine, 2008). Intergovernmental Panel on Climatic Change (IPCC) reported that 0.76°C increase in the world's average temperature in the last century, expecting temperature to rise by 2°C by 2050 (LEISA Magazine, 2008). This is leading to rising sea levels, the disappearance of glaciers, and to drastic changes in rainfall patterns, affecting the production potential of rural areas (LEISA Magazine, 2008).

Cross River State is characterized by presence of numerous ecological and zoo-geographically important high gradient streams, rapids and waterfalls. About 2,888,966 people inhabit the area of which the Efiks, Ejaghams and Bekwarras, are the major ethnic groups (The 2006 Population Census Spread state by state, In: MOFINEWS January-February, 2007). Fishing and subsistence agriculture are the main occupations of the people. Crops and animals are grown in the locality. Population depends largely on natural water sources for all their water-related activities as piped water supply is limited and grossly inadequate. Health services in the area require a lot of improvement. Level of hygiene in the rural communities is generally poor (Arene *et al.,* 1991). Both primary and secondary sources of data were used. The secondary sources of data include Review of

Annual Reports, books, census data, journals and statistical documents whereas the primary source of data was mainly from field survey. Data were obtained through administration of structured and semi-structured questionnaire to 120 randomly selected respondents for the study. This served as population for the study. The first stage involved random selection of three (Ogoja, Ikom and Odukpani) local government areas from eighteen local government areas in Cross River State. This was followed by random selection of three villages (Igoli in Ogoja Local Government Area in the Northern senatorial district, Alesi in Ikom Local Government Area in the Central senatorial district and Adiabo in Odukpani Local Government Area in the Southern senatorial district) in Cross River State. The respondents were randomly selected from each of the villages, 40 respondents were selected each from three villages, making a total number of 120 respondents all together. The types of data collected for the study include information on cost of production and return from the sales of product. Also data were collected on constraints faced by snail farmers in the study area.

Method of Data Analysis

Different types of analytical tools are often employed by researchers in Production Economics studies. Their application depends on researchers' choice, determined by the nature of data resources, time, facilities, available and the use to which the results of the findings are to be used/ applied. This study employed the following analytical tools in order to achieve the already stated objectives of the study:

(i) he descriptive statistics such as frequencies distribution and percentages were used.

(ii) Costs and returns Analysis: Costs-returns analysis as described by Olukosi and Erhabor (1988); Awoke and Okorji, 2003; Adinya *et al*., 2008c) were used to estimate net returns, total cost of production and profitability of the business including net return and return on capital invested in snail business. A general model of the costs and returns analysis presented in the equation below was used in the analysis.

NR=TR-TC.....equation (1)
TR=Q x P…….equation (2)
RI=$\frac{NR}{TC}$...…….. equation (3)
Where: NR=Net Return on snail produced (naira)

TR=Total Revenue from snail (naira)
TC= Total Cost of snail (naira)
Q= Quantity of snail produced in (kg)
P= Price of snail per kilogram
Ri=Return on capital invested in snail (naira)

(iii) The inferential statistics is the regression analysis. Regression analysis is important and useful for describing the relationship between the exogenous and endogenous variables. It estimates the statistical significance of the exogenous variables as well as the overall effect of all these variables on the endogenous variables. The data obtained were analyzed using the Ordinary Least Square (OLS) multiple regression technique to determine the relationship between snail output and the selected variables. The linear, double-log and semi-log function forms were used to determine which of the forms would best fit the relationship between snail output and the explanatory variables.

The implicit form of regression model for this analysis was given as:

$$Y = F (X_1, X_2, X_3, X_4 X_5 e)$$

Where: Y = Value of total output of snail in (naira / hectare)
X_1 = Area of plots (farm size) devoted to snail production in (hectare)
X_2 = Total labour in (man-days/hectare)
X_3 =Farm management practices(measured on 5 point scale of diet containing 28% crude protein, yellow maize, groundnut cake, oil ,bone meal ,oyster shell, AD-Vitamin) or feed supplement=1, provision of clean drinking water=2, medication/vaccines=3, construction of snail pen/cage with mosquito netting on the lid to cover loamy soil up to 3-5cm spread on the floor of the snail pen = 4, weeding of grasses around the snail farm=5.
X_4 = Operating costs (naira/hectare)
X_5 = Farming experience (years)
E = Error (or disturbance term is included to capture the effects of exogenous and endogenous variables not included in the model). The functional forms was tried to ascertain the one that gives the best fit. There are Ordinary Linear Function, Cobb-Douglass (double-log), and semi-log production function forms. Whichever model that has the highest R^2 and shows many statistical significant variables was adopted following (Kmenta, 1971; Koutsoyiannis, 1977 and Awoke, 2001;

Adinya *et al*., 2008b).

The functional forms fitted are specified below:

(a) Linear production function: $Y= a + b_1X_1+ b_2X_2 + b_3X_3 + b_4X_4+ b_5X_5+ e$ equation (1)

X_1-X_5= are defined in the implicit form

b_1-b_5=Regression coefficients of variables X_1-X_5

a = Constant term

e = Error term

(b) Cobb-Douglas Production Function (double log)

$\text{Log } Y=\text{Log } a +b_1\text{Log}X_1+b_2\text{Log}X_2 + b_3\text{Log}X_3 +b_4\text{Log}X_4+b_5\text{Log}X_5 +e$ equation (2)

(c) Semi-Log Production Function:

$Y =\text{Log } a+b_1\text{Log}X_1+b_2\text{Log}X_2 + b_3\text{Log}X_3 +b_4\text{Log}X_4+b_5\text{Log}X_5 +e$ equation (3)

Each resource was measured using the formula:

The average physical product (APP) was derived by dividing total output by total input i.e.

$$APP= \frac{Y}{X}$$

The marginal physical product (MPP) was derived by dividing total output by total inputs

$$MPP= \frac{DY}{DX}$$

MPP x Price of snail product= marginal value product (MVP)

The allocative efficiency (AEL) of resource was determined by ascertaining whether or not the ratio of the marginal value product to the inputs price was equal to one

$$AEL= \frac{MVP}{P}=1$$

Where: MVP= Marginal Value Product

P= Unit Price of Input

The marginal Products (MP) were derived by multiplying the average product (AP) by the elasticity of production (EP), given that: MP= AP x EP

$$EP = \frac{MP}{AP}$$

Results and Discussion

The socio economic characteristics of respondents presented in Table1 shows that respondents were all (100%) adults from above 21years, however, 35.83 percent of the respondents were age between 41-50 years. This is closely followed by age between 31-40 years, which constitutes 34.17 percent. However, 13.33 percent of them were aged between 21-30 years. Only 16.67 percent of the respondents were aged between 51 years and above. The implication of the result is that most of the respondents were within the economically active age. These findings are synonymous with Asa (2003) that people in age groups of 41-60 are more economically active and independent than those in the age group of less than 21 years and above 60 years. The standard deviation of 70.71 from the mean 60 was obtained. Statistically, the coefficient of variation (CV) of 117.85 was also obtained. Data in Table 1 also reveals that 73.33 percent of the respondents were married while 14.17 percent were single. Only 12.50 percent of the respondents were widowed. The table also shows that the participation of married men and women in snail production is higher than single men and women. In addition, it was observed that the standard deviation of the factor from the mean of 40 was 41.50. Statistically, this factor was observed to have a coefficient of variation (CV) of 103.75. Further analysis of Table 1 revealed that 65.83 percent of the respondents had First School Leaving Certificate (FSLC), 14.17 percent of the respondents attended Junior Secondary School Certificate (JSSC)/Senior Secondary School Certificate (SSSC). However, 3.33 percent of the respondents revealed that they attended high education; while 16.67 percent of the respondents had no formal education. Table 1 also disclosed that some of the respondents (16.67%) saw lack of educational training as a factor militating against production of snail in the study area. The standard deviation of 33.40 from the mean of 30 was obtained. The result implies that education was one of the most serious constraints against the efficiency of snail production in the study area. Of course this goes to confirm the earlier deduction by (Stewart,1975); he maintained that

Table 1 - Socio-economic characteristics of respondents in Cross River State

AGE GROUP(YEARS)	FREQUENCY OF RESPONDENTS IN IGOLI IN OGOJA L.G.A.	FREQUENCY OF RESPONDENTS IN ALESI IN IKOM L.G.A.	FREQUENCY OF RESPONDENTS IN ADIABO IN ODUKPANI L.G.A.	TOTAL FREQUENCY	PERCENTAGE	MEAN	STANDARD DEVIATION(SD)	COEFFICIENT OF VARIATION
21-30	10	6	4	20	16.67	30	13.98	
31-40	12	14	15	41	34.17	30	13.98	
41-50	13	16	14	43	35.83	30	13.98	
51- above	5	4	7	16	13.33	30	13.98	46.6
Total	**40**	**40**	**40**	**120**	**100**			
Gender								
Male	35	38	37	110	91.67	60	70.71	
Female	5	2	3	10	8.33	60	70.71	117.85
Total	**40**	**40**	**40**	**120**	**100**			
Marital status								
Married	33	28	27	88	73.33	40	41.50	103.75
Widowed	3	7	5	15	12.50	40	41.50	
Single	4	5	8	17	14.17	40	41.50	
Total	**40**	**40**	**40**	**120**	**100**			
Educational attainment								
OND/HND/ BSC/MSC/Ph. D	1	2	1	4	3.33	30	33.40	111.33
JSSC/SSSC	8	5	4	17	14.17	30	33.40	
FSLC	22	27	30	79	65.83	30	33.40	
No education	9	6	5	20	16.67	30	33.40	
Total	**40**	**40**	**40**	**120**	**100**			

Source: Field survey, 2009

education acquired by farmers has a positive influence on farmers' labour and income. Robin (1974) observed that, the large differential between the wages received by an unskilled farmer and the salary enjoyed by skilled high level manpower in agricultural production and marketing is attributed to skill differentials acquired through education. Adekunle (1978) stated that, technical and commercial education broaden the farmers/marketers intelligence and lay the basis for vocational training. In addition, it enables the farmers/marketers to perform the farm activities/ tasks intelligently and with a full appreciation of their contribution to the final product.

Table2 - Costs-returns of some farm management practices cost on output of snail in Cross River State

COST/RETURN COMPONENT	QUANTITY	UNIT PRICE (₦)	TOTAL VALUE(₦)
Total Revenue(TR)			
Quantity of snail produced(kilogram)	78,998.34	300	23,699500.50
Variable Cost(TVC)			
Cost of feed supplement			58,675.00
Cost of labour in man-days(hired labour)	720	500	360,000.00
Cost of construction of snail cage			17,550.00
Cost medication /vaccines			8,600.00
Cost of other operating expenses (transportation)			10,600.00
Cost of plastic container used for supply of clean drinking water	360	40	14,400.00
Cot of wheel barrow	120	6,000	720,000.00
Cost of shovels	120	1,800	216,000.00
Cost of rakes	120	450	54,000.00
Cost of head pan	120	1500	180,000.00
Fixed Cost (TFC)			
Cost of hiring land	206 hectares	1,500 per hectare	309,000.00
Buildings	120	135,000.00	16,200,000.00
Fencings	98	12,500.00	1225,000.00
Interest on loan of(N450,000) at 8.5%	N450,000	8.5	8,250.00
Depreciation of farm equipment(straight line method)			18,626,950.00
Total cost (TC) =(TVC +TFC)			20,764,500.50
Net return (TR-TC)			2,935,000.00

Source: Field survey, 2009

Table 2 revealed that the per hectare cost of snail was ₦ 20,764,500.50. Human labour accounted for ₦ 360,000.00 of the total cost of production process (₦ 20,764,500.50).

A total of 720 man-days were used in snail production. While the total revenue was

₦ 23,699500.50. The net return on snail is ₦ 2,935,000.00.

Table 3 - Profitability analysis of snail produced in Cross River State

PROFITABILITY INDICATOR	SNAIL(NAIRA)
*Net Return(NR)=(TR-TC)	2,935,000.00
Total cost (TC)	**20,764,500.50**
Return on investment (Ri) = NR(Net Revenue) / TC (Total Production Cost)	0.14

Source: Field survey, 2009

The result in Table 3 indicated that the net returns on snail is ₦2,935,000.00 with return on every naira invested of ₦ 0.14 is also positive indicating a profit from the business. The result of the study corroborate/ agree with the earlier contentious of Datuin, (1993) and Lameed, (2006) which stressed that snail farming is a profitable business.

The study revealed that several constraints militating against the efficient of snail production in Cross River State. These constraints are presented on Table 4. Notable among constraints are high cost of feed supplement, lack of capital, inaccessibility of formal credit source because lack of collaterals, lack of extension agents, lack of medication/vaccines, poor production infrastructures and lack of good farm management practices occupied 15%, 14.17%, 11.67%, 10%, 9.17%, 9.17% and 8.33% respectively.

The result of the study agrees with the findings of Ekanem and Umoh, (1997); Akinnusi, (1998); Lameed, (2006) revealed that some constraints militating against the efficient production of snail. He noted that from the list of seventeen constraints, ten were identified by snail farmers as factors limiting their level of production. The identified factors were based on level of severity and less number of specialized extension agents in snail farming was the highest (90.3%).

Table 4 - Constraints against the efficiency of snail production in Cross River State

CONSTRAINTS	FREQUENCY OF RESPONDENTS IN IGOLI IN OGOJA L.G.A.	FREQUENCY OF RESPONDENTS IN ALESI IN IKOM L.G.A.	FREQUENCY OF RESPONDENTS IN ADIABO IN ODUKPANI L.G.A.	TOTAL FREQUENCY	PERCENTAGE
High cost of feed supplement	7	5	6	18	15
Lack of extension agents	4	3	5	12	10
Lack of good farm management practices	5	2	3	10	8.33
Lack of price information	2	5	4	11	9.17
Lack of capital	10	4	3	17	14.17
Inaccessibility of formal credit source because lack of collaterals	3	6	5	14	11.67
Lack of medication/vaccines	3	5	3	11	9.17
Inaccessibility of formal credit source because of short repayment period	3	3	2	8	6.66
Poor production infrastructures	2	4	5	11	9.17
Lack of storage facilities	1	3	4	8	6.66
Total	**40**	**40**	**40**	**120**	**100**

Table 5 - Multiple Regression Equations for Snail (Archachatina marginata) Production in Cross River State, Nigeria

PRODUCTION FUNCTION FORMS	CONSTANT	X_1 FARM SIZE	X_2 LABOUR	X_3 FARM MANAGEMENT PRACTICES(MEASURED ON 5 POINT SCALE)	X_4 OPERATING COSTS (NAIRA/HECTARE)	X_5 FARMING EXPERIENCE (YEARS)	R^2	ADJ R^2	F-ALUE
Linear	-2.659	0.281	1.139	2.076*	205	3.521*	0.60	0.56	16.43
	(1.498)	(0.374)	(0.026)	(0.042)	(0.102)	(0.000)			
Semi-log	-5.754	0.991	0.111*	0.330*	-1.440	1.275*	0.55	0.50	13.39
	(5.058)	(1.306)	(1.306)	(0.940)	(0.690)	(0.906)			
Cobb-Douglas	-1.313	0.164	0.276*	9.146	0.194	0.372	0.60	0.57	17.16
	(0.710)	(0.183)	(0.290)	(0.132)	(0.97)	(0.127)			

Note:*= Values significant at 1%; Figure in parentheses are standard errors
Source: Field survey, 2009

Table 6 - Estimated Elasticities of Production Function (EP), Average Product (AP) Marginal Product (AP), Marginal Value Product (MVP) and Allocative efficiency (AEL) for Snail (Archachatina marginata) Production in Cross River State, Nigeria

VARIABLES	EP	AP	MPP	MVP	P	AEL	INFERENCE
X_1 (farm size)	0.007	154.286	1.08	1080	1000	1.08	Under utilized
X_2 (Total labour)	0.06	17.167	1.03	20.6	20	1.03	Under utilized
X_3 Farm management practices(measured on 5 point scale)	0.04	152	6.08	972.8	160	6.08	Under utilized
X_4 (Operating costs)	0.08	132.5	1.06	14.84	14	1.06	Under utilized

Source: Field survey, 2009

Table 5: Judging from the value of the R^2 in the analysis above for the three production function forms, one can conclude that Cobb-Douglas equation is a good one compared to all other functional forms (linear and semi-log production functions). Cobb-Douglass production function is the lead equation because it has the highest R^2 value (0.60) and meeting other econometric criteria. The F-value for the functions are also significant at 1 percent indicating that there is a significant linear relationship between the independent variables taken together and the yield of snail produced in Cross River State, Nigeria.

The regression analysis, however, revealed that farm size, labour, farm management practices, operating costs and farming experience has positive influence on output of snail production and are significant at 1 percent level of significance**.** Lameed (2006) reported similar results for operational cost and farming experience , he further stated that many snail farmers(46.7%) had been involved in snail production for the past two years and farming experience has positive influence on output of snail production ; while Nweke, and Winch, (1979); Adesimi, (1982), Datin (1993); Ekanem and Umoh, 1997, Ogar *et al.*, (2002) reported similar results for labour.

Table 6 revealed the marginal value products of farm size, labour, farm management practices and operating costs were ₦1080, ₦20.6, ₦972.8 and ₦ 14.84 respectively, there existed allocative in-efficiency, there is a high potential for snail farmers to increase their yields and income. This findings agrees with the findings of Vietmeyer, (1991); Akinnusi, (1995); Aduku, (1996); Ayodele and Asimalowo, (1999); Amusan and Omidiji, (1999); Francis and Anim, 2(001); Lameed, (2006) that snail farmers are in-efficient in snail production because not all of them possess the skills necessary to know how to improve productivity and this implies that actually farmers are operating below their full potential due to lack of skills, the cost per unit output was proportionately higher.

Conclusion and Recommendations

This study has revealed that snail production was profitable, with attractive net return on investment but snail farmers are not allocative efficient. This study shows that snail farmers are faced with several problems in their production activities. These problems or constraints affect the efficiency of snail production in the study area. Notable among constraints are high cost of feed supplement , lack of capital, inaccessibility of formal credit source because lack of collaterals, lack of extension agents, lack of medication/vaccines, poor production

infrastructures and lack of good farm management practices occupied 15%, 14.17%, 11.67%, 10%, 9.17%, 9.17% and 8.33% respectively. Hence, for efficient production of snail in the study area, these constraints must be drastically reduced to the barest minimum. This can be done through effective and efficient micro and macro-economic policy formulation and implementation, proper supervision of snail production programme, effective extension services and proper agricultural financing. The constraints associated with the business as highlighted in this paper if tackled could pave a way to increase profit and this will alleviate poverty in Cross River State. However, based on the findings of the study it is recommended that snail farmers in the study area should form cooperative group (s) in order to obtain loans from bank (s) to increase their capital base for higher output. In addition to that, snail farmers should increase their yield and income by expansion of their farms, improving efficiency and adopting new technologies**.** Beside that, extension agents should train snail farmers on the adoption of new technologies in snail production.

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