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FACTORS AFFECTING TILAPIA FISH FARMING IN ONDO AND EKITI STATES, SOUTH WEST NIGERIA

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ABSTRACT
Tilapia fish production is not as popular as catfish production. Therefore, in support of the drive of the Federal Government to boost fish production, this study determined the factors affecting tilapia fish production in Ondo and Ekiti States. Primary data were collected from 120 Tilapia fish farmers and researchers using random and multi stage sampling techniques (seventy from Ondo State and fifty from Ekiti State). Most (70%) Tilapia farmers are male, Ninety percent are married and majority (51.7%) has household size with 2-5 members. Gross Margin analysis showed a profit of 11.79%. Regression result showed that cost of equipment, cost of feed, farming experience, household size and pond size were factors affecting Tilapia fish production with 0.28, 0.42, 0.08, 0.02 and 0.00 as coefficients, respectively, and were all significant at 5% level of significance. The p- value (0.742) of the Chi square test revealed that income of the Tilapia fish farmer has no significant relationship with contact with extension agents. The study recommends that agricultural extension services should be strengthened to ensure more farmers receive more visits from extension agents. Government of both Ondo and Ekiti states should provide funds and inputs to boost the productive capacity of farmers.
Keywords: Tilapia, productive capacity, constraints, profitability, production and factors

INTRODUCTION

The rate of population growth in the world is alarming when compared with the rate at which food production is increasing especially in the developing nations like Nigeria. It is more worrisome that the poverty level in most Sub-Saharan African countries has made intake of balanced diet practically impossible for most household members. According to Fanzo (2012) Sub-Saharan Africa is home to some of the most nutritionally insecure people in the world. Mostly consumed foods are the cheap carbohydrates which the disposable income of most homes can accommodate. Protein intake for most individuals in this region is grossly inadequate.

Fish is a cheap source of animal protein, which families can raise in their backyard in order to boost their protein input. Fish plays a vital role in feeding the world's population and contributing significantly to the dietary protein intake of billions of the populace (Amao, Oluwatayo and Osuntope, 2006).Among several species of fishes that can be cultured is Tilapia which is not popularly raised when compared to other species like catfish. Fish farming is the raising of fish in ponds, tanks, net enclosures, cages, or any suitable enclosure (where the fish can be properly monitored) for personal use or profit. Usually the goal is to grow fish as fast and economically as possible to harvestable size. Regardless of whether the raising is for family consumption or commercial purpose, some factors can be manipulated to influence growth rate such as pond environment, type and density of fish, food, fertilizer, water quality, and growth period.

According to Issa, Abdulazeez, Kezi, Dare, and Umar, (2014), the total aggregate domestic fish supply in Nigeria from all sources (captured and cultured fisheries) is less than 0.7 million metric tonnes per annum. The requirement of fish to satisfy the dietary need of Nigerians is approximately 2.66 million metric tonnes per annum. In view of this supply gap; Nigeria imports about0.7 million metric tonnes of fish valued at $500 million annually to augment part of the shortfall. This massive importation of frozen fish in the country has made Nigeria ranked the largest importer of frozen fish in Africa. The total contribution of fisheries to the Nigerian economy is put at N126, 417 billion gross output with a capitalization of N78, 530 billion (Faturoti, 2010). Fishing and marketing of fish and fish products are very lucrative ventures that contribute to food security, poverty alleviation and Nigerian economic growth.

Though not as popular as catfish farming, Tilapia has several advantages when cultured. Tilapia is easy to culture, has good disease and stress resistance ability, able to reproduce easily, short generation time, starts feeding early and with good tolerance to high stocking densities (Al-Sayed, 2006). It is good for hypertensive patient because of its nutritional value. It is rich in Omega-3 fatty acids which help to prevent atherosclerosis, heart attacks, and strokes; the potassium found in tilapia is also a vasodilator, and reduces blood pressure, which is an additional boost to heart health (organic facts, 2015) Tilapia production requires low cost of feed which minimize cost of production and enhance profit because Tilapias are able to eat many types of foods like aquatic algae and plant, insects and manufactured feed. It can be used to control weed and insect in rice paddies and for the control of aquatic saprophytes in large irrigation system (Fagbenro, Nwanna, Adeparusi, Adebayo and Fapohunda, 2005).

In Nigeria, if Tilapia fish must be served at affordable prices; factors that affect its production must be understood. This is necessary so that these factors could be managed or improved as required to boost local production. In doing this the high dependence of Nigeria on fish importation would be addressed.

The broad objective of this study is to determine factors affecting cultured Tilapia fish farming while the specific objectives are to:

- describe the socio economic characteristics of tilapia fish farmers,
- determine the profitability of Tilapia production in the study area,
- determine the level of contact of the farmers with extension services and
- identify the major constraints affecting Tilapia fish farmers in the study area.

METHODOLOGY

The study area is Ondo and Ekiti States located in the South-Western part of Nigeria; Ondo State have geographical co-ordinates of $5^0 45''$ and $8^0 15''$ North of the equator and longitudes $4^0 30''$ and $6^0 00''$ East of the Greenwich meridian while Ekiti state have geographical co-ordinates of $7^0 40''$ North of the equator and longitudes $5^0 15''$ East of the Greenwich meridian. Based on the projection of National Population Commission in 2012, Ondo state's population was 6,882,048 and covers 15,500 km^2 while Ekiti state's estimated population was 4,364,507 and covers an area of 6,353km^2.

Random sampling technique was combined with multistage sampling to draw samples. In Stage I: Ekiti and Ondo states were randomly selected from the list of seven states in South West Nigeria.

In stage II of the sampling, 70 Tilapia fish farmers out of 350 were randomly selected from the list of Tilapia fish farmers in Ondo state and 50 out of 150 from the list of Tilapia fish farmers in Ekiti state. This gives a total sample size of 120 respondents. The lists were obtained from the Agricultural Development Project of both states and the Fisheries Department of Federal University of Technology Akure and Ekiti State University, Ado-Ekiti.

Primary data was used for this study. Data were collected through the use of well-structured questionnaire which was administered using interview method. Chie square was used to test the two hypotheses, Gross margin analysis was used to determine profitability while multiple regression analysis was used to estimate the contribution of certain independent variables to the output of cultured Tilapia fish in the Ondo and Ekiti states. The linear, semi-log, and Cobb-Douglass functional forms of the production function were fitted using Ordinary Least Square (OLS) method. The estimated functions were evaluated in terms of the statistical significance of the coefficients of multiple determination (R^2) as indicated by F-Value, the significance of the coefficients and magnitude of standard errors. The lead equation was chosen based on the following criteria:

1. Apriori-expectation
2. The magnitude of the coefficient of Determinant (R^2)
3. The significance of the explanatory variable.

Based on the statistical and econometric criteria listed above, the linear functional form was selected as the lead equation for this study. The R^2 for the estimated regression was 0.87. This implies that 87.7% variation in production capacity of farmers is explained by the entire explanatory variable considered in this study.

RESULTS AND DISCUSSION

Data procured from 120 respondents selected from Ondo and Ekiti states were collated and analysed. The result of the analysis are as follows;

Socioeconomic characteristics

Socioeconomic characteristics of the respondents described in this study include: age, sex, educational level, marital status, household sizes and fish farming experience.

The ages of farmers as shown in Table 1, reveal that very few (16.7%) of the farmers were below 36 years, but were between 26-35 years. None of them was below 26 years while few 35% of the respondents were in the age category of 46-55 years. This shows that young teens were not really engaged in the culturing of Tilapia but rather adults not below 26 years. A negligible 3.3% of the respondents are 66 years and above. Although most youth prefer white collar jobs compared to farming but it is noticeable that most respondents in this study are not the elderly which is an indication that young able bodied men are into Tilapia farming.

As shown in Table 1, majority of the respondents (70%) are males, while only 30% of them are female. This confirms findings of Folayan, Omoniyi, and Bifarin (2014) that production activities in an agricultural enterprise are a male dominated enterprise. In their study of farm ownership by small scale farmers in Edo state, Nigeria; about 68% agricultural enterprises are owned by male. The Tilapia fish farming being dominated by males is similar to the finding of Adewuyi *et al* (2010) where over 80% of the fish farmers in Ogun state were males. Sex is an important factor in determining the choice of an agricultural enterprise to embark upon, for instance, women are found more in marketing and processing activities that require less tedious production activities than men.

The distribution of the marital status of the respondents as shown in Table 1 shows that 8.3 % were Single, 90.0 % were married and 1.7% were

widowed. This is similar to the findings of Nwosu and Onyeneke (2013) whose study of pond fish farmer in Owerri agricultural zone, Nigeria shows that majority (85%) were married. This may imply that majority of the respondents being married may be able to use family labour and have the opportunity to take decision s on matters. They can jointly be responsible in taking crucial decisions regarding Tilapia production. Majority being married could also be explained by African tradition which frowns at singlehood immediately a man or woman attains a particular age. In addition ruralites often get married quickly in order to have a helping hand from their mates in the farming enterprise.

Table 1 revealed that, out of 120 respondents sampled, 80% had family size between 4-8, and only 4 of the respondents representing 3.4% has a family size of less than 3 members while 16.6 % have above 10 members as household size. This implies that majority have manageable family size, their consumption expenditure may be low and this may not adversely affect their profit margin. Besides, they have cheap family labour which gives extra helping hands in their production enterprise.

Table 1 revealed that majority (95%) of the respondents had one form of education or another and 25.0% completed their secondary school education. From the study, average tilapia producer in the study area were moderately educated implying that they will take moderately better decisions as regards acceptance of innovations and apply better production practices since education is the tool to adoption of newly improve technology. Only 5 % had no formal education, this finding compares favourably with the finding of Aromolaran (2000). The level of education of farmers increases their farm production and also enhances the ability to understand, evaluate and adopt new technologies.

From Table 1, majority of Tilapia farmers (76.7 %) have between 2 to 9 years of Tilapia production experience while only 5.0% of the respondents have production experience above 17 years. This implies that Tilapia farmers are experienced farmers and therefore may be able to handle production challenges.

Table 1: Distribution of Respondents based on Socio-economic Characteristics (n = 120)

Socioeconomic Variables	Frequencies	Percentages
Age in years		
26-35	20	16.7
36-45	40	33.3
46-55	42	35.0
56-65	14	11.7
Above 65	4	3.3
Sex		
Male	84	70
Female	36	30
Marital status		
Single	10	8.3
Married	108	90.0
Widowed	2	1.7
Household size		
< 3	4	3.4
4-8	96	80.0
9 and above	20	16.6
Educational level		
No formal Education	6	5.0
Completed primary	8	6.7
Attempted secondary	16	10.0
Completed secondary	30	25.0
Attempted tertiary	12	10.0
Completed tertiary	50	41.6
Adult education	2	1.7
Years of fish farming experience		
<1	4	3.3
2-9	92	76.7
10-17	18	15.0
>17	6	5.0

Source: Field Survey, 2013

Perceived factors affecting tilapia production

Table 2 shows the distribution of the level (High, moderate or low) of perceived effects of several factors on Tilapia fish production based on the opinion of the respondents. The factors considered in this category include feed availability, weather condition, labour, profitability of the enterprise, traits exhibited by the fish species, tax imposed by the government, infrastructural facilities, demand for the fish, water conditions, government agricultural policy and disease infestation.

From the distribution in Table 2, majority (71.7%) attested that availability of feeds have high effect on Tilapia fish production while few (23.0%) opined that feeds availability has moderate effect on them. Almost 72% of the total respondents believed that weather condition has moderate effect on Tilapia production and they find it easy to adapt to changes in weather condition, though 28% believe that weather condition in the locale has high effect. The distribution further revealed that 55% said labour has low effect while 36.7% believed that labour exerts moderate effect on production.

Based on the distribution, majority (62.0%) believed that the enterprise production is affected greatly by the profit level while 20.0% attested to moderate effect of profit on production. It is few (18.0%) who claimed that profitability has low effect on production. Furthermore, the traits of fish cultured was perceived as having high effect on production by 56.6% of the respondents while 28.3% said it has moderate effect. This shows that

the farmers are aware of the relevance of selecting high quality breeds for stocking since it determines production. Tax effect on tilapia fish production was perceived by 61.6% of the respondents as being moderate in affecting production and 20.0% said it has relatively high effect.

The effect of infrastructure on tilapia production was rated moderate by majority (63.3%) while 13.3% opined that infrastructure effect on production is low. The demand for the fish was rated as having high effect on their production as agreed to by half (50.0%) of the respondents while only 15% agreed that demand does not have high or moderate effect but rather low effect on their production. This may be because, if farmers produced in a fairly large quantity and it was not demanded for or bought off him/her such a farmer will be discouraged in the next cycle of production and may even stop or reduce the quantity he will produce. The perceived effect of water condition was attested to be high by half (50.0%) of the fish farmers while in the opinion of 8.4% of the farmers water condition has low effect on the production of the fish. The distribution however showed the connection between government policies and its effect on tilapia production as most of the respondents (60.0%) attested that government policies have low effect on tilapia production, 38.3% attested to moderate impacts on tilapia production. This implies that there is little or no government policies regulating or promoting the production of tilapia in the study areas.

The table further asked the farmers the effect of disease on tilapia production. From the data collected, it was revealed that 50.0 % approved that disease have low effects on tilapia production while 33.3% attested to moderate effects on production and 13.8% attested to high effects on production. This confirms that Tilapia fish is disease tolerant and are not highly susceptible to diseases infestation.

Table 2: Distribution of Perceived Effect of Selected Factors Affecting Tilapia Production.

Perceived Variables Affecting Production	**Low**		**Moderate**		**high**	
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Feed Availability	6	5.0	28	23.3	86	71.7
Weather Condition	4	3.3	86	71.6	30	25.0
Labour	66	55.0	44	36.7	10	8.3
Profitability	22	18.0	24	20.0	74	62.0
Fish Traits	18	15.0	34	28.3	68	56.6
Tax	22	18.3	74	61.6	24	20.0
Infrastructure	16	13.3	76	63.3	28	23.3
Demand	18	15.0	42	35.0	60	50.0
Water Condition	10	8.4	50	41.6	60	50.0
Government Policy	72	60.0	46	38.3	2	1.7
Disease	60	50.0	40	33.3	20	16.7

Source: Field Survey, 2013

Profitability of tilapia production

The costs, returns and profitability analysis are presented on Table 3. The following items were considered in estimating the costs and returns: Average feed cost, average quantity bought, average maintenance cost, average labour cost, average sundry costs, average equipment cost, average prevailing selling price and quantity sold.

Table 3: Profitability Analysis Associated with Tilapia Production

Expenditure	Average Value (₦)
1. Cost of Feed	56,807.5
2. Sundry	21,041.67
3. Labour	11,217.9
4. Maintenance	3081.63
5. Cost of Equipment	1775.00
TOTAL	**93,923.7**
Average output (kg)	500
Average total Output	210.0
price per kg	105,000.00
Revenue	11,076.3
Gross Revenue	

Source: Computed from Field Data, 2013

$$\text{Profit (\%)} = \frac{Gross\ Revenue}{Total\ Cost} \times 100 = \frac{11,076.3}{93,923.7} \times 100$$
$$= 11.79\%$$

From the analysis above, it can be seen that the profitability level of tilapia fish production is not encouraging. The annual accruable profit on the average was ₦11, 076.3 per annum or a profit of 11.79%.This profit margin is low compared to the production of other cultured fish species based on literature. For example Egware and Orewa (2013) in a study conducted in Ughelli, Delta state, Nigeria, put the profit percentage of catfish reared in earthen and concrete tanks as 65.6% and 47.7%, respectively, Similarly, Adebayo and Adesoji (2008) in a study on profit margin of catfish in Ogun state Nigeria, gave a profit margin of 38.2%. These two examples show clearly that catfish has higher profit level than Tilapia.

Farmers' level of access to extension services

From Table 4, average (46.7%) of the respondents revealed no contacts with any extension agent whether governmental or non-governmental while most (53.3%) representing 64 respondents had contact with extension agents.

From Table 4, 62.5% out of the 32 respondents who have contacts with extension agents claimed that their contacts with agricultural extension agents was on a quarterly basis while 28.1% affirmed that they only enjoy extension services twice in a year. According to the respondents, 6.3% received extension services on monthly basis and 3.1% on weekly basis. This confirms the inadequacy of agricultural extension service in the study area.

Table 4: Distribution of Respondents by Access to Extension Services (n = 120)

Access to agricultural extension services	Frequency	Percentage
No	56	46.7
Yes	64	53.3
Number of contacts with Agricultural Extension Agents		
Weekly	2	3.1
Monthly	4	6.3
Quarterly	40	62.5
Bi-annually	18	28.1
Total	**64**	**100.0**

Production function analysis of tilapia fish production

Multiple regression analysis was used to estimate the contribution of certain independent variables to the output of cultured Tilapia fish in Ondo state.

Table 5: Regression Analysis

Variables	Linear	Semi-log	Cobb Douglas
Constant	-0.241 (4.207)	5439.725 (1.217)	1.501 (0.815)
X_1 = Cost of Equipment (₦)	0.281 (-1.902)*	-1803.197 (-1.327)	0.112 (0.200)
X_2 = Profit Realized (₦)	0.033 (0.515)	-1654.317 (-1.312)	0.227 (0.438)
X_3 = Cost of Feed (₦)	0.420 (-2.178)*	-5214.009 (-4.854)*	-1.148 (-2.593)*
X_4 = Farming experience (Years)	0.084 (-6.735)*	-3040.917 (-0.317)	-1.275 (-3.665)*
X_5 = Cost of Labor (₦)	0.053 (-3.325)	-852.015 (-1.266)*	-0.441 (-1.591)
X_6 = Household Size (Nos)	0.017 (6.085)*	663.35 (12.218)*	0.513 (4.167)*
X_7 = Pond Size(m^2)	0.001 (3.698)*	404.996 (0.916)	0.316 (1.737)*
R^2	0.877	0.864	0.837
Adjusted R^2	0.860	0.821	0.786
F- Value	51.006	20.147	16.365

Source: Field Survey, 2013.
*Significant at 5%.
Figures in parenthesis are t-values of the coefficients.

As shown in Table 5, the linear functional form was chosen as the lead equation because it is the equation that satisfied the evaluating criteria. It gives the equation of best fit with the highest R^2 (0.877), number of significant variable and the correct signs of variable based on apriori expectation. The lead equation is shown below. The 5 variables were significant determinants of production capacity of farmers at 5% level of significance.

$Y = a + bX_1 + bX_2 + bX_3 + bX_4 + bX_5 + bX_6 + bX_7 + \mu_i$

Where Y= Output, a= constant term and μ_i= error term

$Y = 0.241+0.281X_1+0.033X_2+0.420X_3+0.084X_4+0.053X_5+0.017X_6+0.001X_7$

(4.207) (1.902) (0.515) (-2.178) (-6.735)* (-3.325)* (6.085)* (3.698)*

$R^2 = 0.877^*$

Adjusted R^2= 0.860

F value = 51.006

Standard Error = 0.385

From the equation, it could be seen that the explanatory variables accounted for 87.7% variation in the Production Capacity of Farmers (PCF).The significant variables are; cost of equipment, farming experience, cost of feed, household size and Pond Size. The error tem accounted for 12.3%. F-distribution table was used to test the significance of the coefficient of multiple regression (R^2) while T- Value was used to test the significant of the coefficient of the explanatory variable. This result shows that cost of equipment, farming experience, cost of feed, household size and pond size are all determinant factors in Production Capacity of Farmers in the study area. The positive coefficient of pond size suggested that the sizes of pond used for production can be increased to their advantage.

Hypotheses testing

Relationship between the output of Tilapia fish farmers and their selected socioeconomic characteristics

From table 6, theχ^2calculated value for age of the respondents was 70.894 with degree of freedom of 80 and p value of 0.757 (2-tailed). This p value is greater than level of significance of 0.05 which means it is not significant, hence, acceptance of null hypothesis that there is no significant relationship between the output of Tilapia fish and the age of Tilapia fish farmers. The implication of this is that the age of Tilapia fish farmers does not affect the quantity of fish produced.

The marital status of the farmers was not significant with the output of Tilapia fish produced as shown in Table 6 where the p- value of 0.108 is greater than 0.05 level of significance. The $\chi2$ calculated was 106.889. Regardless of the marital status of the respondents whether single, married or divorced their production level of Tilapia fish is not affected.

The table also shows the$\chi2$ value for sex of the respondents was 41.943 with degree of freedom of 40. The p - value is 0.387 which is greater than 0.05 which means it is not significant, hence, acceptance of null hypothesis; there is no significant relationship between the output of tilapia fish and the gender of tilapia fish farmers. The implication of this is that the whether Tilapia fish farmer is male or female does not determine the quantity of fish produced. Any gender can be involved in the Tilapia fish farming and still achieve reasonable level of output under good farming practices.

Furthermore, the table revealed the $\chi2$ value for educational level of the respondents is 1.1732 with degree of freedom of 40, it has p- value of 0.533 (2- tailed) this p-value is greater than level of significance of 0.05 which means it is not significant, hence, acceptance of null hypothesis that; there is no significant relationship between the output of Tilapia fish and level of education of farmers. This translates that the education attainment of tilapia fish farmer does not affect the quantity of fish produced. Tilapia farming does not require formal academic qualification to excel in its farming. Literate or non-literate can achieve same level of output given same production factors and operational environment ceteris paribus.

Table 6: Chi-Square analysis showing relationship between socio-economic characteristics and output of Tilapia Fish Farmers

Variables	Calculated $\chi2$ Values	p-value	D.F	Decision
Age	70.894	0.757	80	NS
Marital Status	106.889	0.108	90	NS
Sex	41.943	0.387	40	NS
Educational level	1.1732	0.553	110	NS

Source: Field Survey, 2013

Testing of significance at p=0.05 level

NS= Not Significant

S= Significant

Relationship between the income of Tilapia fish farmers and their contact with extension services

As can be seen from the Table 7, calculated Chi-Square is 21.000with degree of freedom 26and p-value of 0.742. This p- value is greater than level of significance of 0.05 which means it is not significant, hence, acceptance of null hypothesis which stated that there is no significant relationship between contact with extension services by farmers and their income. The extension services delivery does not influence the income of the respondents. This may be due to the low level of extension contact with the Tilapia farmers in the study area. In addition, those who claimed to have agricultural extension contact may not receive information that have impacted their income.

Table 7: Chi-Square Analysis Showing the Relationship between the Income of Tilapia Fish Farmers and their Access to Extension Services

Variable	Calculated χ^2 Values	p-value	D.F	Decision
Income	21.00	0.742	26	NS

Source: Field Survey, 2013
Test of significance at p=0.05 level
NS= Not Significant
S= Significant

Constraints affecting tilapia production

Table 8 reveals the constraints affecting Tilapia production in the study area. Majority (57%) of the respondents attested to overcrowding as a constraint. This occur as a result of high spawning rate when male and female species of Tilapia are stocked together. Among the respondents, 23%attested to high mortality rate especially during harvesting because of the fragile and sensitive nature of the fish to change in environmental condition. It cannot breathe-in atmospheric oxygen due to the absence of gills unlike catfish. Lack of post harvest method in preservation was identified as a constraint by 15% of the respondents. The fish must be processed or preserved based on the fact that it deteriorates under two hours of harvesting. Among the Tilapia fish farmers 20 % of the respondents attested that they lack technical know-how on production.

Table 8: Distribution of Respondents According to Constraints Affecting Tilapia Production

Constraints	Freq	Perc
High mortality rate	28	23
Low post-production process	18	15
Over-crowding	68	57
Technical know-how	24	20
Total	**138**	

*Multiple responses
Source: Field Survey, 2013

CONCLUSION

The result from this study shows that Tilapia farming is profitable but the profit margin is small. Tax is not a production inhibiting factor. For profitability to improve the factors that are crucial to the production are: cost of equipment, cost of feed, the farming experience, household size and pond size. Nigeria have huge potentials in the production of Tilapia fish if there is enabling environment with policies that will encourage local production and thus no avoidance from dumping of imported fish in the country. The Tilapia fish can be a source of financial empowerment and a way to increase protein intake of households in Nigeria.

RECOMMENDATIONS

1. It is recommended, based on the findings of this study, that production of Tilapia fish should be encouraged and government should provide funds and other inputs (i.e land and credit) that can boost the productive capacity of the farmers.
2. Agricultural extension services should be improved so that farmers currently culturing Tilapia can be trained on better ways to culture the fish and thus improve revenue.
3. There should also be awareness drive on the advantages of culturing Tilapia over other species of fish through effective extension system.

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