

## MUSHROOM CULTIVATION PRACTICE AMONG FARMERS IN DELTA STATE, NIGERIA

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### Abstract

The study examined mushroom cultivation practice among farmers in Delta State, Nigeria. The specific objectives of the study were to: describe socioeconomic characteristics of mushroom farmers; identify the types of edible mushroom that are grown by the farmers; determine the nature of incentives, if any, given to mushroom farmers; and identify the major constraints facing mushroom growers in the State. Snowball sampling technique was employed to select farmers across Delta State. The snowball sampling technique was employed to compose a sample size of 108 mushroom farmers. Data were collected from both primary and secondary sources; primary data were obtained by means of a well-structured and validated questionnaire. Simple descriptive statistics like percentages, means, and frequency distribution were used for analysis of data in order to achieve the specific objectives of the study. The Likert scale was the instrument used to measure the constraints. Inferential statistics used to test the stated hypothesis was the Probit Model. The result shows that four types of edible mushroom were cultivated by farmers in the area; about 62.7% of the respondents cultivated Chanterelles; 58.9% raised Shiitake, 55.1% grow Morel mushroom while about 34.8% of the respondents cultivated Oyster mushrooms. About 55.1% of the respondents received incentive in the form of free training, 12.1% received equipment, 9.4% loan/credit while only about 4.8% were given land. The most serious problems facing the mushroom farmers were the identification of suitable mushroom species to cultivate (mean = 4.16), lack of suitable substrate or medium to grow mushroom (mean = 4.09) and poor environment (mean = 4.03). The results of the Probit model indicated that gender, age, educational level, farming experience, farm size, income and extension contact were all significant variables influencing mushroom cultivation at  $P < 0.05$ . The study concluded that mushrooming in the State is still underdeveloped and faces a lot of constraints which should be tackled.

**Keywords:** Mushroom, cultivation, Likert scale, Probit, Delta State

### Introduction

Although not very popular, mushroom farming does hold unique prospects in Nigeria. Mushrooms have been universally recognized as food and they are nutritious delicacy grown on commercial scale in many parts of the world including Nigeria.

Mushrooms are invariably ubiquitous since they are widely distributed throughout the world, found in both the temperate and tropical regions (Kalu *et al.*, 2013; Chang Shu-Ting and Philop, 2004). The role of mushroom in the diets of man has been recognized for a very long time (Kalu *et al.*, 2013). Nigeria in general and Delta State in particular, has a climate that favours the natural growth of mushrooms even when this potential has not been fully utilized.

The edible mushroom is a type of fungus that typically grows on solid or decaying tree trunks. Actually, it is the fleshy part of the fruiting body of the fungus. Because it usually grows on decaying tree trunks, mushroom farms are always moist or damp because mushrooms need water to grow. To successfully cultivate mushrooms, they must be protected from wind and sun. Unlike other plants, they do not need sunlight to grow. They are therefore typically grown in shades, but must have access to oxygen which they need for survival. However, not all mushrooms are edible. This is because quite a few mushroom species are poisonous.

Mushroom cultivation offers the most efficient and economically viable biotechnology for the conversion of lignocellulose waste materials into high quality protein food. Chang, Shu-Ting and Philop (2004) reported that mushrooms, apart from protein, contain vitamins, fats, carbohydrates, amino acids and minerals (Falade *et al.*, 2008). Apart being a good source of protein and other nutrients, and being tasty, edible mushrooms have a lot of health benefits that Nigerians would be wise to take advantage of. According to Olorun-Ni (2017) mushrooms have the following health benefits:

1. The oyster mushroom has been reported to provide relief to HIV patients. It is currently being studied as a possible cure for the virus. The *button mushroom* can help in reducing weight, *shiitakes* are known to fight tumors. The *chanterelle* contains a reasonable amount of vitamins. While the *oyster* is currently being studied as a possible cure to HIV (Omeh, 2016).
2. The button mushroom is used in weight loss programmes and has been proved to help in weight reduction and control.
3. The shiitake mushroom is said to help in fighting benign/non-cancerous tumors.
4. Mushrooms are a good source of protein for diabetic patients because they have a low salt content. They are also made up of

around 90 per cent water, and are good for a healthy digestive system.

5. Some mushroom farms actually specialise in the growth of medicinal mushrooms for the prevention and treatment of some illnesses such as cancer, tumour, fibroid, hypertension, wounds and high blood pressure. Its use as antibiotics has also been identified.

Olorun-Ni (2017) asserted that research and applications have shown that mushroom cultivation is relevant to four sectors of the Nigerian economy; food, pharmaceutical, agricultural and the environment. There are four categories of mushrooms, namely, saprotrophic, mycorrhizal, endophytic, and parasitic mushrooms. The easiest of all these to cultivate is the endophytic mushroom. This is because it partners with its host, providing it with nutrients and resistance to pathogens, but can be grown in the absence of such a host. The mycorrhizal mushrooms are the most difficult to cultivate because of the symbiotic relationship they share with the plants they grow on.

To cultivate mushrooms on a commercial scale, consideration must be given to the species chosen, taking into note market demand and the environment. In Nigeria, below are the species of mushrooms that are commonly grown and that are in high demand:

1. **Chanterelles:** Chanterelle mushrooms are rich in vitamin C, D and contain a high amount of potassium. It is said to contain more potassium than bananas.
2. **Shiitake:** The shiitake mushroom is a variety of mushroom mostly grown in Asian countries, especially in Japan where its name originated from. It has been known to reduce tumors.
3. **Morels:** Morel mushrooms protect the liver from toxic materials and contains a high amount of vitamin C and antioxidants.
4. **Oysters:** Oyster mushrooms are known to have anti-oxidant and anti-bacterial properties. They also help to reduce the level of cholesterol in the body.

There is a ready market for mushrooms, with Nigeria's hospitality industry being the major consumer of mushrooms. To cater to the dietary needs of expatriates and discerning Nigerians, many big hotels in Nigeria have mushrooms on their daily menu. But because the local supply does not currently match the demand, they have had to resort to the importation of mushrooms. Therefore, there is a ready steady market for local farmers.

Also, Nigeria is becoming increasingly more health conscious and Nigerians are deliberately avoiding red meat and are substituting it with other sources of protein such as mushrooms. Edible mushrooms are considered as healthy food because their mineral content is higher than that of meat or fish and most vegetables. The protein content of fresh mushrooms

is about twice that of vegetables and four times that of oranges. To this end, supermarkets and grocery stores are demanding for the supply of mushrooms for onward sales to the populace.

Then there is the international market. There is a huge export opportunity to countries like Serbia and Brazil and some European countries where mushrooms are used for food and in the pharmaceutical industries.

The best factor in commercial mushroom farming's favour is the fact that it is a short period product. Cultivation to harvest typically takes four to five weeks, and this makes for one of the shortest investment time frames in the farming industry. Also, overheads are extremely low because investors do not have to buy food for the mushrooms. All one needs is the initial investment outlay and nothing more.

There is a ready and even growing market for the products. In a nutshell, cost of production is low, and there is a fantastic rate of yield and a high return on investment. It is indeed a lucrative business. Mushroom production has thus been regarded as the most versatile and prolific agricultural venture all over the world (Ikeji, 2010)

In spite of the nutritional importance and benefits of mushrooms, there is dearth of literature relating to its cultivation in Delta State. This merits a serious attention since a study of this nature will determine the status of mushroom farming in the State and it will serve as a guide post to policy makers and rural development workers like extension agents to enable them to know the type and level of intervention to institute to boost mushroom cultivation. Following this, the following research questions thus arise: what are the socioeconomic characteristics of mushroom growers in Delta State, Nigeria? What species or types of edible mushroom are cultivated by the farmers? Are there any incentives to the farmers to boost mushroom production? If so what are these incentives? What are the likely constraint militating against mushroom cultivation? Therefore the specific objectives of the study are to: describe socioeconomic characteristics of mushroom growers in Delta State; identify the types of edible mushroom are grown by the farmers; determine the nature of incentives, if any, given to mushroom farmers; and identify the major constraints facing mushroom growers in Delta State. The following null hypothesis was tested: there is no significant relationship between the socioeconomic variables of farmers and quantity of mushroom produced.

### Methodology

This study was conducted in Delta State of Nigeria. Delta State was created in 1991. It lies in South-South Geopolitical zone with its capital in Asaba. Delta State is located between latitude 5° and 6° 30' North and longitude 5° and 6° 45' East (DSG, 2016). The State is bordered by Edo State to the north, Ondo

State to the northwest, Anambra State to the east and Bayelsa and Rivers States to the southeast and to the southern flank by about 160 km of coastline of the Bight of Benin on the Atlantic Ocean. Delta State has a total land area of 18,050 square kilometres and an estimated population of 4,098,291 (NPC, 2006). The state is divided into twenty-five Local Government Areas and is sub-divided into three agro-ecological zones, viz: Delta North, Delta Central, and Delta South agro-ecological zones. The State has a mean temperature of about 40°C and annual rainfall of about 2000mm in the coastal parts and over 1500mm in the northern parts. Its natural vegetation consists of rainforest, freshwater forest and mangrove swamp forest. Gigantic trees found like Iroko, Obeche, Sapele wood, Afara and Walnut are found especially in the Southern part. Farming or agriculture (UNDP, 2014) is a major occupation of the people of Delta State, and both arable and tree crops are grown. Livestock of various types are also kept.

#### Sampling Procedure and Sample Size

Snowball sampling procedure was employed to select farmers across Delta State. Twenty communities were first randomly selected from each of the three agro-ecological zones of Delta State. The snow ball sampling procedure was then employed to compose a sample size of 108 mushroom farmers. Snowball sampling uses a small pool of initial mushroom farmers to nominate, through their social networks, other mushroom farmers. The term "snowball sampling" reflects an analogy to a snowball increasing in size as it rolls downhill (Morgan, 2008). Snowball Sampling is a method used to obtain knowledge from extended associations, through previous acquaintances, Snowball sampling uses recommendations to find other people with the specific range of skills that has been determined to be studied (Morgan, 2008; Salganik and Heckathorn, 2004). Snowball sampling is a useful tool for building networks and increasing the number of participants. In a study of this nature where it is not easy to come across mushroom farmers, the snowball sampling offers a promising means to select respondents.

#### Instruments for Data Collection

Data were collected from both primary and secondary sources. The study, however, relied heavily on primary sources of data. A well-structured and validated questionnaire was designed to collect data from the mushroom farmers. The secondary data were collected from official publications, journals, bulletins, and other published and unpublished materials. The questionnaire was designed to collect data on the socioeconomic characteristics of the respondents, the types of edible mushroom are grown by the farmers in the State, the nature of incentives given to mushroom farmers and the major constraints facing mushroom growers in Delta State

#### Method of Data Analysis

Simple descriptive statistics like percentages, means, and frequency distribution were used for analysis of data in order to achieve the specific objectives of the study. The Likert scale was the instrument used to measure the constraints. Inferential statistics used to test the stated hypotheses was Probit Model. The equation for the Probit Model is given as follows:

$$P_i = P_i (y_i = 1) = F(\omega_i, \varepsilon_i) = \int_{-\infty}^{\infty} \frac{1}{2\pi} e^{-t^2/2} dt \quad (I = 1, 2, \dots, n) \dots\dots(1)$$

The equation means that probability of a respondent increasing mushroom production,  $P_i(y_i = 1)$  is a function of the vector of explanatory variables,  $\omega_i$  (in this case the socio-economic variables), and the unknown parameter vector,  $\varepsilon_i$ .  $P_i$  is the probability that the  $i^{\text{th}}$  respondents chooses to increase his production ( $y = 1$ ), and  $y = 0$ , if otherwise. This is because individual farmers vary over a range for which they cultivate mushroom. Tobin (1958) pointed at that the specifications for the expected values of the dependent variable are violated when ordinary least squares regression is used with a limited dependent variable. Probit analysis manages heteroscedasticity of the disturbance term as well as restricting predictions to values between 0 and 1.

$\omega_i$  is defined below:

- $\omega_1$  = Gender (0=male, 1= female)
- $\omega_2$  = age (years)
- $\omega_3$  = marital status (categorical)
- $\omega_4$  = educational level (categorical)
- $\omega_5$  = Farming experience (years)
- $\omega_6$  = Farm size (hectares)
- $\omega_7$  = Household size (number of person)
- $\omega_8$  = Monthly income (naira)
- $\omega_9$  = extension contact (number per year)
- $\varepsilon_i$  = Error term

#### Results and Discussion

##### Socio Economic Characteristic of Respondents

In Table1, the socio-economic characteristics of the mushroom farmers are presented. The result on gender indicated that most of the mushroom farmers (83.3%) were males, while only 16.7% were females. This means that more males than females are involved in mushroom farming in the study area. Most of the respondents involved in mushroom cultivation were in the working age class (the average age of the farmers was 38.5 years). This could have positive effect on farming in the study area. Adesope, Matthews-Njoku, Oguzor and Ugwuja (2012) opined that farmers in this age range are usually economically active and this can result in positive effect on productivity.

The marital status of the respondents indicated that most of them were married (66.7% of the respondents). Issa, Kagbu and Abdulkadir (2016) in their study observed that most farmers were married. Ogunmefun and Achike (2015) observed that

married farmers usually have more responsibilities than other group and that marital status can be an important factor in shaping social rural participation and acceptance of any technology. The result shows of educational attainment of respondents showed majority of the respondents possessed secondary (48.1%) and tertiary (21.3%) school education, which provides a decent level of ability to understand and apply the techniques to be used in mushroom farming. Some respondents had very high educational qualification which provides the ability to act as instructors and subject matter specialist to further train other farmers and clientele in mushroom cultivation. Only about 12.0% and 18.5% of the mushroom farmers had no formal schooling and primary education respectively. Ogunmefun and Achike (2015) and Komolafe (2014) asserted that a farmer's level of acquired knowledge through education determines the ability of such farmer to make profitable decisions on investment. Majority of the farmers have a lot of experience in farming. In fact about 52.1% of the farmers had more than 11 years farming experience. Komolafe *et al.* (2014) observed that most farmers had high farming experience. Ajah and Nmadu (2012) asserted that the more experienced farmers are more efficient in their use of production resources thereby leading to higher output levels.

Farms that the farmers cultivated in the study area were rather very small. Most of the farmers (92.5%)

had farm sizes of 2 hectare and as shown in Table 2. Fragmentation due to the prevailing land tenure systems and resource endowment of farmers may be responsible for this. The finding was corroborated by that Ugwuja, Adesope, Odeyemi, Matthews-Njoku, Olatunji, Ifeanyi-Obi and Nwakwasi (2011) who observed that most farm size were 2 hectares and below in some parts of Nigeria. The implication of the finding is that most of the farmers had small holdings. The household sizes of the farmers were moderately large. Most of the farmers (64.7%) had between 6 – 10 members in their homes. The average household size was 7. According to Oluwatusin and Shittu (2014) farmers with large household members usually have more people who assist on farm and other household activities.

The average monthly income was N7412, majority of the respondents (77.8%) earning N10000 and below. One of the reasons adduced for this could possibly be the small holding of the mushroom farmers. The extension contact of each farmer per year was almost non-existent; as much as 91.7% of the respondents had no extension contact at all. About 5.6% and 2.8% of the respondents had 1-3 and above 3 contacts respectively with extension personnel. According to Adesope, Matthews-Njoku, Ogunmefun and Ugwuja (2012), extension contact provides a medium for transfer of skill, knowledge and information which improves farming.

**Table 1: Socio-economic characteristics of the mushroom farmers**

Variable	Frequency (108)	Percentage (100)	Mean/mode
<b>Gender</b>			
Male	90	83.3	Male
Female	18	16.7	
<b>Age ( years)</b>			
20 and below	12	11.1	38.5
21 – 40	66	61.1	
41 – 60	26	24.1	
61 and Above	4	3.7	
<b>Marital Status</b>			
Single	20	18.5	Married
Married	72	66.7	
Divorced/widow	16	14.8	
<b>Educational level</b>			
No formal	13	12.0	Secondary
Primary	20	18.5	
Secondary	52	48.1	
Tertiary	23	21.3	
<b>Farming Exp. ( year )</b>			
Less than 5	58	53.7	5
6 – 10	35	32.4	
More than 10	15	13.9	
<b>Farm Size ( Hectare )</b>			
0.5 and below	98	90.7	0.3
0.51 – 1.0	10	9.3	
<b>Household Size ( No. )</b>			
5 and below	71	65.7	4.0
6 – 10	37	34.3	

<b>Monthly income (Naira)</b>			
10,000 naira and below	84	77.8	
10,001–20,000 naira	12	11.1	7,412
above 20,000 naira	12	11.1	
<b>Extension contact/year</b>			
No contact	99	55.5	
1-3	6	35.3	0
More than 3	3	9.2	

Source: Survey data, 2017

#### Type of Edible Mushroom grown by Farmers

Four types of edible mushroom were cultivated by farmers in the area. The result indicated that about 62.7% of the Respondents cultivated Chanterelles; 58.9% raised Shiitake, 55.1% grow Morel mushroom

while about 34.8% of the respondents cultivated Oyster mushrooms. Ndem and Oku (2016) identified chanterelles, shiitake and oyster as the predominant mushroom grown by farmers in Nigeria.

**Table 2: Types of cultivated mushroom**

S/N	Type of Mushroom	Frequency	Percentage
1.	Chanterelles	68	62.7
2.	Shiitake	64	58.9
3.	Morel	60	55.1
4.	Oyster	38	34.8

#### Nature of Incentives to Mushroom Framers

The types of incentive given to the mushroom farmers are presented in Table 3. The result shows that the respondents received one form of

incentive or the other. About 55.1% of the respondents received incentive in the form of free training, 12.1% received equipment, 9.4% loan/credit while only about 4.8% as land.

**Table 3: Incentives provided to mushroom farmers**

S/N	Nature of Incentive	Frequency	Percentage
1.	Provision of equipment	12	12.1
2.	Loan/credit facilities	10	58.9
3.	Free training	78	55.1
4.	Provision of land by government	6	34.8

#### Constraint to Mushroom Production

Several problems were identified by the respondents, militating against the cultivation of mushroom in the area. The most serious problems facing the mushroom farmers were the identification of suitable mushroom species to cultivate (mean = 4.16), lack of suitable substrate or medium to grow mushroom (mean = 4.09) and poor environment (mean = 4.03). Other constraints perceived by the respondents included lack of technical know-how (mean = 3.99), biological factors (mean = 3.87), poor financing (mean = 3.79) and problem of marketing (mean = 3.20). Mkpado and Igbokwe (2013) identify Lack of skills-technical know-how, Capital constraints and Market (demand) as some of the constraints militating against mushroom cultivation. According to Ayodele, *et al.* (2010) and Ekanayake, (1998) mushrooms productivity can be constrained by various environmental stresses. The environment in

which mushrooms grow consists of physical, chemical and biological factors. Ekanayake (1998) went further to assert that an imbalance in any of these factors causes stress which may reduce the yield and quality of plants. Environmental stress could be biotic which are caused by biological factors such as diseases, insects or contaminants which compete with the plants for the available nutrients. Stress could also be abiotic factors which are caused by physical and chemical factors such as high temperature, salinity, excess substrate moisture etc (Ekanayake, 1998). Marshall and Nair (2009) also indicated that biological agents like pests, diseases and weeds could pose serious threat to the cultivation of mushroom. Moreover, Awad (2009) asserted that outbreak of diseases, poor production marketing, low profit, poor financing as some of the bottlenecks facing mushroom farmers.

**Table 4: Constraints to mushroom farming**

S/N	Nature of constraint	Std deviation	Mean	Seriousness level
1.	Identification of mushroom	0.67	4.16	Very serious
2.	Suitable substrate	0.24	4.09	Very serious
3.	Environment	0.33	4.03	Very serious
4.	Technical knowledge	0.41	3.99	Serious
5.	Pests/biological factors	0.28	3.87	Serious
6.	Financial bottlenecks	0.71	3.79	Serious
7.	Poor market	0.39	3.20	Serious

#### Relationship between socioeconomic variables of farmers and Scale of Operation

The relationship between the socio-economic variables of the mushroom farmers and the scale of operation of the farmers in the study area was determined by the Probit Model. The results of the Probit Model as presented in Table 5 indicated that as many as 7 out of the 9 variables were significant in determining the quantity of mushroom produced by farmers in the study area. These variables included gender, age, educational level, farming experience, farm size, income and extension contact.

**Gender:** This variable is significant at  $p < 0.05$ . This means that gender is positively related to scale of operation. Thus, since there are more males than females that are involved in mushrooming, male farmers tend to produce more mushroom than their female counterparts in the study area. This finding could be due to the fact that the mushroom farming is a tedious and meticulous activity that requires physical or muscular effort which the male farmers can do better than the female farmers.

**Age:-** This variable is negatively significant to mushrooming. This indicates that old farmers are less likely to be engaged in mushroom production. This result may be as a result of the fact that the older farmers shy away from strenuous tasks involved in mushroom cultivation. Such farmers will rather resort to invest in less tasking farming activities.

**Educational Level:** This has a positive relationship with scale of operation at 5% level of significance. A farmer's level of acquired knowledge through education determines the ability of such farmer to

make profitable decisions on investment and adopt an approach to risk management that best reduces the incidences of production failure although experiences of farmers with risk management strategies is of more relevance.

**Farming Experience:** It was significant at  $P < 0.05$ . Adah, Olukosi, Ahmed, and Balogun (2007) and Okoye et al. (2009) opined that more experienced farmers were very efficient in their decision-making processes and were more willing to adopt innovation which invariably leads to the farmers' ability to manage general and specific factors that affect the farm-firm business

**Farm Size:** This was significant at  $p < 0.05$ . Ajah and Nmadu (2012) observed that the larger the farm of the farmer the more likely his output will increase.

**Household size:** This variable was not significant in determining the scale of operation of farmers (co-efficient for -0.251).

**Income:** Farmers' income is positively related to mushroom farming at  $P < 0.05$ . This suggests that the more the income of the farmer the more likely he will increase his scale of operation; as the farmer's income is increasing there is the tendency to acquire more equipment that will invariably lead to higher yield and hence large scale of operation.

**Extension Contact:** The co-efficient for access to extension delivery is 2.999 which means that farmers exposed to extension services are more likely to increase their cultivation of mushroom almost three times than farmers who are not exposed to extension. Moreover this variable was significant at  $P < 0.05$ .

**Table 5: Socio-economic Determinant of Mushroom farmers' Scale of Operation**

Variable	Coefficient	Standard Error	Z statistics	Probability
Constant ( $X_1$ )	0.601	0.402	0.788	0.499
Gender ( $X_1$ )	0.0270	0.011	3.144	0.007**
Age ( $X_2$ )	-0.712	0.366	-2.897	0.044**
Marital Status ( $X_3$ )	0.030	0.050	0.711	0.621
Educational level ( $X_4$ )	0.004	0.024	2.878	0.012**
Farming Experience ( $X_5$ )	0.412	1.369	2.998	0.018**
Farm Size ( $X_6$ )	0.299	6.413	3.008	0.009**
Household Size ( $X_7$ )	-0.251	-2.407	0.020*	0.802
Monthly Income ( $X_8$ )	3.066	5.229	4.144	0.003**
Extension Contact ( $X_9$ )	2.999	4.755	3.333	0.006**

Source: Field Survey, 2017 \* Significant at  $p < 0.05$

S.E of Regression 0.710344

Avg. Log Likelihood - 0.560322

### Conclusion and recommendation

In this study, an assessment of mushroom cultivation practices of farmers in Delta State, Nigeria was carried out. It can be deduced from the study that mushroom cultivation in Delta State is still at the small scale level; it still underdeveloped and bedevilled by several constraints. However from the findings of the study the following recommendations were suggested:

-Major constraints facing mushroom farmers like the identification of suitable mushroom species, lack of suitable substrate or medium to grow mushroom, poor environment, lack of technical know-how, biological factors and poor financing should be tackled by collaborative efforts of both the government and the mushroom farmers.

- Since extension services to the farmers are poor, more extension agents should be deployed to the area to enlighten the farmers about the technicalities and others requirements needed for sustainable mushroom cultivation.

- More females should be encouraged to go into mushrooming.

- Workshops on the importance of growing mushroom should be organized in different parts of the State.

It is hoped that with the implementation of these recommendations, mushroom farming will definitely contribute immensely to uplifting the nutritional status of our teeming population.

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