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Original Research Article

YAM FARMERS' COPING STRATEGIES AGAINST YAM BEETLE (*Heteroligus* spp.) IN DELTA STATE, NIGERIA: IMPLICATION FOR FOOD SECURITY

ABSTRACT

The study examined the various strategies adopted by yam farmers of Delta State in coping with the menace of yam beetle (Heteroligus meles). The specific objectives were to: describe the socio-economic characteristics of yam producers in Delta State; ascertain the economic losses caused by yam beetle in Delta state; determine the various strategies adopted by farmers in Delta state in coping with the menace of yam beetle; examine the effectiveness of the various coping strategies. A multi-stage sampling procedure was used to compose a sample size of 225 respondents. Primary data were obtained from respondents with the use of structured and validated questionnaire. Various descriptive and inferential statistical methods were used in data analysis. The result shows that majority of the farmers (98.2%) adopted the use of multiple cropping in combating the menace of yam beetle; about 93% adopted late planting and 55.1% agrochemicals. Most of the farmers thus witnessed minimal losses in their farmers since they adopted one form of coping strategy or the other. The study further revealed that the use of agrochemical was the most effective coping strategy. The regression result shows that with the exception of gender, marital status and household size, all other factors were statistically significant at ($\rho \leq 0.05$), indicating that they influenced respondents' adoption of coping strategy. The implication of these findings for food security is that yam production in Delta state is likely to improve, thereby leading to increase in food supply in the area since farmers are combating the menace of beetles. However, from the findings of the study it was recommended, among others, that farmers should be enlightened on the need of using effective coping strategies.

Keywords: Coping strategy, questionnaire, economic losses, agrochemical, Delta, Nigeria

INTRODUCTION

Nigeria is by far the world's largest producer of yam, accounting for over 76 percent of the world production (Wikipedia). According to the Food and Agricultural Organization report, in 1985, Nigeria produced 18.3 million tonnes of yam from 1.5 million hectares, representing 73.8 percent of total yam production in Africa (Wikipedia). Yam production in Nigeria has

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nearly doubled since 1985, with Nigeria producing 35.017 million metric tonnes with value equivalent of US$5.654 billion. In perspective, the world's second and third largest producers of yams, Cote d'Ivoire and Ghana, only produced 6.9 and 4.8 tonnes of yams in 2008 respectively (FAO, 2009). According to the International Institute of Tropical Agriculture , Nigeria accounted for about 70 percent of the world production amounting to 17 million tonnes from land area 2,837,000 hectares under yam cultivation. Yam, a tropical crop in the genus Dioscorea , has as many as 600 species out of which six are economically important staple species. Out of these, Dioscorea rotundata (white yam) and Dioscorea alata (water yam) are the most commonly grown species in Nigeria (O'Hair, 1990). Yams are cultivated in the coastal region in rain forests, woody savannah and southern savannah habitats. Yam is in the class of roots and tubers that is a staple of the Nigerian and West African diet, which provides some 200 calories of energy per capita daily. In Nigeria, in many yam-producing areas, it is said that "yam is food and food is yam." Yam also has an important social status in gatherings and religious functions, which is assessed by the size of yam holdings one possesses. Although it is grown widely in Nigeria, the area where it is grown most is the Benue State (land area of 802,295 km²), one of the states in Benue valley of Nigeria where the labour intensive practices are still the norm and the land holdings are small. Because of high level of yam production in the State of Benue, Benue State is crowned as the Nigerian Bread Basket. Pest and disease control is addressed by cultural control and chemical methods; the pests which affect the plant are nematodes such as root knot (Meloidogyne spp.) and yam nematode (Scutellonema bradys), and insects such as yam shoot beetle, yam tuber beetle and crickets. Tuber is the main part of the yam plant which has high carbohydrate content (low in fat and protein) and provides a good source of energy. Unpeeled yam has vitamin C . Yam, sweet in flavour, is consumed as boiled yam (as cooked vegetable) or fufu or fried in oil and then consumed. It is often pounded into a thick paste after boiling and is consumed with soup. It is also processed into flour for use in the preparation of the paste. Its medicinal use as a heart stimulant is attributed to its chemical composition, which consists of alkaloids of saponin and sapogenin . Its use as an industrial starch has also been established as the quality of some of the species is able to provide as much starch as in cereals. Ritualism and festivity restriction are also associated with yam, which is the staple in south-eastern Nigeria. A yam festival is held every year to mark the harvesting of this crop. The village chiefs and traditional title holders of lands in Nigeria who grow yam make it a religious practice by not consuming yam till it is offered to the gods. During this festival, villagers offer prayers thanking their ancestral gods for the blessings of the land and the women's

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fertility. The festivity observed in villages is in the form of a parade of traditional dances. One of the marriage custom observed in some communities in Nigeria is to measure the bridegroom's wealth by the amount of yams that he can produce. Also, according to tradition, the groom has to present a minimum of 200 big tubers of yams to the in-laws as a proof that he can take care of his wife and the future family. Yam is depicted as a male totem in some areas of the Ibo land. Another custom observed is that women are not permitted to go to the yam farms till it is ready for harvesting; however, harvesting of the crop is the prerogative of the women.

However, the production of yam in Nigeria is very low and cannot meet the growing demand at its present level of use. This is because there are several factors militating against optimum yam production which include expensive planting materials (seed yams/setts) labour, staking, weed menace, diseases and insect pests. In spite of the central role yam plays in the lives of Nigerians, its production could be adversely affected, especially by pests and diseases. Unreliable rains and pest and disease outbreaks cause wide variations in resource availability and in crop yields. The major factor in this regard is the destruction to yams caused by the yam tuber beetles, *Heteroligus* species (Taylor 1964; Tobih *et al.,* 2007, Inoni, 2010). These beetles are very serious insect pests of yam in riverine areas particularly in the rainforest zones (McNamara and Acholo, 1995). Serious losses and drastic reduction in tuber yield and market value as a result of the beetle damage has been reported by Tobih *et al.(*2009) and Inoni (2010). Inoni (2013) in his study on the effects of yam beetles infestation in Oshimili North LGA of Delta State indicated that damage due to yam beetles ranged from 27.69% to 39.72% with a mean beetle attack rate of 32.69% that caused a loss of tubers worth N1.09million in market value. The menace of these insects had caused untold hardships to farmers in terms of economic losses. It therefore becomes imperative that the various ways farmers have coped in managing yam beetles in their farms be examined.

Problem Statement

Nigeria is the major producer of yam in the world. Yam is a major staple food crop for the people of Nigeria in general and Delta people in particular. In spite of the importance of yam in this area, its production has faced many challenges. One of the limiting factors to yam production is the incidence of pests. Pests of yam could cause serious crop losses to farmers in Nigeria and Delta State in particular. Yam beetle (Heteroligus meles) is the most serious pest affecting yam production in Delta State. Damage to yam beetles ranged from 27.69% to

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39.72% with a mean beetle attack rate of 32.69% that caused a loss of tubers worth N 1.09 million in market value in Delta North agricultural zone of Delta state, Nigeria (Inoni, 2010). Serious losses and drastic reduction in tuber yield and market value as a result of the beetle damage has been reported by Tobih (2010) and Tobih *et al (*2009). High cost of pesticides and cost of equipment and labour were reported as major obstacles to the effective control of yam tuber beetles (Inoni, 2010) Since the yam beetle could lead to considerable losses to farmers in the area, it therefore becomes imperative that farmers manage this pest properly in order to boost their productivity. The following research questions then arise: what are the socio-economic characteristics of yam producers in Delta State? What is the extent of losses caused by yam beetles? How have farmers in Delta State, Nigeria, been able to cope with the menace of yam beetles over the years? How effective are these coping strategies in ameliorating the menace of yam beetle? The objectives of the study are therefore to: describe the socio-economic characteristics of yam producers in Delta State; ascertain the economic losses caused by yam beetle in Delta state; determine the various strategies adopted by farmers in Delta state in coping with the menace of yam beetle; examine the effectiveness of the various coping strategies. The study tested the following hypothesis, stated in the null form: there is no significant relationship between the socio-economic characteristics of farmers and their coping strategies against yam beetle.

Research Methodology

Delta State was the study area. Delta state was created from the then Bendel state on August 27, 1991 by the regime of General Ibrahim Babangida. Delta state shares common boundaries with Edo and Ondo States to the North-West, Imo and Anambra States to the North-East, Rivers and Bayelsa to the South-East. In the South and South-West it has approximately 122 kilometres of coast line bounded by the Bight of Benin on the Atlantic Ocean. The Major ethnic groups are Urhobo, Igbo, Ezon, Isoko and Itsekiri. Delta state lies approximately between longitudes 5°00' and 6°45' East and latitudes 5°00' and 6°30' North. It has an estimated population of 4098291 (NPC, 2006) and total land area of 18,050 square kilometres, and about one-third of this is swampy and waterlogged. It experiences average rainfall of about 2000mm per annum with an average monthly temperature of30.4-36.4°C and a relative humidly varying room 56-86 percent per annum. Delta state is divided into three agricultural zones namely, Delta South, Delta North and Delta North.

Delta state is situated in the Niger Delta flood plain on the coast of Nigeria. A large number of the coastal towns in the State have already been displaced by flooding induced by sea level rise.

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The economy of Delta State is dominated by the Oil and Gas sector because of its abundant reserves of Oil and Gas. This sector contributes as much as 40% of the Country's GDP and 83% of total government revenue. Other major activities of the State which include agriculture, fishing and trading are on the decline since the discovery of Oil. Despite the success of the Oil industry, the level of poverty, unemployment, intercommunity conflict, conflict over land and housing pressure are high.

The State is rich in biodiversity and the mangrove swamps are the largest in Africa. However, climate change impacts have led to loss of wetlands through deforestation, oil spills and saline intrusion from sea level rise and flooding having devastating effect on the State's biodiversity resource and livelihood options (Welch and Okoh, 2013).

Sampling Procedure and Sample Size

A multi-stage sampling procedure was used to compose a sample size of 225 respondents. This was done as follows: out of the three agricultural zones in the state, one local government area was randomly selected from each zone. Seventy-five (75) respondents were selected from each of the randomly selected local government areas, giving a total of two hundred and twenty five (225) respondents that were sampled and studied.

Primary data were obtained from respondents with the use of structured and validated questionnaire. The instruments for primary data collection include a five point likert scale with values: 1= strongly disagree, 2= disagree, 3= undecided, 4=agree and 5=strongly agree. From point 3 will be regarded as effective while below 3 as non-effective as used by Akwiwu et al (2000). Furthermore, data were collected from secondary sources such as Journals, past research work, Government records, documented statistics collected from the study area, internet and Library.

Descriptive and inferential statistical methods were used in data analysis. Information was presented using tables and simple percentages. Inferential statistics that was used in testing the stated hypothesis was a regression model. As all the farmers surveyed used one form of coping strategy or the other, we apply an ordinary least square, (OLS) estimation

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instead of Tobit, probit or logit model to explain the variation in use of coping strategies. The linear model was the best fit as it has the highest R^2 and most variables were significant.

Results and Discussion

Socioeconomic characteristics of yam farmers

The socioeconomic characteristics of the respondents in the study area are presented in Table 1. The result indicated that more women were actively involved in yam production than men. This result is contrary to expectations of many as yam is culturally regarded as a "man" crop in Delta State (Inoni, 2010). Most of the respondents (97.23%) are in their economically active age group. A relatively large household size was found in the study area with an average size of 8 persons per household. These findings support the preponderance of large family sizes among the poor in rural areas reported by many scholars. About 93.33 percent of the farmers had one form of formal education or the other. Most of the yam farmers had secondary education. Illiteracy and lack of education poses significant constraints to agricultural productivity in sub-Saharan Africa. According to Njoku (1991) and Biswanger (1989), farmers who are educated formally are more likely to adopt modern agricultural innovations in order to increase overall productivity, than their less educated counterparts. Moreover, apart from being early innovators that provide examples that may be copied by illiterate farmers, educated farmers are better able to copy those who adopt innovation, thereby enhancing wider diffusion of the new technology in the community (Weir and Knight, 2004)

Most of the respondents had a lot of experience in farming. Over 90% of the farmers had more than ten years farming experience. Ogungbile, Rahman and Tabo (2002) indicated that length of time of farming business can be linked to the age of farmers, access to capital and experience in farming may explain the tendency to adopt innovations and new technology.

Table 1: Socio-economic characteristics of respondents

Variable	Frequency(225)	Percentage (100%)
Gender		
Male	110	48.89
Female	115	51.11
Age		
20 – 30 years	13	5.78
31 – 40 years	65	28.89

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41 – 50 years	105	46.67
51 – 60 years	36	16.00
61 and above	6	2.67
Marital Status		
Single	28	12.44
Married	162	72.00
Widowed	14	6.22
Divorced	11	4.89
Educational Background		
No formal	15	6.67
Primary school	56	24.89
Secondary school	124	55.11
Tertiary education	20	8.89
Farming Experience		
1 – 10 years	22	9.78
11 – 20 years	68	30.22
21 – 30 years	98	43.56
31 years and above	37	16.44
Household Size (number)		
1 -5	94	41.78
6 – 10	131	58.22
Farm Size (ha)		
2 and below	178	79.11
Above 2	47	20.89
Extension Agent Contact		
Monthly	23	10.22
Weekly	14	6.22
Others	188	83.56

Source: Field survey, 2014

The economic losses to farmers, in monetary terms, as a result of yam beetle attack on their farms are presented in Table 2. The result in Table 2 indicates that majority of the respondents incurred minimal losses in their farms. For instance, whereas as much as 40.9% of the respondents incurred losses of only N10000 and below, only about 0.9% of them incurred losses of more than N50000. The reason adduced for this is probably due to the fact that most of the respondents had adopted some strategies in one way or the other to combat yam beetle attack.

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Table 2; Economic losses to yam farmers due to yam beetle attack

Economic loss (Naira/ ha)	**Frequency**	**Percentage**
Above 50000	2	0.9
40001- 50000	6	2.7
30001- 40000	6	2.7
20001- 30000	55	24.4
10001- 20000	64	28.4
10000 and below	92	40.9

Source: Field Survey, 2014

The various coping strategies adopted by yam farmers is presented in Table 3. The result shows that most of the farmers (98.2%) adopted the use of multiple cropping in combating the menace of yam beetle. This was followed by the adoption of late planting (92.9%) and agrochemicals (55.1%). Most of the yam farmers feel that multiple cropping (i.e. growing different crops on the same piece of land at the same time) serves as insurance for them against crop failure. Late planting of yam was adopted by most of the yam farmers as this helps the farmers' yams to escape attack of the pest. Some farmers also use agrochemicals like Aldrin dust or Gammalin 20 to dust their yams before planting. However, in view of the deleterious nature of most of these agrochemicals, their usage by yam farmers is dwindling.

Table 3: Coping strategies adopted by yam farmers

Strategy	Frequency	Percentage
Use of agro chemical	124	55..1
Late planting	209	92.9
Fallowing	12	5.3
Alternative cropping	56	24.9
Multiple cropping	221	98,2

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Source: Field Survey, 2014

Effectiveness of the coping strategies adopted by farmers

The effectiveness of the various coping strategies adopted by farmers is as shown in Table 4. From Table 3 it is obvious that, according to the respondents, use of agrochemicals (mean = 4.79) was the most effective coping strategy adopted by farmers in the study area. This was followed by late planting (mean = 4.68) and multiple cropping (mean = 4.01). Tobih (2014) reported that the use of insecticide was very effective in the control of yam beetle.

Table 4: Effectiveness of various coping strategies against yam beetle

Strategy	Mean	Standard deviation	Rank of mean
Use of agrochemical	4.79	0.51	1st
Late planting	4.68	0.73	2nd
Multiple cropping	4.01	0.66	3rd
Alternative cropping	2.94	0.59	4th
Fallowing	2.42	0.81	5th

Source: Field Survey, 2014

Likert scale: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = Agree, 5 = strongly Agree

Test of hypothesis

Ho_1: There is no significant relationship between yam farmers' socioeconomic characteristics and their coping strategies against yam beetle.

A regression analysis was run to determine the influence some selected socioeconomic characteristics on coping strategies of farmers; the variables included farmers' gender, age, marital status, educational level, farming experience, household size and farm size. The model presents a good fit to the data (Chi-square of 89.1; $P<0.01$) and indicates that all parameters considered are different from zero (Table 5). Five factors have a significant influence on the adoption of coping strategies by farmers. Table 5 shows that with the exception of gender, marital status and household size, all other factors were statistically significant at ($\rho \leq 0.05$), indicating that they influenced respondents' adoption of coping strategy. Farming experience positively affects the adoption of coping strategies ($P<0.05$). This means that farmers with many years of experiences in agriculture are the major adopters

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of coping strategies against yam beetle. The level of education also positively affects farmers' decision to adopt coping strategy (P<0.5). Thus, farmers who highly educated are more amenable to adopt various coping strategies. The adoption of hybrids requires extra costs such as buying suckers and hiring labour. There is a positive relationship between coping strategy and farm size of farmers. Extension services play a key role in the mechanism of diffusion and adoption. This result is corroborated by findings of Adesina et al. (2000) and Nkamleu and Coulibaly (2000), who assert that extension has a positive impact on the adoption and the diffusion of agricultural practices.

Table 5: Relationship between socioeconomic variables and coping strategies of farmers

Characteristic	B	Standard error	T	p-value
Constant	1.754	1.988	0.842	0.192
Gender	-0.467	0.911	0'766	0.546
Age	-0.094	0.041	3.988	0.002*
Marital status	0.045	0.033	0.997	0.422
Educational level	0.512	0.042	3.124	0.031*
Farming experience	0.433	0.051	3.222	0.038*
Household size	0.866	0.085	0.688	0.450
Farm size	0.474	0.422	2.946	0.0441*

Source: *Field Survey, 2014*

*Significant at p< 0.05

Conclusion and Recommendation

Empirical evidence from the study indicated that the yam farmers in the area employed various strategies to cope with the menace of yam beetle in the area. However, the farmers make lesser use of agrochemicals in spite of the fact that agrochemicals were rated by the respondents as the most effective means of combating yam beetles. It was also observed that some socioeconomic variables like age, educational level, farming experience and farm size influence coping strategies adopted by farmers. The implication of these findings for food security is that yam production in Delta state is likely to improve, thereby leading to increase in food supply in the area. However, from the findings of the study, the following recommendations are made:

1. The cost of agrochemicals for controlling yam beetle should be reduced to encourage yam farmers to use them.

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2. Since education is crucial to the adoption of coping strategy, farmers should be enlightened on the need of using effective coping strategies.

When these measures are instituted, this will go a long way in boosting yam production in the area, thus improving food security in the state.

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