INDIGENOUS ADAPTATION TECHNOLOGIES STRATEGIES ON WATER YAM PRODUCTION BY FARMERS IN PATANI LOCAL GOVERNMENT AREA OF DELTA STATE, NIGERIA.

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Abstract
The study examined Indigenous Adaptation Technologies Strategies on Water Yam Production by Farmers in Patani Local Government Area of Delta State, Nigeria. Data were collected from 100 farmers using structured questionnaire and analyzed with frequency tables and multiple regression model. The result indicated that Farm size (coeff=0.046), Education (coeff=0.948), Access to credit (coeff=0.057), Age (coeff=0.513) and Family size (coeff=0.274) were positively related to output of water yam except labour that was not significant. The result showed that majority (84%) of the water yam farmers were females, about 75% were married and 81% of the farmers were educated. The foremost information sources available to water yam farmers for adaption of technology in the study area were co-farmers (34.4%), friends (22.4%) and family members (19.3%) respectively. The result showed that high proportion of the farmers adapted mulching (16.6%), inter-cropping (13.4%), organic/green manure (13%) and crop rotation (12.1%) practices on water yam production. Major constraints militating against farmers indigenous adaptation of water yam production technologies are lack of credit facilities (20%), lack of capital (15.6%), pest and disease (14%) and fertilizer (12.8%). It was recommended that water yam farmers should be given modern technologies adaptation training to use the strategies for maximum utilization and water yam production in the study area.

Keywords: Indigenous, knowledge, Technology, Water Yam, Farming, Adaptation

Introduction
Yam dioscorea species are annual or perennial tuber bearing climbing plants. The major edible species of African origin are dioscorea rotundata (white yam), dioscorea cayenensis (yellow yam) and dioscorea alata (water yam). Water yam (Dioscorea alata.) originated from South East Asia, it is the species most widely spread throughout the world and in Africa is second only to white yam in popularity. According to Lebot et al, (2005), it is the most widely distributed species in the humid and semi-humid tropics. It is a vigorously growing, twining, herbaceous vine reaching 10 -20 m in length. The large tubers are used as food. D. alata is the most widely distributed species globally (Mignouna et al., 2004; Brunnschweiler, et al, 2004) and the world's most popular yam after the D. rotundata. The tuber shape is generally cylindrical, but can be extremely variable. Tuber flesh is white and "watery" in texture. A large number of cultivars has been recorded throughout the tropics varying in shape and colour of leaves, stems and tuber (Lebot et al.,2005).The cultivars are high -yielding, with shallow -rooting tubers with a pronounced neck and 2 -3 fingerlike portions with a length of about 20 cm; outer cortex creamy white; flesh white; very palatable and storing well for 5 -6 months. They are produced on 5 million hectares in about 47 countries in tropical and sub tropical regions of the world. Yields are about 11 tonnes per hectare in the major producing countries of West Africa 48.7 million tonnes of water yams were produced worldwide and 97% of this was in sub Saharan African. West and central Africa accounts for about 94% of world water yam production (FAO, 2005). In Nigeria alone, export earnings from water yams hit ₦56 billion in 2008 up from ₦37 billion realized in 2007. The figures underpinned the socioeconomic importance of water yams (Robert and Abraham, 2009). However, Nigeria is the leading producer with 34 million tonnes followed by Cote d' Ivoire (5 million tonnes). The average water yam consumption per capita per day in Nigeria is 258k calories (IITA, 2007).
According to Onwueme (1997) edible water yams reach maturity in 8-11 months after planting. Ayanwu (1998) stated that in many parts of West African water yam zone, mature water yams were harvested at the end of the rainy season or early part of the dry season. In many parts of south eastern Nigeria, water yam is harvested when the crops has attained maximum growth and maturity. Yields of 8-30 $mtha^{-1}$ in commercial water yam production has been reported, the exact value depending on the location, variety and cultural practices (Onwueme and Charles, 1994). .
Due to the perishability of the crop, the tuber cannot be kept for more than a few weeks after harvesting. 50% of the crops may be lost within 6 months due to rot or germination if no stabilization processes are used and this explains the volatility in fresh yam prices

over the years (Vernier, 1998). Martins et al (1984) said that to avoid tuber damage minimum storage temperatures of 10°C, 12°C and 13°C were suitable. Water yam is closely associated with the culture of the people in sub Saharan Africa, contributing significantly to wealth and improving food security (Robert and Abraham, 2009). According to Opara (1999), he observed that leaving the tubers in the ground until required is the simplest storage technique practiced by small scale farmers when carried out on farm. This type of storage prevents the use of the land for further cropping. Harvested water yams are also put in ashes and covered with soil, with or without grass much until required. Traditionally, water yam plays a significant role in societal rituals such as marriage ceremonies, which made the crop a yard stick of wealth evaluation for people especially in the water yam producing communities (Robert and Abraham, 2009). With the growing demand water yam has assumed great importance in Nigeria. The entire production offers vast employment opportunities. The supply of water yam offers prospect for income generation due to the number of people involved and the value attached to it. This had a profound impact on food security (IITA, 2007).

Ozowa (1995) reported that water yam seeds were obtained using the traditional methods instead of the ministett technology introduced from research institutes. Some other farmers used inorganic fertilizers but complained of unavailability and high cost of inputs and this was often caused by lack of information. These inputs might include fertilizer, improved variety of seeds and seedlings feeds, plant protection chemicals, agricultural machinery and equipment and water. An examination of the factors influencing the adoption and continued use of these inputs would show that information dissemination was a very important factor, a factor that required more attention than it now gets. To encourage production Nigerian government put in place policies that would stimulate rapid inputs, delivery mechanization of cultivation, research into improved varieties and accessibility to credit facilities (Peter and Johnson, 2001). Nigerian farmers rank extension highest in terms of providing credible information and advice, especially on agricultural technology. A major function of extension was to get the farmers into a frame of mind and attitude conducive to acceptance of technological change. Ozowa (1995) opined that information needs of farmer are grouped into agricultural inputs, extension education, agricultural technology, agricultural credits and marketing. He stated further that modern farm inputs were needed to raise small farm productivity. These inputs include; fertilizer, improved variety of seeds, plant protection chemicals, agricultural machinery and equipment and water. A look at the factors affecting adoption and continued use of these inputs showed that dissemination of information was paramount which required serious attention than that is practice presently. The objectives of the study were to; describe the socioeconomic characteristics of water yam farmers, determine the factors affecting indigenous technologies on water yam production adaptation strategies, identify sources of technology for water yam farmers, identify the adaptation strategies of the water yam farmers as well as identifying constraints.

Materials and Methods

Study area

The study was carried out in selected farming communities in Patani Local Government Area (LGA) of Delta State, Nigeria. Patani town is the capital of the LGA which has land area of 217km^2 and a population of 67,707 people. It has geographical coordinates of latitude and longitude 5.22724 and 6.19238. Agrarian activities are mostly done by the women folk. Patani LGA is located at the rain forest zone. The food crops majorly engaged in the area are cassava, yam, plantain, sweet potato, cocoyam and vegetables.

Data source and sampling technique

The study employed primary data with the use of well structured questionnaire. The information elucidated to drive the study were farm size, socio-economic status of the farmer, process of production, technology application, quantities of inputs and cost, level of output, adaptation strategies and constraints. A multistage sampling procedure was adopted for the study. In the first stage, 10 farming communities that are involved in water yam production were purposively selected. In the second stage, 10 water yam farmers were randomly selected from each community giving a total sample size of 100 respondents used for the study.

Analytical techniques

The analytical tools used to achieve the objectives of the study were descriptive statistics such as percentages, frequency distribution and Ordinary least square regression (OLS).

Results and Discussion

Socio-economic characteristics of respondents

The socio-economic characteristics of the respondents discussed here include gender, age, marital status, farming experience, educational level, farm size and household size. The result of the distribution of the respondents according to their socio-economic characteristics is presented in Table 1. As presented in Table 1, majority (84%) of the water yam farmers were females while the remaining 16% were males. This indicated that the water yam farmers in Patani

LGA are mainly headed by female farmers. Majority (51%) of the farmers as found in this study fell between 41-50 years' age bracket. The result showed that majority (75%) of the farmers were married, majority (71%) of the farmers had between 11-15 years of experience, 81% had formal education at varying degrees. It implies that the farmers are educated. Majority of the farmers (83%) had farm size of 1.1 to 2.0. ha; Majority of the farmers (81%) fell within the household size of 6-10 persons.

Table 1: Distribution of the Respondents by Socio-Economic characteristics

Variable	Frequency	Percentage (%)
Gender		
Male	16	16.0
Female	84	84.0
Total	100	100.0
Age		
20-30years	8	8.0
31-40years	36	36.0
41-50years	51	51.0
51-60years	5	5.0
Total	100	100.0
Marital Status		
Single	12	12.0
Married	75	75.0
Divorced	9	9.0
Widowed/widower	4	4.0
Total	100	100.0
Farming Experience		
Less than 5years	4	4.0
5-10years	7	7.0
11-15years	71	71.0
Above 15years	18	18.0
Total	100	100.0
Education level		
No formal education	19	19.0
Primary edu	65	65.0
Secondary edu	13	13.0
Tertiary	3	3.0
Total	100	100.0
Farm Size(Ha)		
1.1-2.0	83	83.0
2.1-3.0	15	15.0
3.1-4.0	2	2.0
Total	100	100.0
Household Size		
1-5	7	7.0
6-10	81	81.0
11-15	12	12.0
Total	100	100.0

Information sources for water yam Technology adaptation

Table 2, it is seen that 34.4% of the respondents (farmers) acquired information from other co-farmers. The result also revealed that 22.4% out of the 100 respondents sampled for the study received information on water yam production from their friends. It shows further that 19.3% of the respondents received information about adoption of water yam production technology from family members, about 6.3%, 13.5% and 4.2% had information on available technology on water yam production through Media TV, Radio and Newsprint respectively while Extension worker has no impact which is zero contact. This shows that technology adoption information received by water yam farmers for practices were not from the extension workers but as a result of farmers interaction with other farmers, friends and family members. The result presented in Table 2 shows that, extension worker had no effect on the respondent in the study area.

Table 2; Sources of information for water yam farmers (N=100)

Source	Frequency of Respondents	Percentages Distribution	Mean Ranking
Co-farmers	66	34.4	1
Friends	43	22.4	2
Family members	37	19.3	3
Media : TV	12	6.3	5
Radio	26	13.5	4
Newsprint	8	4.2	6
Contact with extension worker	0	0	7

Adaptation strategies of water yam farmers

Table 3 shows various indigenous practices used by farmers to sustain their environment. The result in Table 3 shows that about 16.6 % of water yam farmers adapted mulching strategy, 13.4% of farmers practice intercropping, 12.1% practice crop rotation, 13% applied organic/green manure. The result showed that 10.6% of respondents carry out shifting cultivation. Similarly, the result indicated that 8.7% and 8.6% of respondents practices cover cropping and use of resistant varieties methods respectively. Table 3 added that 7.5% of the water yam farmers practices mixed farming system to boost production. A little fraction of the multiple responses of the farmers showed that only 5.8% and 3.6% of the respondents practiced bush fallow and minimum tillage system respectively.

Table 3: Adaptation strategies of water yam farmers

Variables	Frequency*	Percentage
Minimum tillage	28	3.6
Crop rotation	95	12.1
Mulching	130	16.6
Inter-cropping	105	13.4
Shifting cultivation	83	10.6
Cover-cropping	68	8.7
Bush fallowing	45	5.8
Use of resistant varieties	67	8.6
Mixed farming	59	7.5
Organic/green manure	102	13.0
Total	782	100.0

**Multiple responses*

Regression result of socio-economic factors affecting water yam production technologies adaption

The multiple regression analysis was used to determine the factors affecting water yam production technologies adaptation. Different forms of the regression were used such as the linear, Cobb-Douglas, exponential and semi log function. Cobb-Douglas had the best fit and was chosen as lead for the discussion based on the economic and statistical criteria i.e a priori expectations, number of significant variables and R-square value. The result in Table 4 revealed that the coefficient of multiple determinations (R^2) was 0.736 which implies that about 74% of the variability in output of water yam was accounted for by the independent variables in the model. The result indicated that Farm size had a positive coefficient (0.046) and significant at 5% probability level. This implied that one percent increase the farm size will lead to a corresponding increase in the output of water yam production. The result revealed that the coefficient of age (0.513) was positive and significant at 5% level of probability. The implies that one percent increase in age of farmers will lead to corresponding increase in the output of water yam production because experience goes with number of years that evolves round age. This agrees with Kainga and Seiyabo (2012) on a study on plantain production in Bayelsa State. The coefficient of family size (0.274) was positive and significant at 5% probability level. This entails that an increase in family size result to an increase in the production of water yam in the study area. This support Onu (2005) work on factors influencing farmers adoption of alley farming technology in Imo State.

Table 4: Socio-economic factors affecting water yam production

Variables	Estimated parameters	Coefficients	Standard errors	T-values	Significant levels
Constant	X_0	2.535	0.241	10.519	0.000
Labour supply	X_1	0.043	0.136	0.523	0.316
Farm size	X_2	0.046	0.022	2.091	0.041**
Education	X_3	0.948	0.365	2.597	0.000
Access to credit	X_4	0.057	0.032	1.781	0.084
Age	X_5	0.513	0.228	2.250	0.035**
Family size	X_6	0.274	0.140	1.957	0.052**

Diagnostics Statistics: $R^2 = 0.736$, F-value = 45.23, **Significant @ 0.05

Constraints militating against water yam farmers

The result in Table 5 showed the constraints faced by water yam farmers. The major constraint was lack of credit facilities that ranked 1st, followed by the problem of lack of capital. This was closely followed by pest and diseases and fertilizer amid others.

Table 5: Constraints of water yam production

Constraints	Frequency	Percentage	Rank
Lack of credit facilities	86	20.0	1st
Lack of capital	67	15.6	2nd
Pest and diseases	60	14.0	3rd
fertilizer	55	12.8	4th
High cost of inputs	52	12.1	5th
High cost of transportation	45	10.5	6th
Lack of storage facilities	40	9.3	7th
Lack of processing facilities	25	5.8	8th
Total	430	100.0	

Multiple Responses

Conclusion and recommendations

The result of the study showed that majority of the water yam farmers are females. The major sources of information to farmers to enable them easily adapt the strategies effectively and efficiently were through co-farmers, friends and family members. The water yam farmers in the study area adapted different farming practices at various degrees but chiefly used practice was the mulching. The R^2 value of 0.736 of the regression result showed there was 74% variation in output of water yam which was accounted for by the explanatory variables in the model. The production problems encountered by the farmers were lack of credit facilities, lack of capital, pest and disease. It is recommended that government should from time to time provide fund to water yam farmers to boost production. The men folks should be encouraged by all means to involve in water yam production otherwise it might at the long run go to extinction since water yam production is laborious which need strength.

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