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Adoption of Yam Minisett Technique by Small Scale Farmers in Taraba State, Nigeria

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ABSTRACT

A farm management survey on the adoption of yam minisett technique by small scale farmers in Taraba state, Nigeria was conducted in 2013. The minisett technology which was developed in 1982 by National Root Crop Research Institute Umudike to address the problem of access to quality seed yam and improved productivity of yam farmers appears not to have been adopted by farmers in Taraba state despite the inadequate supply and exorbitant cost of quality yam seeds in Nigeria. This study examined the level of awareness and factors that influence adoption of yam minisett technology package in Taraba State. Data for the study were obtained from a field survey of 150 yam farmers using multistage simple random sampling technique. Descriptive statistics and probit regression model was used to analyze the data. Results showed that only about 37% of the respondents were aware of the yam minisett technique while only about 30% adopted the technique. About 7% of the respondents who were aware of the technique refused to adopt it due to the following reasons: poor and non-uniform` germination of setts and size of seed yam produced which was said to be small; high labour requirement and poor assess to production inputs and technical information on minisetts technology. The results of probit regression shows that educational status of respondent (X_2), access to credit (X_5), number of extension contact (X_6) and membership of cooperative society (X_7) are positive and statistically significant($P < 0.05$). This implies that these variables significantly influence farmer's likelihood to adopt yam minisetts technology. Farming experience (X_3) and household size (X_4) are negative but significant ($P < 0.05$). This implies that more experienced small scale famers tend not to adopt yam minisetts technique. To realize the full potentials of yam minisett technology package in this state, the researcher's need to address the issues

identified in this study with regards to size of seed yam produced and non-uniform germination of minisetts. Farmers' practices should be integrated into the technology package while Taraba State Agricultural Development Programme should disseminate relevant and appropriate agricultural extension information geared towards creating awareness and adoption of Yam minisett technique and provide access to necessary yam production inputs for easy adoption of this innovation with the aim of boosting food security in Taraba State and Nigeria at large.

Keywords: Small Scale farmers, Yam minisett, Adoption

INTRODUCTION

The Agricultural sector has always been an important component of Nigerian economy with over 70% of the population engage in agriculture and agricultural related activities. The sector is almost entirely dominated by small scale farmers living in rural areas, with farm holdings of 1-2 hectares, which are usually scattered over a wide area. The farms dominated by these small scale farmers are responsible for about 95% of the total production. In addition, small scale farmers till date suffered from limited access to credit facilities, modern agricultural technologies, farm input and inefficient use of resources (Izekor & Olomese, 2010). Agriculture has played and will continue to play a key role in the Nigerian economy. The sector holds the key to rapid economic transformation, poverty alleviation, stable democracy and good governance. National security cannot be actualized without food security. Though, Nigeria is still a net importer of food, she provides nearly all the staple food consumed by the Nigerian population and exports substantial quantities of food especially to the Economic Community of West Africa States (ECOWAS) sub-region (Donye,Gwary, Nuhu and Zhintswen, 2012). The geography of Nigerian development shows that the country has enormous natural and human resources for the attainment of food security. The land area of the country is about 923,770km square, while the population is over 140 million (NPC, 2006). The dependent population consists of 41.5 percent, with the age bracket of 0-16 years and 70 years and above indicating that the burden of providing for the entire population is borne by about 60% of the country's population. In Nigeria, the production of food is largely small scaled rural based and it is a function of environmental factors. Food production in the country is also an agricultural issue in terms of development policies. Job and Felix (2012) observed that, over the years, the various government of the country has enunciated and implemented a myriad of agricultural policies and programmes so as to stimulate

the sustainable growth and development of agricultural sector. Till date, the achievement of these remains a subject of discussion both at the public and private forum. Most of the relevant technologies in agricultural production such as yam minisett technology have not yet become a significant seed multiplication technology in this sector. Technological innovation in Nigeria is still rudimentary with low level of adoption resulting to low agricultural production.

Yams (*Dioscorea*species) are annual root tuber-bearing plants with more than 600 species out of which six are socially and economically important in terms of food, cash and medicine (IITA, 2009). Some of its species are water yam (*Dioscoreaalata)*, white yam (*Dioscorearotundata*) and yellow yam (*Dioscoreacayanensis)* (FAO, 1998; Ike and Inoni, 2006; Zaknayiba and Tanko, 2013). Yam as a staple food crop is grown in tropical regions (Thouvenel and Fauquet, 1979) and mostly produced in the savannah region of West Africa, where rainfalls are divided into wet and dry seasons (FAO, 1998). Yams are the fifth most harvested crops in Nigeria, following after cassava, maize, guinea corn, and Beans/cowpeas. More so, after cassava, yams are the most commonly harvested tuber crops in the country (NBS, 2012).Yam plays significant role in the social-cultural and economic wellbeing of thousands of people in Taraba state and elsewhere in West African sub region. Yam is among the major cash and most consumed food crops in West African countrieslike Nigeria (Babaleye, 2003; NBS, 2012). Its production is profitable despite high costs of production and price fluctuations in the markets (IITA, 2013; Izekor and Olumese, 2010). An average profit per seed yam, after harvest and storage, was calculated at over US$13, 000 per hectare harvested, and over 60% of people grow yams as a primary source of livelihood in Nigeria (IITA, 2013).Nutritionally, yam is an essential source of carbohydrates for the consumers, especially in the tropical and subtropical regions (Coursey, 1967). Many yam belt areas in Nigeria continuously proclaimed "yam is food and food is yam" (Maikasuwa and Ala, 2013). Despite the importance of yams to people and as a source of food security, the attention to yam production is still questionable, as many rural dwellers are still living in hunger in Nigeria. Yam productionhas gone some dramatic changes in many parts of the world. However, production process from bush clearing, cultivation, planting, chemical application, harvesting and marketing is still labour intensive (Ennin, Otoo and Tetteh, 2009). Maximum food production and availability is threatened where inputs are used inefficiently (Udoh and Etim, 2007). Annual statistical data available from FAO (2014) shows that the area harvested in the world has increased from 1.15 million (Ha) in 1961 to 5.04 million (Ha) in 2012. Yield in the world also increased from 72.35 thousand metric tons in 1961 to 116.65

thousand metric tons in 2012. Over 58.8 million tons of yams were produced in the world in 2012, out of which 92.2% were from West Africa.

Nigeria remain the major producer of yam in the world with about 71- 75% of the world output followed by Ghana, Cote d' Ivoire, Benin and Togo. Annual production of yam in the country is estimated at 26.587 million metric tons (FAO, 2006). Yam has some inherent characteristics, which make it attractive, first, it has a multiplicity of end use and it is eaten boiled, fried or roasted. The boiled one can be pounded into variety of dishes. Secondly, it is available all year round making it preferable to other seasonal crops. Yam also plays vital roles in traditional culture, as well as local commerce of the African people (Hahns *et al.*, 1993). However, yam production is often hampered by high cost of production and unavailability of yam seed. (Okoro, 2008). Yam planting materials account for about 50% of the cost of production and Up to 33% of yams which can be used to feed people are kept for planting (Nweka *et al.* 1991). In Nigeria yam is becoming more expensive and relatively unaffordable in urban areas, as production has not kept pace with population leading to demand exceeding supply. This is because increased production of yam is believed to be constrained mostly by high cost of seed yam (Jonathan & Anthony, 2012). The National Root Crop Research Institute (NRCRI) in association with the International Institute for Tropical Agriculture (IITA) developed the yam minisett technique in 1982 as a means of rapid multiplication of seed yams to reduce inadequate supply of high quality and disease free seed yams. The technique involves the use of about 25g cut set to produce whole tubers of about 100g that serve as yam seed. In addition to the development of minisetts technology, complementary management practices have been developed to form the minisetts technology package. The minisetts technology package has been disseminated to farmers in Nigeria for adoption since 1982

In Taraba state yam is produced mostly by the Tiv ethnic group in Wukari, Ibi, Takum, Donga, Gassol and Bali local government areas and the Mumuye people of Zing and Yorro local government. The major yam markets in the state are found in "*Wukari, Zing, Mutum - Biyu and Mai-hura"* where buying and selling of yam tubers and planting materials take place. Despite the importance of yam venture especially, in terms of revenue generation, food security and employment to Taraba state popularly known as 'natures gift to the nation, "the cost of yam production in state is becoming so high due to the exorbitant cost of planting materials in recent times due to high demand and low supply and the general inflationary trend in the country. Perhaps, the adoption of yam minisett technique by small scale farmers in the area will solve the problem of scarcity

of planting material and will allow small scale farmers the opportunity to produce yam of uniform sizes. In addition, it will help to lower the cost of production and also reduces the cost of controlling pest and disease since it makes use of healthy yams from sanitized sources. This study was carried out to investigate adoption of yam minisetts technique by small scale farmers and how the farmer's factors affect the adoption of recommended practices for yam production in Taraba state which has not been sufficiently investigated. The study is indeed a breakthrough to increased understanding of adoption behaviour of yam farmers which allow agricultural policy makers to make decisive decisions that will stimulate adoption of yam minisetts technique as a viable step to yam seed multiplication in Nigeria.

RESEARCH QUESTIONS

The questions that the study answered center on understanding the adoption behaviour of yam farmers with regards to yam minisetts production technology.

These questions include:-

i. What is the level of awareness and adoption of yam minisetts technology?
ii. What factors significantly influence the adoption?
iii. What is the nature of acceptance of the complementary technology associated with yam minisett technology?

MATERIALS AND METHODS

The study was conducted in Taraba State of Nigeria. The State had a population of about 2,300,736 people as at 2006 (NPC 2006). It has 16 Local Government Areas and one Special Development Area. It is divided into three Senatorial Districts: North, South and Central. It lies between latitudes 6° 30'N and 8^0 30'N of the Equator and between longitudes 9^0 and 12^0 E of the Greenwich Meridian with a land mass of 54,426 km2 (Oruonye and Bashir 2011). Taraba State shares boundaries with Bauchi and Gombe States in the North, Adamawa State in the East and Republic of Cameroun in the South and Nasarawa and Benue States in the South-West. It has a tropical wet and dry seasons, well drained alluvial soils and characterized by both savannah and temperate vegetation. Its dry season lasts for a minimum of five months (November to March) while the wet season spans early March to late November in the south and early April to November in the north. The mean annual rainfall ranges from 1000mm in the northern part to over 1800mm in the extreme southern part and Mambila area (Oruonyeand Bashir 2011)

Multistage, purposive and simple random sampling techniques were adopted in sampling the respondents. In the first stage, six Local Government Areas were purposively picked because they were high yam-producing areas with large volumes of yam marketing activities. These Local Government Areas were: Yorro and Zing in the northern zone, Bali and Gassolin the central zone and Ibi and Wukari in the southern zone, and. In the second stage, five villages were randomly selected from the lists of yam-producing villages in each Local Government Area, making a total number of 30 villages in the sample. In the last stage, 5 yam farmers were randomly selected from each of the sampled villages making a total of 150 yam farmers. Data used for this study were from primary sources. The relevant primary data were obtained through a yam farm management survey of small scale yam farmers in the state conducted between March and May, 2013 by experienced Taraba State Agricultural Development Project's (TADP) Extension Agents (EAs) in the selected Local Government Areas. The list of yam farmers prepared during survey visit to the selected villages served as sampling frame for the study.

Adoption Index Used in the Study

In this study, the package approach to technology adoption as used by Daramola (1987); Rahji, (2006) and Lawal *et al*(2014) was adopted. As a result an index that quantifies the adoption level of the recommended technique of the innovation is required. This is used to measure the relative contribution of each component to output. The components are ranked and the ranking are used to develop the adoption index of the farmer. The minisett technology consists of using healthy whole yams to produce "clean" seeds within a gestation period of 6-7 months. Nursery will be established where yam minisett of about 25g will be planted. Minisetts seed yams should be treated with aldrin dust to prevent effect of soil pest and diseases. Planting commenced in May and yam minisett will be harvested in November and replanted on heaps75cm by 25cm in March next cropping season. Yam minisett vines are staked using trills or pyramid method. The technology recommends hand weeded nursery, application of organic fertilizers and chemical weed control in the field. The farmer have adoption index ranging from zero to one hundred. These are calculated from the components of Yam minisett production technology as follows: pre-planting of yam minisetts (25g) in the nursery (35%); this is the main component in this technology. Yam setts dressed with Aldrin dust in the nursery (5%), hand weeding in nursery (5%), field planting on heaps 75cm by 25cm in March next year (15%), staking using trills or pyramid method (20%), use of fertilizers (10%), use of agrochemicals: herbicide in the field (10%). The adoption index is equal to 1 if the yam farmers scores 60% and above hence an adoption

otherwise it is 0 implying non-adopter. This is the threshold concept that is used to categorize the yam farmers as adopters and non-adopters of yam minisett production technologies in the probit model.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Yam Farmers in Taraba state

Socioeconomic variables of yam farmers analyzed in this study include: gender, age, and educational attainment, marital status, farming experience, farm size and sources of capital. The result of the analysis as shown in Table 1 indicated that 80% were males, while only 20% were females. This means that men do most of the yam production activities than women probably due to their ownership of farmland. This is most obvious as more strenuous yam operations such as heap making are mostly done by men that are active and energetic. The educational status of the respondents indicated that 27% attended secondary school, 17% attended tertiary educational level and 23% had no formal education, a greater percentage of 33% attended primary education. Age is an important factor in labour productivity and literacy level affects adoption of technology (Adewumi and Omotesho, 2002). Majority of the respondents representing 63.% had farm size of less than or equal to 2 hectares, only about 27% had above 2 hectares, 47% had farming experience between 11 to 20 years. This therefore, reveals that the yam farmers in the study area are really small scale farmers. Ibrahim (2004) observed that small scale farmers are those that cultivate farm land not more than 2 hectares. This result is also supported by Lawal *et al* (2014) where he pointed out that a typical yam farmer is about 41 years, married, literate with about 15years' experience in yam production and cultivating about 2 hectares of land. The results show that farming is a popular occupation among the young and active men in the villages around the major yam producing areas of Taraba State. Access to formal credit facility was poor; about 79% of the respondents do not have access to formal credit facility during the survey. This result is in line with that reported by Rahji (2006), Lawal (2008), Musa Et al (2011) and Lawal *et al* (2014).

Table 1: Distribution of Respondents by Socio-Economic Characteristics (n = 150).

Variable	Frequency	Percentage
Gender		
Male	120	80
Female	30	20
Age		
21 – 30	5	3
31 – 40	20	15
41 – 50	98	65
51 – Above	25	17
Educational attainment		
Non-formal education	35	23
Primary education	50	33
Secondary education	40	27
Tertiary education	25	17
Marital status		
Married	118	79
Single	20	13
Widowed	8	5
Divorced	4	3
Yam Farming experience (years)	15	10
1 - 10	70	47
11 - 20	39	26
21 - 30	25	17
31 - Above		
Farm size (hectares)		
Less than 1	15	10
1 - 2	95	63
Above 2	40	27
Source of Credit		
No credit	70	47
Family and friends	48	32
Money lenders	0	0
Cooperative society	15	10
Community Bank	8	5
Bank of Agriculture	9	6

Source: Farm Management Survey (2013)

Yam Minisetts Technologies Awareness and Adoption Level

The survey result as shown in Table 2 indicate that awareness level of the technology is low in Taraba state for only 37% of sampled yam farmers in the study were aware of yam minisetts production technology. The farmers that adopted the technology in their farm during the survey were 30% of the sampled farmers. The finding in this study differ from that reported by Bolarinwa and Oladeji (2009) that about 70% of yam farmers adopted Yam minisetts technique in Oyo, Osun and Kwara States of Nigeria. However, the result is similar to those reported byOkoro (2008) and lawal (2014) who reported less than 30% adoption rate for yam minisetts technology.

Table 2: Level of Awareness and Adoption of Yam Minisetts Technology

Variable	Frequency	Percentage
Awareness of yam minisett technique	55	37
Adopt yam minisett technique in seed multiplication	45	30
Not aware of yam minisett technique	95	63

Source: Farm Management Survey (2013)

Yam Minisetts Technologies Adoption Characteristics

As stated under the adoption index used in this study, there are seven main components of yam minisetts technology package. The rate of adoption of these components of the package differs among the respondents. Table 3 shows the adoption characteristics of the sampled yam farmers during the survey. All the adopters' utilized field planting of yam setts and hand weeding in the nursery while the use of fertilizer and herbicide were the least adopted among the production package in yam minisett technology. Inability to adopt the use of fertilizers and herbicides may be due to the capital intensive nature of these agricultural inputs. Non-adoption of pre-planting of yam setts may be due to extra care needed in raising the nurseries and transplanting which deviate from the farmer's previous planting experience. Farmers seldom need to apply fertilizer on yam because land adjudge very fertile is used for yam production. This study corroborated with F. A .O (1997) and lawal (2014) which asserted that farmers adopted only those practices they have been familiar with and which are in line with existing farm practices. Small plot adoption technique by Taraba State Agricultural Development Programme Extension services may create a positive adoption atmosphere capable of convincing small scale farmers to adopt modern agricultural innovations in the state.

Table 3: Adoption Characteristics of Yam Minisett Package by Farmers in Taraba State.

Yam Minisett production Technologies	Adoption %
Pre- planting of yam setts (25g)	56
Treatment of yam setts with Aldrin dust	57
Hand weeding in nursery	100
Field planting at 25 cm spacing in May	100
Staking with trills or using pyramid method	55
Use of fertilizers	32
Use of herbicide	55

Source: Farm Management Survey (2013)

Reasons for Non-Use of Yam Minisetts Technology

The reasons for non-use of the yam minisetts technology by farmers is presented in Table 4 which shows that low percentage germination of setts due to rotting and dying in the nursery (82%) and small size of seed yam produced through the technique (73%) are the two most important during the survey in Taraba State. Onwueme (1982) attributed the rotting and drying up of setts to the problem of apical dominance in tubers. He define apical dominance as a phenomenon whereby tubers sprout first from the head region whether in whole tuber or cut setts, followed by the middle portion and lastly from the tail region, due to greater concentration of the hormones which promote sprouting on the head region. This results in non-uniform sprouting of setts from various portions of the tuber as reported by farmers during the farm management survey. This result is similar to those reported by Okoro (2008) and Lawal (2014) on the reasons for non-use of Yam minisetts technique in Oyo, Osun and Kwara States of Nigeria.

The researchers should go back to the field to find a solution to this problem if this promising technique will be completely accepted and adopted by farmers in Taraba state. More efforts should be geared towards accelerating the dissemination of the technology throughout the yam belt of Nigeria. Both the print and electronic media should be mobilized to disseminate the technical details of the technique to supplement the efforts of Extension agents. Nahanga and Vera (2014).suggested specialized training programme for farmers. Awareness creation through mass media, strategic technology campaign programmes as well as regular field days/agricultural shows or the combination of a selected number of these strategies would necessarily become useful in increasing technology adoption by the farmers.

Table 4: Major Reason for Non-Use of Yam Minisetts Technology by Farmers that are Aware of the Technology in Taraba State

Reason for Non-Use	Percentage (%) N= 55
Low germination of setts	82
Too small seed yam produced	73
Labour intensive	65
Poor access to production inputs – agrochemicals, fund,	55
Ignorance of technical details	47

Source: Farm Management Survey (2013)

Factors Affecting Adoption of Yam Minisetts Production Technology in the Study Area

Table 5 shows the probit regression model estimates of the likelihood influence of farm size, education status of respondent, farming experience, household size, access to credit, and number of extension contacts as well as membership of cooperative society on adoption of yam minisetts production technique among sampled yam farmers during the study. The results indicate a chi-square value of 144.57 for the estimated model. This implies a good fit for the regression model used for the analysis. The coefficient of the probit regression model shows that educational status of respondent (X_2), access to credit (X_5), number of extension contact (X_6) and membership of cooperative society (X_7), were positive and statistically significant at different levels. This implies that these variables significantly influence farmers likelihood to adopt yam minisetts technology, that is farmers that are educated who are members of an association with access to credit and extension services are more likely to adopt the minisett technology. Yam farming experience (X_3) and household size (X_4) are negative but significant ($P < 0.05$). This implies that more experience famers with large household size tend not to adopt yam minisetts production technology because it is different from the farming practice they are familiar with. FAO (1997) asserted that farmers adopted only those practices they have been familiar with and which are in line with existing practices. This results support the findings of Bolarinwa and Oladeji (2009) and *Lawal (2014) who* reported similar trend in their work on adoption of yam minisetts technologies.

Table 4: Probit Regression Estimates of Factors Influencing Farmers Likelihood to Adopt Yam Minisetts Technology

Variable	Regression Coefficient	Standard Error (SE)	Coefficient/(SE) (F – Value)
Farm size (x_1)	0.328	0.302	1.085
Highest educational attainment (x_2)	0.645**	0.298	2.161
Yam farming experience (x_3)	-0.767**	0.389	1.971
Household size (x_4)	-0.546**	0.214	2.214
Access to credit (x_5)	0.468**	0.209	2.239
Number of Agricultural extension visit (x_6)	0.841**	0.361	2.330
Membership of Cooperative society (X_7)	1.605***	0.465	3.452
Intercept	1.968**	0.990	1.987
Chi-square	114.675***	2.824	139.169

***** Implies significant at 1%; ** Implies significant at 5%**
Source: Analysis of farm management survey data (2013).

CONCLUSION AND RECOMMENDATION

The study assessed the level of awareness and adoption of yam minisetts and its complementary techniques among yam farmers in Taraba state after about 31 years since the introduction of the yam seed multiplication technology. The result reveals that about 37% of yam farmers in the Study area were aware of the yam minisetts technique while only 30% adopted the technology on their farms during the survey. Compliance with the recommended production techniques also varied among the adopters, they only adopted those parts of the technology they are familiar with on their yam farms. The low level of adoption of minisetts and its complementary technology was shown to be primarily due to poor and non-uniform germination of setts and size of seed yam produced which was said to be small; high labour requirement and poor assess to production inputs and Agricultural extension information on yam minisetts technology in Taraba state. The result of this study shows that there is need for a reappraisal of the yam minisetts technology package for it to be attractive to yam farmers in Taraba state. Therefore, to realize the full potentials of yam minisett technology package in this state, the researcher's need to address the issues identified in this study with regards so size of seed yam produced and non-uniform germination of minisetts. Farmers' practices should be integrated into the technology package while Taraba State Agricultural Development Programme should disseminate relevant and appropriate agricultural extension

information geared towards creating awareness and adoption of Yam minisett technique and provide access to necessary yam production inputs for easy of adoption of this innovation with the aim of boosting food security in Taraba state and Nigeria at large.

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