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Factors Influencing Adoption of Improved Sweet Potato Technology in Kwara State

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Abstract
This study analysed factors influencing the adoption of improved sweet potato technology in Kwara State, Nigeria. Purposive sampling was used to select four villages that have been dedicatedly involved in sweet potato production for a period 5 years. Data were gathered through the administration of interview schedule to 20 randomly selected potato farmers from each of the 4 villages given a sample frame of 80 farmers. Descriptive statistics such as frequency counts, percentages, means and standard deviation were used to analyse the results of the study. Results revealed that majority of the respondents were in their middle age (42.5%) 41-50 years; 66.3% were male, 90% were married, 51.3% have no formal education. While 75% have farming as their primary occupation. The level of constraints faced by extension agents in meeting training needs due to poor extension contact had the highest mean value of 2.30 with standard deviation of 0.74. Chi-square result revealed that educational level, land tenure system, membership of cooperative society and contact with extension agents have X^2 value of 11.309, 15.235, 7.182 and 19.445 respectively and all significant determinants of adoption of improved production technology of sweet potato at $p< 0.05$. On the basis of these findings, it is recommended that improved extension contacts will boost farmers' understanding of the innovation as well as their decision to adopt.

Key words: Sweet potato, Improved technology, Adoption

Introduction
The emphasis on the contribution of maize, rice, soyabeans and wheat in solving the problem of food insecurity has made these crops very conspicuous in the world food security discourse. The vantage position occupied by these crops has not only placed them in the front burner of crop research activities but has made them targets of international research investments (Shiferaw *et al.* 2013). However, food security status depicted by heavy reliance on a limited agricultural biological diversity will undermine optimising potential for diversification presented by plant gene pool and thereby depleting options available to breeders in the natural ecosystem. Therefore a broadened cropping and food production to include pulses, oilseeds, roots and tubers will enhance sustainability of food security status and a robustness that captures local perspectives exhibited in the local context uniqueness of some food crops to food security. Sanginga (2015) reported that root and tuber crops namely yam, cassava, potato and sweet potato are major staples in Africa whose aggregate production value exceed all other African staple crops; higher than that of cereals and adaptable in varied agro-ecologies and production systems that range from highland densely populated regions to flood or drought-prone lowland areas. This versatility implied in their broader agro-ecological adaptation has positioned them to address food security for millions of people in Africa.

In addition to being drought tolerant and adaptable to a wide range of the ecology, sweet potato has a short maturity period of 3 to 5 months which makes it

suitable for multiple cropping that makes continuous food availability and accessibility (Agili *et al,* 2012). The use of its vine, a non-edible part of the crop for its propagation and its low input requirement on even degraded soils make it very easy for poor resource farmers to grow(Akoroda, *et al*. 2008; Motsa, *et al*. 2014; Sanginga and Mbabu 2015). Once established, sweet potatoes can continually produce adequately year in year out with just minimal care. It is highly nutritive and it supersedes most carbohydrate foods in vitamins, minerals, dietary fibre and protein contents. It contains vitamin A rich in beta-carotene. Therefore, it is a cheaper and rich source of vitamin A for children, pregnant and lactating women especially among the rural poor (Odebode, *et al.* 2008). These inherent nutrition and health potentials in sweet potato comfortably place it as a crop that can help address food insecurity and reduce poverty which is almost endemic in sub-Saharan Africa (Mwakanyamale *et al.* 2015).

Internationally funded research programmes on roots and tubers with focus also on sweet potato is on a steady growth in Africa with efforts channeled towards genetic enhancement, seed systems, production, marketing and nutrition impacts. In Nigeria, the National Root Crops Research Institute (NRCRI) Umudike, developed several improved sweet potato lines with greater root yield and disease resistance potentials as well as significant amounts of beta-carotene (Akoroda *et al.* 2007). These research approaches targeted at improving production technologies used by smallholder farmers were evaluated by exposing farmers to new varieties of sweet potatoes and other improved production packages. This is premised on the fact that encouraging small scale sweet potato farmers to adopt the use of improved cultivars and production technologies will boost sweet potato production and enhance food security especially among the rural people. Azimuddin *et al.* (2009) opined that producing and consuming more potatoes could make up for the food insecurity that can arise from shortage in rice production.

Although, agricultural technology adoption study has vital implications in agricultural development. Nevertheless the adoption of innovations by smallholder farmers in Africa has always come with some tradeoffs especially as farmers' input are either not harvested or integrated into the development of technology package meant for them. Rogers (1995) demonstrated that adoption of technologies depends on their characteristics: compatibility with the existing values and norms, complexity of the innovation, observability of the edges the new innovation has over the old practice, the degree to which it can be broken into adoptable units and its relative advantage over other existing practice. Nmadu *et al.* (2015) also submitted that innovation uptake is a function of the capacity of the user to access innovation and utilise it. This capacity, predicated on some cultural, socio-economic, personal, political and geographical variables is predicted by the relevance of the information, the reliability of the information channel, and the integrity of the information provider. Therefore, farmers' innovation adoption decisions are guided by perceptions borne out of their subjective evaluation of the disseminated innovations. Farmers make choices of what to grow and which technologies to adopt with the goal to maximise their

expected utility. Mwanga and Ssemakula, (2011) reported farmers' choice of improved sweet potato cultivars to propagate as a product of their experience, technical knowledge, educational level, and contact with researchers, extension agents and fellow farmers. It is noteworthy therefore that boosting innovation adoption among farmers and particularly sweet potato improved production technology as addressed by this study, goes beyond enhancing farmers' understanding of the importance of new varieties and improved production technologies but also doing a thorough analysis of factors that informed their innovation adoption decisions. It is therefore against this backdrop that this study seeks to understand factors affecting the adoption of sweet potato technology in Kwara State. The purpose of this study was to:

Describe the socio-economic characteristics of sweet potato farmers in the study area.

Identify the constraints faced by sweet-potato farmers that limit the adoption of improved sweet-potato production technologies in the study area.

Assess the factors that determine adoption of improved sweet-potato production technologies by sweet-potato farmers in the study area

Materials and Methods

Irepodun Local Government Area, one of the sixteen Local Government Areas in Kwara State, is the study area. It has it's headquarter at Omu-Aran. Irepodun local government area is located between latitude 8.1393° N, and longitude 4.8174° E. It has an area of 737 km² and a population of 2,742,093 (NBS, 2011). It has about 247,975 farm families and 254,242 hectares of cropped area. The rainfall pattern extends between the months of April and October every year. It has a minimum temperature that ranges from 21.1°C to 25°C and maximum average temperature that ranges from 30°C to 35°C. The main crops grown are sweet potato, cassava, yam, cowpea, groundnut, maize, sorghum, wheat, melon, okra, pepper and some leafy vegetables (KWADP, 2006). The local government has a number of educational institutions, primary and secondary schools established by Kwara State government and private individuals. A privately owned University, Landmark University is also located in OmuAran, the local government headquarter.

Irepodun local government area parades a number of tourist centres notable among them is the Esie museum. The museum established in 1945, was the first in Nigeria. It once housed over one thousand tombstone figures or images representing human beings. It is reputed to have the largest collection of soapstone images in the world. The Esie museum has been the center of religious activities and hosts a festival in the month of April every year. It is a mountainous region with very special and significant rock formations that were thought to have been used by the Yoruba in ancient warfare. Folktales also talk about gods and men with superhuman strength and abilities who fought for the people. Irepodun local government is populated by the Igbomina people.

Instrument for data collection

An interview schedule, administered by trained enumerators from the Kwara State Agricultural Development Programme was the instrument used for data collection. The instrument was divided into sections, the

first section which dwelled on the personal characteristics of the respondents, elicited information on their age, sex, educational status, years of farming experience, and contact with extension agent. Age was measured in years, sex as male or female, educational status was measured as the highest certificate obtained, farming experience as the number of years spent in farming while contact with extension agent was measured using a dummy variable, if they have had contact with extension agent scored 2 and no contact score 1. Adoption of improved sweet potato technology was measured using the five point adoption model of awareness, interest, evaluation, trial, and adoption (AIETA). Awareness was scored 1, Interest was scored 2, Evaluation was scored 3,Trial was scored 4, while Adoption was assigned the score of 5. The responses of the extension personnel on a list of possible constraints was measured on a three point scale of major constraint, assigned the score of 3, minor constraint, assigned 2, and not a constraint, assigned 1. The mean score is 1.67.

Data were analyzed using descriptive statistics such as frequency counts, percentages, means and standard deviation. Chi square analysis was used to test the relationship between some selected socio economic characteristics and training needs of respondents.

Results and Discussion

Population of the study and sampling procedure

The population of the study area is sweet potato farmers actively involved in sweet potato production in the selected villages who were introduced to improved technologies in sweet potato production about five years ago, these villages were: Agbamu, Araromi, Falokun, and Owode. Twenty farmers were randomly selected from each of selected villages to give a sample size of eighty farmers.

Personal and socio economic characteristics of respondents

Table I shows that 42.5% of the respondents fall within the age bracket of 41-50years. About 25% of the respondents are between 31-40 years of age while 20% are between ages 51-60 years. About 6.25% of the respondents fall between 20-30 years old and 61 years old and above. This age distribution revealed that majority of the respondent are still in their mid-age an implication that more young people are now into agriculture. These young people are opened to new ideas, with a wide embrace of agricultural innovations disseminated to them. This is corroborated by the findings of Ironkwe *et al*. (2016) which reported that majority of the respondents in a study on adoption of root and tubers technologies were between age 41-50 years old, an economic and productive age that can facilitate adoption of technologies. Chikezie *et al.* (2012) also reported that the relatively young age of respondents in a study on cassava adoption affect their receptivity of innovations. The pocket of respondents in age categories of 51-60 and 61 years and above also revealed that a good number of older farmers are still responsive to improved technology in agriculture contrary to the sweeping generalization about them that they have most times formed ideas that are too rigid to change. This is supported by the findings of Mignouna *et al.* (2011) that older farmers by reasons of their age are mature and will appreciate and evaluate technologies better than younger farmers which can be a precursor to technology adoption.

Table 1: Socio- economic characteristics of the farmers

Variable	Frequency	Percentage
Age		
20-30	5	6.25
31-40	20	25
41-50	34	42.5
51-60	16	20
61 and above	5	6.25
Sex		
Male	53	66.3
Female	27	33.7
Marital Status		
Single	06	7.5
Married	72	90
Widowed	2	2.5
Educational Level		
Non formal education	41	51.3
Primary education	18	22.5
Secondary education	5	6.2
Tertiary institutions	16	20
Primary Occupation		
Farming	52	65
Trading	28	35
Land Ownership		
Inheritance	21	26.3
Purchase	58	72.5
Lease	1	1.2
Farm Experience		
1-10	19	23.8
11-20	36	45
21-30	20	25
Non respons	5	6.2
Extension Contact		
Yes		
No	36	45
	44	55

Source: Field survey 2017

It is also revealed in Table 1 that 66.3% of the respondents are male while the remaining 33.7% are female. This distribution in the sex of respondents indicated that more male farmers are involved in sweet potato production in the study area. A good percentage of female farmers were also involved in the production of sweet potato in the study area. This distribution is a reflection of the usual distribution of male and female participation in agriculture. Agricultural enterprise as practiced in most developing countries, Nigeria inclusive is still typically traditional with bulk of the activities done with simple farm tools and crude implement. This is always characterized by the usual drudgery that attends the use of crude implements mostly used in the practice of this type of agriculture. Moreover female, by most traditions and culture have limited access to productive resources especially land, which can hamper their willingness to participate in agriculture. Nmadu *et al.* (2015) reported male domination in cocoa farming in Ondo State of Nigeria.

Table 1 also shows that 90% of the respondents are married while 7.5% of them are single. This implies that majority of the respondents are breadwinners who will want to adopt innovation to boost production so as to meet up with the demand of meeting the food needs of their families. Adopting innovation by these categories of farmers will further boost their production which can increase their income through sales of produce. The family members can serve as source of cheap labour whose demand can be heightened due to increased activities borne out of the adoption of innovation in sweet potato production. Nmadu *et al*. (2015) in a study on socioeconomic factors influencing cocoa production opined that the large percentage of married respondents indicated that more members of farm family may be available for production. Having a family mean more mouth to feed and adoption of innovation implied improved production and the attendant food security. Bawa *et al.*(2015) observed that married people frequently seek information about improved agricultural innovations/technologies so as to enhance the welfare of their families.

It is revealed in Table 1 that 51.3% of the respondents have no formal education, 22.5% have primary school education, and 20% had tertiary education while 6.2% had secondary school education. This distribution showed that majority of the respondents were not educated, however education was a major determinant of adoption of improved production technologies in sweet potato in the area. It should be noted that the young age of the majority of the respondents might also have positively predisposed them to adoption despite the lack of formal education by many of them. Amos (2007) observed that young cocoa farmers are more receptive than the older ones in innovation uptake, because older farmers are not always ready to part with the old techniques for new ones. Technology adoption is a social process, and adoption decisions are not just taken based on farmers' assessment of the qualities of innovations but on the subjective assessments of the innovations by their peers. It is therefore probable that the adoption decisions of the educated farmers influenced their illiterate counterpart's decision to adopt innovation. This is in line with the submission of Agbamu (2006) that educated people handle any task with higher degree of

dexterity and have higher propensity for improved technology uptake than their uneducated counterparts.

It is also revealed in table 1, that 75% of the respondents have farming as their primary occupation, 21.7% have teaching as their primary occupation, while 3.3% have trading as their primary occupation. This distribution revealed that majority of the respondent have farming as their primary occupation. This indicated that farming is the major occupation in rural area. It is very clear that innovations that will boost production will be embraced because that will improve the well-being of the respondents. However, respondents in other professions may be members of the community who practice farming on a part time basis, or as a hobby. Nevertheless their professional backgrounds are good platforms that will encourage innovation adoptions, the teachers among them have the needed literacy that can enhance understanding and adoption of improved technology why the traders may be favourably disposed to embracing innovations that can make more agricultural produce available for sale.

It was also observed that 45% of the respondents have 11-20 years of farming experience, 25% have between 21-30 years of farming experience, and 23.8% have been in farming between 10-20 years. This distribution shows that the majority of the respondents are not new entrants into farming, but have had many years of farming experience. Their many years of interactions with the farming environment, might have translated into familiarity with improved knowledge of growth performance of crops, common challenges and approaches to yield may enhance their adoption decision process. Also the attendant impacts of past innovations adopted, experienced over the years may be a profitable platform for a new innovation adoption decision. Moreover, farming to them can be said to be a way of life borne out of their many years of experience, which may make them to be less risk aversive and therefore be willing to invest into farming by way of innovation adoption to further boost their production. Chikezie *et al*. (2012) reported that longer years of farming experience enhances sound decisions in resource allocation and management which in turn facilitates adoption of innovation of improved cassava production technology.

It is also revealed in Table 1 that 45% of the respondents reported that they have contact with extension agents while 55% of the respondent did not have contact with extension agents. This distribution may be as a result of the existing disproportionate extension agents to farmers' ratio, due to inadequate extension agents in the employment of ministry of agriculture and other sister agencies. It may also be as a result of the farmer to farmer information dissemination strategy which extension agents leveraged on to get innovation disseminated to farmers, especially with the use of local leaders which may not involve having to bring farmer in direct contact with extension agents.

One of the objectives of this study was to determine constraints faced by respondents in the adoption of improved sweet potato. Responses of the respondents on the listed constraints were measured on a three point scale to which scores that range from1-3 was assigned. The mean values and standard deviations, with the rankings of their responses are presented in Table 3. Constraint with the highest mean value of

2.30 and standard deviation of 0.74 indicated poor extension contact ranked 1st by respondents. Pests and diseases infestation with a mean value of 2.13 and a standard deviation of 0.49 ranked 2nd on the list of constraints. Poor access to inputs with a mean value of 2.01 and a standard deviation of 0.46 ranked 3rd. Poor storage facility with a mean of 1.99 and a standard deviation of 0.41ranked 4th on the list, land tenure problem with a mean score of 1.64 and a standard deviation of 0.58 ranked 5th, while poor access to credit which ranked 6th on the list has a mean score of 1.66 and a standard deviation of 0.53. Poor extension contact which ranked first on the list of constraints reported by the farmers may be due to the dearth of extension agents. This may be as a result of poor funding of extension agencies particularly the dwindled funding witnessed by the Agricultural Development Project after the withdrawal of the World Bank support, and the present economic recession in the country, which made government to place embargo on employment (World Bank, 2003).The few extension agents available have problem of logistics which hindered them from making regular contacts with these farmers. Pests and diseases infestation ranked second on the list of constraints. This may be borne out of poor agronomic practices still engaged in by farmers, and the incidence of climate change which made pests and diseases very prevalent. Poor access to input which came third on the list of constraints being faced by the farmers may be due to high cost of inputs and the non -availability of these inputs especially the case of fertilizer which due to the diversion of allocation meant to be distributed to the farmers have made the commodity not to be available for farmers' use. And where they are accessed they are sold at very exorbitant prices which most times, are beyond the reach of an average farmer. Poor storage facility ranked fourth on the list of constraints faced by the farmers, this may be due to the short shelve life of sweet potato and the non-availability of modern storage methods. Most farmers still use poor storage methods which may not guarantee storage for a long period of time. This may be as a result of farmers poor awareness of value chain addition of sweet potato, that is processing sweet potato into different products with longer shelve life. Poor access to credit ranked fifth on the list. This may be because of the stringent conditions rolled out by loaning institutions like commercial banks and other microfinance agencies, particularly as it borders on the provision of collaterals and the high interest rate charged on loans. However, access to credit not been a major constraints may be due to some social safety nets that existed among these farmers.

The result of Chi- square analysis in Table 3, revealed that educational level, land tenure system, membership of cooperative society, and contact with extension agents with X^2 value of 11.309, 15.235, 7.182 and 19.445 were all significant determinants of adoption of

Table 2: Constraints to adoption of improved sweet potato production practices by respondents

Constraints	Mean	Std.Dev.	Rank
Poor extension contact	2.30	0.74	1st
Pests and diseases	2.13	0.49	2nd
Poor access to input	2.01	0.46	3rd
Poor storage facility	1.99	0.41	4th
Land tenure problem	1.66	0.53	5th
Poor access to credit	1.64	0.58	6th
Illiteracy	1.36	0.51	7th
Poor awareness	1.34	0.50	8th
Poor technical know how	1.27	0.48	9th
Poor access to market	1.04	0.25	10th

Source: Field survey 2017

improved production technology in sweet potato at p <0.05. Literacy improves understanding of the disseminated technology and makes the farmers to better appreciate the edges the innovation has over the traditional methods. A stable and reliable tenure systems depicted by the main tenure systems in the areas, which are tenure by inheritance and purchase will enhance adoption of innovation, since residency by respondent is permanent and more secured. Contact with extension agents will definitely determine adoption because extension agents are professionally saddled with the duty of disseminating innovations in agriculture, therefore improved contacts with them will boost farmers understanding of the innovation and their decision to adopt. This is corroborated by the findings of Orebiyi, *et al* (2005) that contact with extension agents influences the adoption of innovation. Years of farming experience with X^2 value 15.053. Farmers with many years of farming experience are better positioned to appreciate better improved production technologies. Their years of experience will help them to make useful decisions on technology adoption. This is contrary to the findings of Truong and Ryuichi (2002), that experienced farmers would not want to adopt improved technology. Sex and marital status with X^2 value of 1.458 and 1.625 respectively were not significant determinants of adoption of improved sweet potato technologies. Since the technologies are tailored towards improved production, the sex of the farmer may not be a major determinant of adoption, because all farmers will definitely embrace any technology that will improve their yield.

Conclusion and Recommendation

Based on findings, the study concludes that majority of the farmers in the study area were; within their active age range between 41- 50 years, married, with farming as the primary occupation of most of them. Although majority of the farmers were not educated, nevertheless few of them had primary and secondary education. Contact with extension agents is still limited in the study area, less than half of the sampled farmers had access to extension agents. However major factors found to influence adoption of sweet potato technology among

Table 3: Relationship between selected independent variables and farmers' adoption of improved sweet potato production technology

Independent Variable	X^2	DF	P	Decision
Sex	1.4585	1	0.227	NS
Marital Status	1.6255	2	0.444	NS
Educational Level	11.3093	3	0.001	S
Land tenure system	15.235		0.000	S
Years of farming experience	15.053	5	0.001	S
Membership of cooperative Society	7.182	1	0.007	S
Contact with Extension agents	19.445	1	0.000	S

Source: Field survey, 2017

the respondents include farmers' contact with extension agents, educational level of the respondents, years of farming experience and membership of cooperative society. Constraints identified as slowing down adoption of improved technology in sweet potato production include poor access to inputs, pests and diseases and poor extension coverage.

This study therefore suggests improved extension coverage in terms of scope and quality of services rendered to farmers in the study area. Access to farm inputs should be enhanced through subsidy and proper monitoring of the supply chains to ensure farm inputs like fertilizer get to farmers and not diverted to persons not primarily meant for.

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