ADOPTION GAPS OF IMPROVED SWEET POTATO PRODUCTION TECHNOLOGY AMONG FARMERS IN EBONYI STATE, NIGERIA.

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ABSTRACT
This study examined the adoption gaps of improved sweet potato production technology among farmers in Ebonyi State, Nigeria. The state was purposively selected as it is one of the major State to which the improved sweeetpotato production technology had been disseminated. The multistage sampling technique and structured interview schedule were used as instrument for data collection. Forty-five famers were selected from each of the three agricultural zones to give a total of 135 farmers used for the study. Data generated were analyzed statistically using simple tools like percentages, adoption of technology gap index and regression analysis. Result showed that the extent of knowledge of individual practices in the improved sweetpotato production technology was 65.12% while thatof adoption was 49.81%, with adoption gap of 50.00%. Practices like pre-planting and plant protection had high knowledge values of 62.50% and 65.87% with low adoption values of 31.25% and 25.00% respectively, attributable to the complexity of the practices, their incompatibility with traditional practices as well as high cost and unavailability of require inputs. The knowledge adoption index revealed that 61.60% of knowledge gap and 10.90% adoption gap were at the low level; 25.90% knowledge gap and 26.70% adoption gap fell within the medium level, which 10.60% knowledge gap and 62.15% adoption gap fell within the high level. This implies that problems associated with the improved sweetpotato production technology were attributable to non-adoption of the entire practices in the package. Regression result showed farm size, farming experience, contact with extension membership of farmers' organization and major occupation as determinants of adoption of the improved sweetpotato production technology. The study recommended measures that ease access to land for farming purposes, intensification of extension education to farmers and increase in number of extension agents through partnership with the private sector.

Key words: Adoption gap, improved sweetpotato, production technology.

INTRODUCTION

Sweetpotato *(Ipomoea batatas* (L*) Lam*), a herbaceous, warm-weather creeping plant, belongs to the family *Convovulaceae* and genus *Ipomoea* (Woolfe, 1992). This family comprises 45 genera and 1,000 species with *Ipomoea batatas* as the only one with significant economic importance to man and animals (Woolfe, 1992). It is one of the world's most important under-exploited crops with many different uses (International Potato Centre, 1999). Currently, it ranks as the fifth most important food crop on a fresh-weight basis in developing countries after rice, wheat, maize and cassava. Annual world production is over 133 million tonnes, and average yields in many developing countries are well below 15 tonnes per hectare which in turn are far below the crop's potential (FAO, 2012). Although its centre of origin, routes and times of dispersal to some of its present locations are still in dispute, Edmond and Ammermans (1971) indicated that *Ipomoea batatas* originated from Central America and northwestern part of South America in about 3000 B.C. It arrived Nigeria between 1694 and 1698 through the early Portuguese and Spanish explorers. Sweetpotato is highly adaptable to relatively marginal soils and erratic rainfall, has high productivity per unit of land and labour and guarantees some yield even under the most adverse conditions (NRCRI, 1987; Nwokocha, 1993; Ogbonna, Nwauzor, Asumugha and Emehute, 2005).

The cultivation of sweetpotato was, before 1974, without appropriate attention by the Nigerian populace despite its nutritional constituents, ease of propagation, soil conservation attribute and industrial use. It was regarded as a crop with little economic importance; a volunteer or discard crop that children picked mostly around refuse dump sites (Nwokocha, 1993). Farmers paid no attention to the time of planting the crop, where it was planted, as well as its time of harvesting, storage, processing and marketing. No consideration was given to such agronomic practices as fertilizer application, pest and disease control, weeding regime, earthening up, detopping, rolling and tying of vines at the base which were required for increased crop yield.

From 1974, however, the National Root Crops Research Institute (NRCRI), Umudike, took leadership of rigorous and active research into the genetic improvement, production, processing, storage, utilization and marketing of root and tuber crops of economic importance in Nigeria (NRCRI, 2009). One of the root crops under its mandate is sweetpotato. The research efforts of NRCRI have led to the development of many improved on root and tuber crops. These include the improved production technologies of sweetpotato such as improved sweetpotato varieties, seedbed preparation, plant

population or spacing, planting material, soil requirement, time of planting, weed control methods, fertilizer application, earthening up, pest and disease control methods and time of harvest (Mbanaso, 2011). These technologies were disseminated to the farmers for uptake and subsequent use through the State Agricultural Development Programmes (ADPs) in the South-east agro-ecological zone of Nigeria, including Ebonyi State. This study was, therefore, undertaken to:

a. analyse the knowledge and adoption gaps in the improved sweetpotato production technology among farmers in Ebonyi State, Nigeria

b. examine the determinants of adoption of the technology and make recommendations based on the findings.

METHODOLOGY

The study was carried out in Ebonyi State, one of the states in the Southeastern agro-ecological zone of Nigeria. This zone was chosen because of its proximity to National Root Crops Research Institute, Umudike, which has the national mandate on sweetpotato research, among other root and tuber crops of economic importance. The zone has a land area of 29,526 km^2 and stretches from Latitude $04^o15'N$ to $07^o00'N$ and Longitude $05^o34'E$ to Longitude $09^o24'E$ (CBN, 1997; Unamma, Odurukwe, Okereke and Ene, 1985; FMANR, 1990). Agriculture is the major occupation of the people and they grow such crops as yam, cassava, rice, pulse crops, sweetpotato, pepper, oil palm, bananas and varieties of vegetables. Ebonyi State was purposively selected for the study because it is one of the major states to which the improved sweetpotato production packages had been disseminated. The multistage sampling technique was used in selecting the agricultural zones, blocks, circles and farm households. All the three agricultural zones in the State, namely, Ebonyi North, Ebonyi South and Ebonyi Central, were used for the study. Three extension blocks were randomly selected from each agricultural zone, two circles from each extension block and eight farmers from each circle. This gave a total of one hundred and thirty-five (135) farmers used for the study. A structured interview schedule was used for data collection. The interview elicited responses on the respondents' socio-economic characteristics and level of Knowledge/adoption of the different practices in improved sweetpotato production.

Adedoyin (1997), Okoro (1999) and Wayagari *et al* (2000) investigated rate of adoption of improved farm technologies using such techniques as interval scales of 8 (to group the farmers into 4 major categories of laggards, late adopters, early adopters and innovators), adoption gap index and logistic curve. Onyenweaku and Mbuba (1991), Chikwendu *et al* (1996), Adedoyin *et al* (1997), Wayagari *et al* (2000) and Tamiyu *et al* (2001) used variables as socio-economic characteristics, institutional factors and characteristics of change agents to determine the rate of adoption of improved technologies. This study employed simple statistical tools like adoption of technology gap index and multiple regression analysis.

The knowledge/adoption of technology gap index, following the formula by Okoro (1999), is given as:

$$KGI = \frac{P - K}{P} \times 100; \quad AGI = \frac{P - K}{P} \times 100$$

Where

KGI = Knowledge Gap Index;

P = Possible maximum scores for all the practices/respondents

K = Knowledge score obtained by a respondent over all practices

AGI = Adoption Gap Index,

P = Possible maximum scores for all the practices/respondents;

K = Knowledge scores obtained by a respondent over all items/practices;

The main areas in the improved sweetpotato production package studied are :

Knowledge of improved sweetpotato Production	– 1 item
Pre-planting practices	- 4 items
Planting practices	- 2 items
Management practices	- 3 items
Plant protection practices	- 2 items

The adoption of each practice attracted 1 point, and each farmer had a knowledge/adoption score of 0 as minimum and 12 as maximum. A cut off point of 30% was used for low technology adopters, 31 – 50% for medium adopters and above 50% for high adopters. The degree of association between farmers' personal and farm related characteristics and their level of adoption of the improved sweetpotato production technology was determined using the Ordinary Least Square regression technique. Explicitly, the model is specified as:

$$ATI = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + U$$

Where

ATI = Adoption of technology index (measured by number of practices of the improved sweetpotato production technology adopted by the respondent)

X1 = Age (years)

X2 = Formal education (years)

X3 = Average farm size (hectare)

X4 = Membership of farmers' organization

X5 = Farming experience (years)

X6 = Extension contact

X7 = Major occupation (1 if a farmer; 0 otherwise)

U = Error term

RESULT AND DISCUSSION

Extent of knowledge and adoption individual practices in the improved sweetpotato production technology

As shown in Table 1, the extent of knowledge and adoption of the individual practices in the improved sweetpotato production package was 65.12% for knowledge level and 49.81% for adoption. The adoption gap was 50.00. However, practices like pre-planting and plant protection had high knowledge values of 62.50% and 65.87% with low adoption values of 31.25% and 25.00% respectively. The low adoption values could be attributed to the complexity of these practices, their incompatibility with traditional practices, as well as high cost and unavailability of required inputs. Thus the farmers substituted chemical weed control with hand weeding, and the use of disease-free plants from the nursery with sprouts from old plants. Moreover, some of the respondents showed ignorance of the importance of some of the practices in attaining the required high productivity. This, therefore, underscores the need for more intensive extension education to the farmers.

The highest level of adoption (66.67%) was attained by planting operation, the reasons being that the farmers found it easier and simpler to manipulate, in addition to its conformity with traditional methods or norms. Knowledge of the improved sweetpotato production technology and management practices showed consistent high values for both extent of knowledge and adoption. Obasi *et al* (2002) found similar consistencies in values while studying the gap between recommended yam production technologies and actual adoption rates among male farmers in Enugu State. Similarly, Odurukwe *et al* (2003) found consistent high values for the extents of knowledge and adoption in the knowledge of the yam minisett technique and management practices while determining the adoption gaps in yam minisett technique of women farmers in Rivers State.

It could, therefore, be said that the non-adoption of the full package of the improved sweetpotato production technology by farmers in Ebonyi State was not due to lack of knowledge of the individual practices. It could be as a result of the existence of choice of alternative. This choice was necessitated by the need to reduce cost, save time and energy, minimize risk and maximize profit. Farmers would be more willing to adopt innovations that are simple and conform to their traditional norms than complex ones that are completely new to their farming system. The implication of the foregoing is that an average of 50.00% of all the practices involved in the improved sweetpotato production technology are omitted by farmers in the study area who claim to have adopted the package.

Table 1: Extent of knowledge and adoption of improved sweetpotato production practices

Recommended Practices	Marks Allotted	Max score attainable for all respondents /practices	Extent of knowledge	%	Extent of adoption	%	Adoption gap
Knowledge of improved sweetpotato production	1	120	80	66.67	78	65.00	35.00
Pre-planting operation	4	480	300	62.50	150	31.25	68.75
Planting operation	2	240	160	66.67	160	66.67	33.33
Management practices	3	360	230	63.87	220	61.11	38.89
Plant protection practices	2	240	158	65.87	60	25.00	75.00
Total	**12**	**1440**	**928**	**65.12**	**668**	**49.81**	**50.00**

Source: Field survey, 2010

Table 2 contains the knowledge/adoption index and is categorized into three: low, medium and high. It revealed that the respondents have relatively high knowledge of the various practices involved in the improved sweetpotato production technology. Thus, whereas 61.60% recorded low knowledge gap, only 10.90% had low adoption gap. Furthermore, small proportions of the knowledge and adoption gaps fell within the medium level (25.90% and 26.70% respectively). Moreover, only 10.60% had high knowledge gap whereas 62.15% showed high adoption gap. This finding is in agreement with Odurukwe *et al* (2003) who determined adoption gaps in yam minisett technique of women farmers in Rivers State. This result implies that problems associated with the improved sweetpotato production technology was attributable to non-adoption of the entire practices in the package.

Table 2: Distribution of respondents according to levels of knowledge and adoption gap

Gap levels	Knowledge frequency	%	Adoption frequency	%
Low (0.0-30.0%)	70	61.60	14	10.90
Medium(31.0-50.0%)	32	25.90	32	26.70
High(above 50.0%)	16	10.60	76	62.15

Source: Field survey, 2010.

Regression results on determinants of adoption

Equation 1 showed that coefficients of farm size, extension contact, membership of farmers' organizations, farming experience and major occupation were positively and statistically significant at 5% level. This means that when these variables increased in value there would be corresponding increase in the adoption of the improved sweetpotato production technology. This is in agreement with Mbanaso, Chukwu and Chijioke (2005) who showed that farm size and extension contact, among others, were significant factors affecting the adoption of the two-node cutting technique of sweetpotato production in Ebonyi State. Tokula (2003) also showed farming experience and membership of co-operatives among factors influencing the adoption of cocoyam production and processing technologies in Ikwuano Local Government Area of Abia State. Similarly Chikwendu, Chinaka and Omotayo (1995) reported age, co-operative membership and intensity of extension contact as some of the significant determinants of adoption of the yam minisett technique by farmers in the eastern forest zone of Nigeria, while Imo and Essien (2005) found farm size and level of formal education as determinants of adoption of improved cassava varieties by small-scale farmers in Ikot-Ekpene agricultural zone of Akwa Ibom State of Nigeria. Age and education were negatively and statistically significant, implying that older farmers and those with higher educational qualifications were less likely to adopt the improved sweetpotato production technology than younger and less educated ones. This agrees with Tiamiyu *et al* (2001) which showed positive and significant relationship between literacy level and adoption of soyabean in Niger State, Nigeria. Odurukwe *et al* (2003) also found negative and significant relationship between education and adoption of yam minisett technique by women farmers in Rivers State. Membership of farmers' organization was positively significant, implying the more of such organizations a farmer belongs to, the more likely he will be predisposed to adopt improved farm practices. This is in agreement with Chikwendu, Chinaka and Omotayo (1995) and Tokula (2003). Major occupation was also significant, implying that farmers with farming as main source of income will be more predisposed to adopt new innovations than those who engage in farming on part time basis. The positive significance of farm size implies that farmers with larger farm holdings will more easily adopt farm innovations than those with small farm holdings. These findings imply that increased adoption of the improved sweetpotato production technology would be attained through emphasis on farmers' membership of farmers' organizations, access to farm land and extension contact with farmers who engage in farming on full time.

Equation 1

$$ATI = 1.031 - 2.071X_1 - 0.233X_2 + 1.278X_3 + 0.934X_4 + 1.472X_5 + 0.611X_6 + 0.817X_7$$
$$(2.035)^*(-1.512) \quad (-0.693) \quad (2.514)^* \quad (2.470)^* \quad (2.633)^* \quad (4.318)^{**} \quad (3.183)^{**}$$

$R2 = 0.74881$; Adjusted $R2 = 0.71620$; F-ratio = 82.35

Where

*=T-values significant at 5%, **=T-values significant at 1%

TT-statistics of respective coefficients are in parenthesis

CONCLUSION AND RECOMMENDATIONS

The study showed that, among farmers in Ebonyi State, there is relatively high level of knowledge but high adoption gaps of the individual practices contained in the sweetpotato production technology. This was due to its non-conformity with the traditional norms of the farmers, complexity of some practices, unavailability and high cost of some relevant inputs. Determinants of adoption of the technology included farm size, farming experience, contact with extension, membership of farmers' organizations and major occupation.

On the basis of above findings, the following recommendations were made:

1. Government should enunciate policies that ease access to land for farming purposes to farmers
2. Extension education to farmers should be intensified
3. Numerical strength of extension agents should be increased through partnership with the private sector.

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