Journal of Agriculture and Social Research (JASR) Vol. 12, No. 1, 2012

ASSESSMENT OF THE EXTENT OF ADOPTION OF SWEETPOTATO PRODUCTION TECHNOLOGY BY FARMERS IN THE SOUTHEAST AGRO-ECOLOGICAL ZONE OF NIGERIA

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ABSTRACT
Sweetpotato (Ipomoea batatas (L) Lam) is one of the most important staple carbohydrate foods in Sub-Saharan Africa, reputed for its capacity to tolerate marginal environments and high energy-fixing efficiency to produce high dry matter at a short period of time. It arrived Nigeria between 1694 and 1698 and, through the research and extension efforts of National Root Crops Research Institute, Umudike, and other collaborating institutions, has been disseminated to farmers in Nigeria. Using the multistage sampling technique, and a structured interview schedule as instrument for data collection, this study assessed the extent of adoption of sweetpotato production technology by farmers in the Souteast agro-ecological zone of Nigeria. The findings showed 79.63% of the farmers were aware of the technology, while 20.37% were not. Majority of the farmers had adopted all the sweetpotato production practices except plant spacing. The constraints to increased adoption of the technology were scarcity of land, difficulty in integrating sweetpotato production technology into existing production system, low consumer preference associated with sweetpotato products, lack of market, unavailability of sweetpotato vines, high cost of available sweetpotato vines and unavailability of inorganic fertilizer. Others included high cost of available inorganic fertilizer, unavailability of agro-chemicals, high cost of available agr-chemicals, lack of contact with important sources of information on sweetpotato production, lack of adequate technical knowledge about recommended sweetpotato farm practices, and problems of pests and diseases. The study recommended the development of less complex technologies by research, increased use of contract out-growers to multiply planting materials and increased farmer-participation in farmers/social organizations.

Key words: Adoption, sweetpotato, production technology, farmers, southeast agro-ecological zone.

INTRODUCTION

Sweetpotato (*Ipomoea batatas (L*) Lam) is one of the most important staple carbohydrate foods in sub-Saharan Africa. It is highly adaptable to relatively marginal soils and erratic rainfall, has high productivity per unit land and labour, and guarantees some yield even under the most adverse conditions (NRCRI, 1987; Nwokocha, 1993; Ogbonna, Nwauzor, Asumugha and Emehute, 2005). It has high energy fixing efficiency, produces much dry matter at a short period of time and contains high levels of vitamins A and C (Nwokocha, 1993; 2002). Sweetpotato and potato are the only root and tuber crops that can be grown and harvested within four months in Nigeria. Specifically, sweetpotato can be grown two to three times in a year with supplementary

irrigation (Nwokocha, 1993). It does not have the problem of anti-nutritional factors such as cyanides and oxalates that exist in cassava and cocoyam respectively (NRCRI, 1989; Nwokocha, 1993). Apart from the roots, the young leaves of sweetpotato serve as green vegetable for man, while the leaves and vines are cherished as fodder and hay by livestock (Villereal, Tson, Lo and Chiu, 1985; Ukpabi and Oji, 1984). Its short life cycle of less than 20 weeks and yield potentials make crops like yam (*Dioscorea spp.*) relatively poor competitors for general industrial starch (NRCRI, 1989). It ranks as the fifth most important food crop on a fresh-weight basis in developing countries after rice, wheat, maize and cassava (International Potato Centre (CIP), 1999).

Sweetpotato arrived Nigeria between 1694 and 1698 through the early Portuguese and Spanish explorers. Thereafter it was mostly seen growing in the wild and not generally cultivated, particularly prior to 1974. People regarded it as a crop with little economic importance, a volunteer or discard crop that children picked around refuse dump sites. Its consumption was surrounded by the erroneous idea that it caused amoebic dysentery (NRCRI, 2009). From 1974, however, the National Root Crops Research Institute (NRCRI), Umudike, took leadership of, and embarked on 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). The mandate crops are cassava, yam, sweetpotato, cocoyam, ginger, potato, sugar beet, turmeric, risga and Hausa potato (Nwosu, 2004). The Institute carries out the research work sometimes in collaboration with other research centres like the International Institute for Tropical Agriculture (IITA), International Potato Centre (CIP) and faculties of agriculture of universities in the country. These research efforts have led to the development of many improved technologies. With regard to sweetpotato, these technologies included various improved sweetpotato varieties, notable among which is the orange-fleshed varieties. These are rich in beta carotene, a pro-vitamin A from which the body synthesizes vitamin A (Kapinga, Ewell, Hagenimana and Collins, 2001).

Some varieties were introduced specifically for livestock production because of their high yield of foliage and include TIS 8164, Tanzania and Wagabolige (Ikwelle, Ezulike and Eke-Okoro, 2001; Njoku, Nwauzor, Okorocha and Afuape, 2006). Other varieties with bland taste have been introduced to benefit consumers averse to the usual sugary taste of sweetpotato. These varieties include TIS 87/0087, 440216, 440163, Naspot 2 and Tanzania (Njoku, Nwauzor, Okorocha and Afuape, 2006). Varieties such as 199004.2, 440216, 440031, 440163, Tanzania and Centennial have low oil absorption capacity when fried, a desirable quality in sweetpotato varieties that are demanded for preparation of snacks (Njoku, Nwauzor, Okorocha and Afuape, 2006). Other technologies developed for sweetpotato production included seedbed preparation, plant population (30cm on ridges and 25cm on mounds), planting material, soil requirement, time of planting, weed control methods, earthening up, pest and disease control methods and time of harvest.

In order to disseminate these technologies to the farmers for uptake and subsequent use, NRCRI programmed the sweetpotato production technologies into the technology review

meetings of the Agricultural Development Programmes (ADPs) in the South-east zone of Nigeria through the Research-Extension-Farmer-Input-Linkage System (REFILS) (Odurukwe and Anuebunwa, 1996). Since 1996, the Institute embarked upon regular and intensive campaigns aimed at educating the farmers on the benefits of sweetpotato production to ensure its widespread adoption (Odurukwe and Anuebunwa, 1996). It did this in conjunction with the State Ministries of Agriculture through their respective ADPs, with the farmers as targeted clients. Furthermore, NRCRI opened six sub-stations to serve as service centres and channels for disseminating the Institute's research findings (Nwosu, 2008) to other parts of the country. These sub-stations are Gassol in Taraba State, Igbariam in Anambra State, Maro in Kaduna State, Nyanya in Abuja (Federal Capital Territory), Otobi in Benue State and Vom in Plateau State. There is, hitherto, no study carried out to elucidate the level of awareness and extent of adoption of the sweetpotato production technology. This study was, therefore, designed to examine the socio-economic characteristics of the farmers, assess their level of awareness, extent of adoption and constraints to their increased adoption of the sweetpotato production technology.

METHODOLOGY

The study was carried out in the South-east agro-ecological zone of Nigeria, comprising nine states, namely, Abia, Akwa Ibom, Anambra, Bayelsa, Cross River, Ebonyi, Enugu, Imo and Rivers States. Using the multistage sampling technique, three states were randomly selected. These were Abia, Ebonyi and Imo States. Three agricultural zones, according to the State ADP's delineation, were selected from each state, and three extension blocks from each agricultural zone. Two circles were selected from each extension block while five farmers were selected from each circle. This gave 90 farmers from each state and a total of 270 farmers from the three states. A structured interview schedule was used as instrument for data collection. In analyzing data generated for the study, descriptive statistics were used in examining the socio-economic characteristics of the farmers, as well as assessing the levels of awareness. Determination of the extent of adoption of sweetpotato production technology by farmers was carried out using the seven steps (not aware to rejection) adoption model (Madukwe, 1995; Agwu, 2000). The farmers were asked to indicate their adoption stages for the various sweetpotato production technologies. The response categories and the corresponding weighted values were as follows: Not Aware (Have not heard about)=0, Aware (Have heard about but know few details)=1, Interest (Know details but have not considered using)=2 Evaluation (considered using, but have made no decision)=3; Trial (Have definitely decided to use)= 4; Adoption (Have already been using in my farm)=5; Rejection (Have definitely decided not to use)=6. Total adoption score for each farmer was calculated by adding up the adoption scores for the various technologies. In calculating farmers' scores, however, rejection, with a weighted value of six was converted to zero to give meaningful interpretation to the results (Agwu, 2000). Identification of the constraints to the adoption of the sweetpotato production technology in the country was achieved using a five-point Likert-type rating scale. The response options and assigned values were: To a very great extent=5; To a great extent=4;To some extent=3;To a little extent=2; None at all=1. A list of possible constraints was supplied, from which the respondents were asked to indicate the extent of their perceived seriousness of each constraint according to the response options provided. Data were subjected to exploratory factor analysis procedure, using the principal factor model with varimax rotation in classifying the constraint variables into major constraint factors. In

factor analysis, the factor loading under each constraint variable (beta weight) represents a correlation of the variables (constraint areas) to the identified constraint factor, and has the same interpretation as any correlation coefficient. The variables with loadings of 0.40 and above (10% overlapping variance; Chukwuone, Agwu and Ozor, in Akinnagbe 2009) were used in naming the factors.

RESULTS AND DISCUSSION

Socio-economic characteristics of respondents

As shown in Table 1, the largest proportion (24.82%) of the respondents were within the age range of 40-49 years, followed by those of 50-59 years (23.70%), 60 years and above (23.33%), 30-39 years (17.78%) and lastly 20-29 years (10.37%). The average age of the respondents was about 48 years, showing that there was a relatively high proportion of middle aged farmers among the respondents. This falls within the economically productive proportion of the population as defined by Food and Agriculture Organization (1983) cited in Emodi (2009). Moreover, the farmers were still in their active years, as majority (66.30%) of them were between 30 and 59 years, a situation that is likely to favour the adoption of the sweetpotato production. About 51% of the respondents were males while 49% were females. This implies that gender distribution among farmers in sweetpotato production is skewed slightly towards males. This is at variance with the findings of Okwusi, Amamgbo and Asumugha (2005) which showed that females predominated in the production, processing and utilization of sweetpotato in South-eastern Nigeria. Entries in Table 1 also revealed that 14.07% of the farmers had no formal education, 26.30% had primary education, and 38.89% had secondary education, while 20.74% had post secondary education. This means that majority of the farmers were literate, as about 86% of them had one form or other of formal education. The high proportion of literate people among the farming population implies that majority of them are in a better position to be aware of, understand and adopt the sweetpotato production technology. Education has always been known to play a positive role in the adoption of improved technologies among farmers (Sheikh, Ather, Arshed and Kashi, 2006). Table 1 also showed that 27.78% of the respondents had 1-10 years of farming experience, 31.48% had between 11 and 20 years of experience, while 40.74% had 21 or more years of farming experience. The mean years of farming experience was 22.22 years, implying that the farmers have long period of farming experience that will enhance their understanding and subsequent adoption of the sweetpotato production technology. The table further showed that households that had between one and five people made up 37.78% of the respondents, those with six to ten members constituted 49.26%, while those households with 11 persons or more made up 12.96% of the respondents. The average household size was 7 persons. This means that the farmers had relatively large-sized households. This is advantageous to farming since it will enable the farmer to use family labour and thereby reduce the cost of hiring labour for sweetpotato production.

Entries in Table 1 also showed that 59.63% of the respondents indicated farming as their major occupation, 15.92% indicated trading to be their major occupation, 18.52% were in the civil service while 5.93% were artisans. This means that majority of the respondents in the zone had farming as their major occupation. This is in agreement with Emodi (2009) and Aniedu (2006) who found that most of the farmers in the South-eastern zone have farming as their major occupation. With regard to membership of social/farmers' organizations, the table showed that majority (90.74%) of the respondents belonged to social/farmers' organization, while only 9.26% did not. This is advantageous to farming since, according to Peterson (1997) in Agwu (2000),

farmers'/social organizations offer an effective channel for extension contact with large numbers of farmers, as well as opportunities for participatory interaction with extension organizations. This enhances farmers' uptake of new practices such as the sweetpotato production technology. As revealed in the table also, only 4.44 of the respondents participated in formal or informal credit system for the production of sweetpotato while majority (95.56%) of the respondents did not participate in any. This implies that their scales of operation were such that can easily be funded from their personal earnings without resorting to loans. This should be expected since sweetpotato is a low input crop, and does not require large capital outlay to produce (Nwokocha, 1993; Ogbonna, Nwauzor, Asumugha and Emehute, 2005).Table 1 further showed that 60% of the respondents have had contact with the extension agency in the zone while 40 percent had none. This means that majority of the respondents have had contact with extension and are, therefore, expected to be more exposed to relevant technologies like the sweetpotato production technologies being disseminated through the agency. Majority (62.96%) of the respondents cultivated less than one hectare of land for sweetpotato, 25.93% of them cultivated 1 to 1.99 hectares, 7.41% cultivated 2 to 2.99 hectares, and 1.85% cultivated 3 to 3.99 hectares while another 1.85% cultivated 4 to 4.99 hectares. The average farm size was 1.34 hectares. Shaib, Aliyu and Bakshi (1997) classified farm holdings in Nigeria into three broad categories of small-scale, medium-scale and large-scale. Small-scale farm holdings were less than 6 hectares in size, medium-scale farm holdings were 6 to 9.99 hectares in size while large-scale farm holdings were 10 hectares and more in size. In this study, none of the farmers cultivated more than 4.99 hectares of land. This means that all the sweetpotato farmers in the zone were small-scale farmers. This finding is in agreement with the findings of studies by Aniedu (2006) and Emodi (2009) which found small-scale farmers predominating in the zone.

Table 1: Percentage distribution of respondents according to their socio-economic characteristics (n=270)

Category	%	Mean (M)
Age (Years)		
20 – 29	10.37	
30 – 39	17.78	
40 – 49	24.82	48.31 years
50 – 59	23.70	
≥ 60	23.33	
Sex		
Male	51.11	
Female	48.89	
Marital status		
Married	72.59	
Single	9.26	
Divorced/separated	3.33	
Widowed	20.74	
Formal education		
None	14.07	
Primary	26.30	
Secondary	38.89	
Post secondary	20.74	

Farming experience (Years)		
1 – 10	27.78	
11 – 20	31.48	22.22 years
≥ 21	40.74	
Household size		
1 – 5	37.78	
6 – 10	49.26	7 persons
≥ 11	12.96	
Major occupation		
Farming	59.63	
Trading	15.92	
Civil service	18.52	
Artisanship	5.93	
Membership of social/farmers' organization		
Yes	90.74	
No	9.26	
Participation in credit		
Yes	4.44	
No	95.56	
Extension contact		
Yes	60.00	
No	40.00	
Farm size (Ha)		
≤ 0.99	62.96	
1.00 – 1.99	25.93	
2.00 – 2.99	7.41	1.34 ha
3.00 – 3.99	1.85	
4.00 – 4.99	1.85	

Awareness of the sweetpotato production technology

Entries in Table 2 showed that 79.63 percent of the respondents were aware of the sweetpotato production technology, while 20.37 percent were not aware of it. This means that majority of the farmers in the South-east geo-political zone of Nigeria were aware of it. This is of advantage to the adoption of the sweetpotato production technology, as awareness is an indispensable and preceding step towards the adoption of any improved practice.

Table 2: Percentage distribution of respondents according to level of awareness of the sweetpotato production technology (N=270)

Category	%
Aware	79.63
Unaware	20.37

Extent of adoption of the sweetpotato production technology

The technologies discussed here in the sweetpotato production package were the use of ridges or mounds, use of improved varieties, plant spacing, vine cuttings, time of planting,

weeding and fertilizer application. Others include earthening up, timely harvest and pest and disease control.

Table 3 showed the distribution of the respondents based on their stages in the adoption of sweetpotato land preparation methods of ridges or mounds. Majority (38.0 percent) of the respondents were planting sweetpotato on ridges or mounds in their farms. About 19 percent of the respondents were not aware of the use of ridges or mounds for sweetpotato production, 24 percent were aware of the land preparation methods, 12.7 percent were at the interest stage, while about one percent of the respondents were at the evaluation stage in the adoption of this technology. Furthermore, the table showed that 5 percent of the respondents were at the trial stage of this technology while none of them rejected it. Table 3 also revealed that 50 percent of the respondents were using the improved sweetpotato varieties on their farms. Eight percent, 7 percent, 3 percent and 6.2 percent were at the not aware, aware, interest and evaluation stages respectively. About 3 percent of the respondents were at the trial stage in the adoption of this technology, while 22.6 percent rejected it. This means that majority of the respondents were at the adoption stage in the use of improved sweetpotato varieties. One of the reasons proffered by the farmers for rejecting the improved sweetpotato varieties was the consumption preference of sweetpotato varieties among urban and rural consumers. The improved varieties absorbed oil when fried and, as a result, was not in high demand. Another reason for rejection was the sugary taste of the improved varieties, which was a quality disliked by many of the consumers. There are, however, improved varieties with bland taste, such as TIS 87/0087; these can be used by people who are averse to the sugary taste.

The recommended plant spacing on sweetpotato farms is 30cm x 100cm on ridges and 25cm x 100cm on mounds for both sole and intercropped systems. The table showed that about 9 percent of the respondents were not aware of this technology. Eight percent were aware of it, 12 percent were at the interest stage, while 6 percent and 4 percent were at the evaluation and trial stages respectively. Twenty percent of the respondents were using the recommended plant spacing on their sweetpotato farms, while 40.5 percent rejected it. This means that a greater proportion of the farmers rejected the plant spacing recommended for sweetpotato production. The reason for rejecting this technology by the farmers was that it was too wide and did not enable them to get their envisaged plant population. It is evident from research, however, that high population densities in sweetpotato farms produce root tubers that are small in size (NRCRI, 1979).

The recommended vine cuttings used for planting sweetpotato are 2-node cuttings and 5/6-node cuttings. The table revealed that 4 percent of the respondents were not aware of this technology, whereas 5 percent, 12 percent and 15 percent were at the aware, interest and evaluation stages in the adoption process of this sweetpotato production technology. About 9 percent of the respondents were at the trial stage, 34.5 percent had adopted the technology while it had been rejected by about 21 percent of the respondents. Thus majority of the respondents were using the sizes of vine cuttings recommended as planting material. The reason indicated by the farmers for the rejection of the recommended size of vine cuttings was that longer vine

cuttings which had more nodes rooted faster than the recommended vine cuttings which were shorter and with fewer nodes. Research has, however, shown that there is no significant difference between the performances of long vine cuttings with more nodes and the 5/6-node cuttings recommended (Chinaka, 1976; NRCRI, 1996).

The recommended time for planting of sweetpotato in the South-east agro-ecological zone of Nigeria is late May through June. This is when the rains are relatively steady. As shown in the table, 70.2 percent of the respondents had adopted the recommended time for planting of sweetpotato, 5.8 percent were unaware of the technology, 12 percent were aware of it while 3.5 percent, 2.5 percent and 4 percent were at the interest, evaluation and trial stages respectively. This means that majority of the respondents have adopted the recommended time for planting sweetpotato. Table 3 also showed that 80 percent of the farmers have adopted the weeding regime for sweetpotato, which is one major weeding at 4 to 6 weeks after planting. None of the respondents was unaware of this technology, 2 percent were aware of it while 8 percent, 3.5 percent and 6.5 percent were at the interest, evaluation and trial stages in the adoption of the technology. Moreover, none of the respondents rejected it. It, therefore, means that majority of the respondents give their sweetpotato farms one major weeding at 4 to 6 weeks after planting. The recommended inorganic fertilizer application rate for sweetpotato production is 400kg NPK 20:10:10 per hectare. Table 3 showed that none of the respondents was unaware of the technology, 10 percent were aware of it and 8 percent were at the interest stage. About 12 percent and 15 percent were at the evaluation and trial stages respectively, while 47 percent had adopted the technology. Moreover, 8 percent of the respondents had rejected the technology, indicating that their soil was fertile enough for sweetpotato production and that they would use available inorganic fertilizer on their cassava farms. Furthermore, only one percent of the respondents were not aware of the earthening-up practice in sweetpotato production, 5.0 percent were aware of it, 9.0 percent were at the interest stage while 5.0 percent were at the evaluation stage. About 18 percent of the farmers were at the trial stage whereas 62.5 percent had adopted the technology. None of them rejected it. The table also showed that 80.5 percent of the respondents harvest their sweetpotato root tubers as soon as they mature. This is within the period of 3 to 4 months after planting. About 2.0 percent of the respondents were not aware of this technology, 8.0 percent were aware of it, while 4.0 percent, 2.0 percent and 3.5 percent were at the interest, evaluation and trial stages, respectively, in the adoption of the technology. None of them rejected it. This means that majority of the farmers have adopted timely harvesting of sweetpotato root tubers. Finally, it was shown in Table 3 that 80.7 percent of the respondents use the recommended pest and disease control measures on their sweetpotato farms. About 1.8 percent of the respondents were not aware of the control measures, 6.5 percent were aware of them while 5.0 percent were at the interest stage. Those who were at the evaluation stage constituted 3.5 percent of the respondents, with 2.5 percent being at the trial stage. There was no farmer that rejected the pest and disease control measures.

Table 3: Percentage distribution of respondents according to their stages on the adoption of sweetpotato production technologies (n=215)

Technology	Extent of adoption						
	Unaware	Aware	Interest	Evaluation	Trial	Adoption	Rejection
Land preparation methods	19.0	24.0	12.7	1.0	5.0	38.0	0.0
Improved varieties	8.0	7.0	3.0	6.2	3.0	50.0	22.8
Plant spacing	9.5	8.0	12.0	6.0	4.0	20.0	40.5
Planting material	4.0	5.0	12.0	15.0	9.5	34.5	20.0
Time of planting	5.8	12.0	3.5	2.5	4.0	70.2	2.0
Weeding regime	0.0	2.0	8.0	3.5	6.5	80.0	0.0
Fertilizer application	0.0	10.0	8.0	12.0	15.0	47.0	8.0
Earthening-up practice	1.0	5.0	9.0	5.0	17.5	62.5	0.0
Timely harvest	2.0	8.0	4.0	2.0	3.5	80.5	0.0
Pest and disease control	1.8	6.5	5.0	3.5	2.5	80.7	0.0

Factors constraining the adoption of technologies

Table 4 showed the varimax rotated constraint factors influencing the adoption of the sweetpotato production technologies as perceived by the farmers. The identified constraint factors were: production complexity problems, economic problems, poor technical information and pathological problems. Production complexity problem was dominated by recommended sweetpotato production practices are costly to carry out (0.805), high cost of sweetpotato vine needed for planting (0.709), low consumer preference associated with sweetpotato product (0.707), and difficulty in integrating sweetpotato production technology into existing production system (0.684). Other constraining variables included unavailability of sweetpotato vines needed for planting (0.643), recommended sweetpotato production practices are complex to carry out (0.628), and lack of market to sell increased quantities of sweetpotato (0.595). Most farmers in the rural areas will not adopt any innovation which they find to be complex. In this regard, the farmers will be unable to manipulate the innovation (van den Ban and Hawkins, 1996; Adekoya and Tologbonse, 2005). Subsequently, they will not be able to integrate such innovations, like the sweetpotato innovation, into their existing production system.

Items that loaded high in factor 2, (economic problem), included high cost of available inorganic fertilizer (0.774), available agro-chemicals (herbicides) are costly (0.758), unavailability of inorganic fertilizer (0.748) and unavailability of agro-chemicals (0.673). In many situations, the development of sustainable production requires increased use of purchased inputs such as inorganic fertilizers and agro-chemicals like herbicides (Agwu, 2000). These inputs require funds, and the poor economic conditions of the farmers often constrain them from using these sweetpotato technologies. This situation is compounded by the unavailability of the inputs.

Issues which loaded high under factor 3, (poor technical information), included: lack of contact with important sources of information on sweetpotato production (0.768), and lack of adequate technical knowledge about recommended farm practices associated with sweetpotato production (0.725). The transfer of agricultural technologies is a process that involves multiple

functions of information, teaching, technology supply and technology service (Asiabaka, 1991). The implication is that the recipients of the technology require the technical knowledge that underlie the formulation and design of the technology (Okono,1994, in Agwu, 2000). Thus the poor technical knowledge of the farmers may contribute in making the adoption of the sweetpotato production technologies difficult.

Specific issues with high loading under factor 4 (pathological problem) included problem of pest attack on sweetpotato (0.809), problem of disease attack on sweetpotato (0.783) and scarcity of land (0.504). The major pathological problem of sweetpotato in Nigeria is attack by the sweetpotato weevil, *Cylas spp*. The incidence of this pest increases with increase in the dryness of the soil. Therefore, farmers who harvest their crops piece-meal or leave their crops in the soil into the dry season stand the risk of losing more of their produce through the attack of this pest than those who harvest their crops earlier (Nnodu, 1981; Anioke, Ene and Abazie 1987).

However, some variables were loaded high in more than one factor and were, as a result, not considered in the process of naming the extracted factors. These included: unavailability of labour (loaded in factors 3 and 4), high cost of labour (loaded in factors 2 and 3) and lack of capital to carry out necessary farm activities (loaded in factors 2 and 3). One variable, low soil fertility, had loadings that were below 0.40 which was used in naming the factors. It was, therefore, not included in the extracted factors.

Table 4: Varimax rotated factors constraining the adoption of sweetpotato production technology by farmers

Constraint variables	Factor1	Factor2	Factor3	Factor4
Scarcity of land	-0.127	0.066	-0.344	**0.504**
Low soil fertility	0.275	0.265	0.028	0.205
Unavailability of labour	-0.037	0.328	-0.577	0.438
High cost of hired labour	-0.167	0.430	-0.527	0.340
Difficulty in integrating sweetpotato production technologies into existing production system	**0.684**	0.134	0.141	-0.155
Low consumer preference associated with sweetpotato product	**0.707**	-0.051	0.178	-0.053
Lack of market to sell increased quantity of sweetpotato	**0.595**	-0.088	-0.097	-0.091
Lack of capital to carry out necessary farm activities	0.022	0.459	-0.457	0.314
Unavailability of sweetpotato vines needed for planting	**0.643**	-0.048	0.012	0.383
High cost of sweetpotato vines needed for planting	**0.709**	-0.147	-0.099	0.332
Unavailability of inorganic fertilizer	0.017	**0.748**	0.020	0.044
High cost of inorganic fertilizer	0.051	0. 774	-0.107	0.309

Unavailability of agro-chemicals (herbicides)	-0.013	**0.673**	0.210	-0.140
Available agro-chemicals are costly	0.037	**0.758**	0.101	-0.167
Recommended sweetpotato production practices are complex to carry out	**0.628**	0.165	0.377	-0.050
Recommended sweetpotato production practices are costly to carry out	**0.805**	0.068	0.125	-0.143
Lack of adequate technical knowledge about recommended farm practices associated with sweetpotato production	0.224	0.200	**0.725**	-0.073
Lack of contact with important sources of information on sweetpotato production	0.069	0.066	**0.768**	0.329
Problem of pest attack on sweetpotato	-0.105	0.021	0.052	**0.809**
Problem of disease attack on sweetpotato	-0.115	-0.034	-0.032	**0.783**

Extraction method: Principal Component Analysis
Rotation method: Varimax with Kaiser Normalization

CONCLUSION AND RECOMMENDATIONS

The extent of adoption of sweetpotato production technology by farmers in Nigeria was assessed. Most of the farmers were aware of the technology. Similarly, majority of them had adopted most of the sweetpotato production practices, except plant spacing. The main factors constraining increased adoption of the technology were production complexity problems, economic problems, poor technical information and pathological problems, with production complexity problems predominating. The development, by research, of technologies that are less and easy to manipulate by farmers is imperative. Contract out-growers should be widely used to multiply sweetpotato vines as planting material, while farmers should be encouraged to participate more actively in farmers/social organizations since this act as effective channels for extension contact with large numbers of farmers.

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