# FARMER'S ADOPTION OF IMPROVED TECHNIQUES OF SWEET POTATO PRODUCTION IN NIGER STATE, NIGERIA

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**Abstract**

The study was conducted in Niger state Nigeria; it investigated the factors affecting the adoption of improved sweet potatoes technologies. Two local Governments were purposively selected and a total of one hundred and fifty (150) sweet potato farmers were randomly selected from 2 extension blocks from the two local Governments. A well-structured interview schedule was used to elicit information from the respondents. The data collected were analysed using descriptive statistical tools such as frequency tables, percentage, mean, and regression statistical tool (logit model) was also used to determine the factors affecting adoption. The result revealed that Age ($X_1$), Farm size ($X_2$), Educational level ($X_3$), Farming experience ($X_4$) and household size ($X_5$) had a significant relationship with adoption. Furthermore, the level of awareness of improved potato techniques among the respondents was high (98.0%}, however 2.0% claimed they were not aware. The study also shows that extension agents (40%) and friends and neighbors' (42.7%) were the principal sources of information and distribution of improved potato technology packages. The following technologies were highly adopted, fertilizer use (3.6), weeding regime (3.7) and harvesting techniques (3.9). Some constraints to technology adoption includes small farm size (63.3%), high cost of technology (56.7%), inadequate extension contact (60.0%) complexity of technology (68.7%) and also inadequate credit (74.7%). All the constraints were however perceived as important (with mean scores equal to or above 3.0) in exception of religious belief (1.8.) The significant mean difference in yield before and after adoption of improved potato technologies reveals that adoption of improved technologies has significant effect on the output of the potato farmers and consequently on their income and standard of living.

**Key words:** Adoption, Improved techniques, potato,

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Sweet potato (*ipomoea batatas*) is one of the world widely grown and valuable crops. 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 (Nwokocha 1993 and Ogbonna *et al*, 2005). Farmers in more than 100 countries in the tropics, subtropical and warm temperate areas rely on it for its ability to produce high yields on marginal land with little investment (Horton *et al*, 1998). It has high energy fixing efficiency, produces much dry matter at a short period of time and contains high levels of vitamin A (Nwokocha 1993, 2002). It serves as feeds for animals and raw materials for industries. It is grown over a wide range of environment with latitude $30^0$N and $30^0$S and altitudes as high as 2000m above sea level. Sweet potato can yield over a long period of time; one crop may be harvested for as long as six years.

Adoption is regarded as decision to make full use of an innovation or technologies as the best of action available. According to van den Ban and Hawkins (2006) an innovation is an idea, object or method which is regarded as new by an individual, but which may not always be the result of recent research. Adoption of an innovation is a decision of an individual or group to use or apply as innovation. Most farmers are said to passed through a logical, problem solving process when considering any new technology or innovation (Swanson et al, 1996).

Agbamu (2006) reported that farmers' characteristics such as knowledge, market orientation and innovativeness influence the adoption gap significantly. In addition farmers' knowledge of innovation is an important factor in the adoption process. Lack of technical know-how on the use of technology by farmers can be a serious constraint to the adoption and the success of that innovation. Agbamu (2006) ;Obibuakau and Hursh (1994) and Obeta & Nwagbo (1991), noted that the adoption of technology is a function of the characteristics of the technology proposed, farmers perception of its advantages and need, as well as availability and distribution of

production factors. Other factors that affect the adoption of any technology are; Farmers attitude towards experiment and risk, institutional support/knowledge sharing and the policy environment surrounding the technology. Infrastructure such as roads and irrigation plays key roles in facilitating technology adoption. Improved transportation is also association with diffusion of technology, better use of inputs and better prices for farmers (ATAI 2011 and Agbamu 1998).

According to Nwamkhewu and Agbamu (2006) One of the way farmers use in gathering or gaining information is on the basis of interpersonal and personal sources of information. The interpersonal sources of information dissemination are those communication contacts involving direct face-to-face exchange of word between communicator (Encoder) and receiver (Decoder). The second means of disseminating information can be categorized as follows:

- Commercial source which includes Dealers and Salesman.
- Informal source which includes relatives, friends and neighbour.
- Government/ Agricultural agencies which also includes institutions of Agricultural Extension Agencies.
- Mass Media, which includes television, radio, posters, farm/agricultural magazine and bulletins etc.

Nweke et al. (2004) concluded that, personal contact tends to be more important than formal mass media both in term of total exposure and effective exposure.

Inadequate skills on the method of production of sweet potato have been one of the major constraints to improving sweet potato production, farmer's income and livelihood, and globalization of agriculture in Nigeria. Despite the excellent qualities and potentials of sweet potato in achieving household food security, the level of production and consumption of sweet of

potato in chanchaga and shiroro L.G.A of Niger state remains on an average level. This is as a result of a poorly developed agricultural system compounded by unfavourable macro and micro-economic policy frame work, unhealthy seed varieties, uncertified seeds, seeds being subject of seed-borne diseases, poor storage facilities amongst others. International potato centre (IPC) (2012) declared that for poor potato farmers in developing countries yield is essential to their ability to achieve economic independence and food security. While average potato yield in North America Western Europe often reach 40 metric tons per hectare , yield in developing countries are usually below 20 metric tons per hectare, this of is a persistent and sizable yield gap. Most of this yield gap can however, be closed through adoption of improved potato production technologies and helping farmers realise this crop economic potentials.

On the bases of the above, this study was designed to achieve the following objectives: identify the sources of information about the improved techniques of sweet potato production, determine the level of adoption of the improved techniques of sweet potato, determine the factors affecting the adoption of improved sweet potato techniques and to examine the constraints associated with the adoption of improved sweet potato production technologies and farmers' perception of the constraints.

**HYPOTHESIS**

There is no significant difference in potato yield before and after adoption of improved potato production techniques

The objectives were achieved through descriptive statistics such as frequency, percentages, mean, 4 point Likart type of scale and through inferential statistics, mainly through Logit regression model to determine the factors affecting adoption of improved sweet potato production techniques.

**Model specification**

The Logit model was used to determine the variables that influence the adoption of improved potato production techniques amongst farmers which is specified in linear form.

$$Y=F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9)$$

Where;

Y= level of adoption

$X_1$= Age of the farmer (in years)

$X_2$= farm size (ha)

$X_3$= level of education (years spent in formal edu.)

$X_4$= farming experience (in years)

$X_5$= household size

$X_6$= access to extension

The Explicit function is specified as,

$$Y=b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+U$$

Where, Y, $X_1$-$X_9$ are defined as above

$b_0$-$b_9$ are the coefficients of the parameters estimated

U is the error term

**Table 1: Distribution of respondent based on awareness and sources of information about improved technologies of sweet potato production.**

| Variables | Frequency | Percentage (%) | Awareness |
|---|---|---|---|
| Aware | 147 | 98.0 | |
| Not aware | 3 | 2.0 | |

**Sources of information**

| | | |
|---|---|---|
| Friends & neighbours | 64 | 47.2 |
| Extension agents | 60 | 40 |
| Print/mass media | 26 | 17.3 |

Source: Field survey,2012

Table 1 reveals that majority (98%) of the respondents were aware of the existence of improved sweet potato varieties. This implies that the propensity of the potato's farmers to accept and eventually adopt improved sweet potato varieties is likely to be very high, since many previous studies had shown that awareness is significantly and positively related to adoption. The table also shows sweet potato farmers obtained their information mainly through friend and nighbours (47.2) and extension agents (40%). This implies that farmer-to- farmer extension network is a major information source; also the result shows that the extension service is fulfilling her mandate of disseminating improved technologies .This findings is in agreement with that of Agbamu (1998) who pointed out that farmers obtained information through several sources but most importantly through extension agents and their fellow farmers

**Table 2: Distribution of respondents based on access to improved potato packages and sources of information**

| Variables | Frequency | Percentage |
|---|---|---|
| **Access to improved sweet potato** | | |
| Access | 93 | 62.0 |
| No access | 57 | 38.8 |
| **Sources of improved sweet potato** | | |
| Research institute | 35 | 23.3 |
| Other farmers | 42 | 28.0 |
| ADPs | 56 | 37.3 |

| | | |
|---|---|---|
| State Ministry of Agric. | 17 | 11.3 |

Source; Field survey,2012

Table 2 shows that Majority (62%) of the respondents claimed that they had access to improved sweet potato varieties .This implies that farmers readily had access to improved seed, access to improved seeds is also a major factor in the adoption process. Also majority of the respondents sourced their improved seeds from government owned institutions and organizations, such as research institute (23.3%), ADPs (37.3%) and state ministry of agriculture (11.3%). This implies that majority of the sweet potatoes farmers who adopted improved potato varieties sourced their planting material from government sources. This findings is in agreement and confirm the claims of IPC (2012) that they directly worked with government and Non-governmental agencies in distributing improved potatoes to the farmers.

**Table 3: Distribution of respondents according to access to extension services and frequency of contact**

| Variables | Frequency | Percentage (%) |
|---|---|---|
| **Access to Extension agents** | | |
| Yes | 139 | 92.7 |
| No | 11 | 7.3 |
| **Frequency of contact** | | |
| Weekly | 31 | 20.7 |
| Monthly | 155 | 76.7 |
| Quarterly | 1 | 0.7 |
| Yearly | 3 | 2.0 |

Source: Field survey, 2012

The entries in table 3 indicated that overwhelming proportion of the respondents (92.7%) readily had contacts with the extension agent, and majority (76.7%) usually had frequent contact with extension agents on monthly bases. The level of contact with extension agent is also significantly and positively associated with adoption of improved technologies. This result is in line with those of Van dan Ban and Hawkins (2006) who affirmed that frequent contact with extension agents had significant effect on adoption

**Table 4: Distribution of respondents based on stages and levels of adoption of various improved potato production technologies**

| Improved technologies | Not aware=1 | Aware stage=2 | Interest stage=3 | Evaluation stage=4 | Tried stage=5 | Adoption stage=6 | Sum | Mean | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Planting of Improved varieties | 19(12.7) | 96(64.0) | 1(0.7) | _ | 13(8.7) | 21(14.0) | 405 | 2.7 | **Low** |
| Timeliness in planting | 15(10.0) | 79(52.7) | 2(1.3) | _ | 29(19.3) | 25(16.7) | 474 | 3.2 | **Moderate** |
| Recommended spacing | 35(23.3) | 59(39.3) | 3(2.0) | _ | 23(15.3) | 30(20.0) | 457 | 3.0 | **Moderate** |
| Planting pattern | 40(26.7) | 50(33.3) | 6(4.0) | 1(0.7) | 24(16.0) | 29(19.3) | 456 | 3.0 | **Moderate** |
| Fertilizer application | 21(14.0) | 59(39.3) | 2(1.3) | _ | 19(12.7) | 49(32.7) | 534 | 3.6 | **High** |
| Sweet potato intercrops | 49(32.7) | 41(27.3) | 2(1.3) | _ | 28(18.7) | 30(20.0) | 457 | 3.0 | **Moderate** |
| Weeding regime | 22(14.7) | 48(32.0) | 2(1.3) | 1(0.7) | 34(22.7) | 43(28.7) | 552 | 3.7 | **High** |
| Harvesting technique | 18(12.0) | 51(34.0) | 1(0.7) | _ | 24(16.0) | 56(37.3) | 579 | 3.9 | **High** |

**Source: Field survey, (2013)**

- ★ **High - Mean scores equals to or greater than 3.5**
- ★ **Moderate Adoption- Mean scores between 3.0-3.4**
- ★ **Low Adoption- Mean scores less than 3.0**

Table 4 shows the level at which the respondents adopted the various improved potato production technologies; the following improved technologies were highly adopted because their

means were either equal to or above 3.5; Fertilizer application (3.6), weeding regime (3.7) and timely harvesting (3.9). Also the following improved technologies were moderately adopters because their means scores falls between 3.0-3.4, Time of planting (3.2), recommended spacing (3.0), Planting pattern (3.0) and sweet potato intercrops (3.0). Meanwhile planting of improved varieties was rated low (2.7). This implies that majority of the sweet potatoes farmers were still using their local varieties, this can be attributed to conservativeness and fear of unknown.

**Table 5: Distribution of respondents based on their perception of the constraints**

| Constraints | Very important=4 | Important =3 | Slightly important=2 | Not important=1 | Sum | Mean | Remark |
|---|---|---|---|---|---|---|---|
| **Small farm size** | 99(66.0) | 45(30.0) | 5(3.3) | 1(0.7) | 587 | 3.9 | **Important** |
| **Cost of technology** | 42(28.0) | 75(50.0) | 25(16.7) | 8(5.3) | 451 | 3.0 | **Important** |
| **Inadequate extension contact** | 41(27.3) | 65(43.3) | 33(22.0) | 11(7.3) | 436 | 2.9 | **Important** |
| **Poor communication system** | 28(18.7) | 77(51.3) | 39(26.0) | 6(4.0) | 427 | 2.8 | **Important** |
| **Accessibility to improved varieties** | 31(20.7) | 86(57.3) | 23(15.3) | 10(6.7) | 438 | 2.9 | **Important** |
| **Technology too complex to understand** | 30(20.0) | 76(50.7) | 30(20.0) | 14(9.3) | 422 | 2.8 | **Important** |
| **Inadequacy of improved technologies** | 19(12.7) | 86(57.3) | 34(22.7) | 11(7.3) | 413 | 2.8 | **Important** |
| **Religious belief** | 13(8.7) | 31(20.7) | 21(14.0) | 85(56.7) | 272 | 1.8 | **Not important** |
| **Labour** | 11(7.3) | 94(62.7) | 28(18.7) | 17(11.4) | 399 | 2.6 | **Important** |
| **Low price of potatoes** | 22(14.7) | 98(65.3) | 15(10.0) | 15(10.0) | 427 | 2.8 | **Important** |
| **Inactive farmers association** | 33(22.0) | 93(62.0) | 19(12.7) | 5(3.3) | 454 | 3.0 | **Important** |
| **Inadequate credit** | 30(20.0) | 112(74.7) | 3(2.0) | 5(3.3) | 468 | 3.1 | **Important** |

**Source: Field survey, (2013).**

Table 4.24 shows the perception of the respondents about the constraints they faced, the following constraints were perceived as important because their mean scores were either equal to or greater than 2.5 which is the cut up mean. Small farm size (3.9), Cost of technology (3.0), Inadequate extension contact (2.9), Poor communication system (2.8), Accessibility to improved varieties (2.9), Inadequate improved technologies (2.8), Technology too complex to understand (2.8), Labour (2.6), Low price of potatoes (2.8), Inadequate credit (3.1) and inactive farmers associations (3.0). While Religious belief (1.8) was perceived as not important. Farmers perception of the constraints faced in adoption process signicantly affect the rate of adoption. This is in line with Van dan Ban and Hawkins (2002) finding that perception significantly affects adoption either positively or negatively

**Table 6 Factors affecting the rate of adoption of improved potato technologies**

| Variables | Coefficient | Z-value |
|---|---|---|
| Constant | -0.092 | -0.09 |
| Age ($X_1$) | -0.096 | -3.03 *** |
| Farm size ($X_2$) | -0.954 | 2.39 ** |
| Educational level ($X_3$) | -0.083 | 3.12 *** |
| Farming experience ($X_4$) | -0.045 | 1.69 * |
| Household size ($X_5$) | -0.161 | 2.05 ** |
| Access to extension agents ($X_6$) | -0.552 | 0.77 NS |

**Source: Field survey, (2013)**

**Pseudo $R^2$=0.131**

Note: ***= Significant at 1% **= Significant at 5% *= Significant at 10%

NS= Not significant

The result in table 6.Shows that the model had a Pearson Goodness of Fit. Test of Chi-square value of 27.23 which is significant at 1% level. The coefficient of Age ($X_1$) is significant at 1% level but negatively correlated with adoption of improved sweet potato production technologies. This implies that as the farmers get older the propensity to accept and adopt new technologies decreases. Farm size ($X_2$) was significant at 5% level, Educational level ($X_3$) was significant at 1% level, Farming experience ($X_4$) of the respondent was significant at 10% level and Household size ($X_5$) was significant at 5% level. These variables are significant and are positively correlated with adoption of improved sweet potato production technologies. This implies that these significant variables were major determinants of adoption of improved sweet potato production technologies. This agrees with the finding of Agbamu (1991) who pointed out that socio-economic and institutional factors significantly affect the level of adoption of improved packages of practices.

**Table 7: Average Marginal Effect of the significant Explanatory Variables**

| Variables | Standard Error | Z-value |
|---|---|---|
| Age | 0.01 | -3.42 |
| Farm size | 0.08 | 2.56 |
| Education | 0.00 | 3.56 |
| Farming experience | 0.00 | 2.06 |
| Household size | 0.02 | 2.16 |

Source: Field Survey, (2013)

The result on table 7 shows the marginal effects of significant factors, a unit increase in age will lead to reduction in adoption rate of the farmer's by 3.4%, which implies that as the farmers grows older, the propensity to accept and adopt new technologies reduces. Other variables like; farm size (2.56), education (3.56), farming experience (2.06) and house hold size (216) were significantly and positively related with adoption, This implies that a unit increase in all of these significant variables will automatically led to an increase in the rate adoption with the corresponding percentage values

**Table 8: Test of hypothesis**

HO -There is no significant difference in sweet potato yield before and after adoption of improved sweet potato production technologies

| **Mean scores** | **Variance** | **Z –value** | **Significance** |
|---|---|---|---|
| Before adoption74.06 | 17411.13 | -1.25 | 0.003*** |
| After adoption 95.17 | 25173.63 | | |

The result in table 8 showed a significant mean deference in yield before (74.06) and after (95.17) adoption of improved potato production technologies, significant at 1%. The null hypothesis is here by rejected and the alternative hypothesis which state's that there is significant difference in potato yield before and after adoption of improved sweet potato production technologies is accepted. Implying that adoption of improved potato production technologies had the tendency to boast potato production in the study area This result is in line with those of Alfred (2000) and IPC (2012) who pointed out that adoption of improved techniques usually resulted into increase in output, income and consequently improvement in the standard of living.

CONCLUSION AND RECOMMENDATIONS

The main difference in income of the respondents before and after adoption of improved potato technologies was an indication that adoption of improved technologies is profitable.

The conclusion is that success in achieving a viable potato production and contributing to food security depends on the level of awareness, availability of technologies, level of adoption and potato farmers' perception of the technologies

Based on the foregoing, it is recommended that constraints limiting the adoption of improved potato technologies should be addressed through holistic approach. that is, by every segment of the agricultural sector playing their roles as expected.

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