

Factors Influencing the Adoption of Orange Fleshed Sweet potato (OFSP) Production among Smallholder Farmers in Kwara State, Nigeria

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Abstract: This study aimed to determine the factors that influence the adoption of Orange Fleshed Sweet potato (OFSP) as well as the constraints to non-adoption of (OFSP) varieties among small holder farmers in Kwara State, Nigeria. Purposive sampling technique was used to collect data from one hundred and twenty (120) sweet potato farmers (sixty adopters and sixty non-adopters each). The data collected were analyzed using descriptive statistical tools like, percentage, mean scores and likert scale. The results of the study revealed that larger percent of both adopters and non-adopters of OFSP were males. Also, the majority of adopters had high knowledge, while non-adopters had moderate knowledge of OFSP. The adopters were motivated to adopt the OFSP mainly as a result of its high yield, pleasant taste, nutrient content of the roots, profit from the sale of OFSP roots and early maturing. The Perceived constraints to the adoption of OFSP by non-adopters were inadequate capital to carry out necessary farm activities, high cost of required inputs (herbicides, Organic fertilizer, and OFSP vines) for OFSP production and difficulty in integrating OFSP production technologies into existing production system. It was recommended that, concerted effort should be made to include OFSP in the mandate of extension workers and provide adequate incentives to them so that they can sensitize farmers on the importance of this crop. Also, farm inputs should be subsidized for farmers in order to promote OFSP production.

Keywords: Adoption, Orange Fleshed Sweet potato, Smallholder famers & Production.

I. INTRODUCTION

Nigeria is the second largest producer of sweet potato in the world after China with an annual output of 3.46 million metric tons per year [1]. Efforts to control vitamin A deficiency include supplementation and elemental fortification, each of which has been reported effective, but slow in combating the deficiency [2]. Recently, emphasis in many countries has been placed on supplementation programs using vitamin capsules. Though effective, there is need for repeated distribution every six months, which is costly and may not be accessed by some rural poor. Food-based

approach has been reported as the most sustainable solution to this unenviable situation of food and nutrient deficiency, especially bio-fortification [2]. Bio-fortification is used to reduce micronutrient deficiency through traditional breeding of certain crops that contain higher levels of essential micronutrients [3]. The orange-fleshed sweet potato (OFSP) variety has been biofortified to contain high levels of beta-carotene, the precursor to vitamin A [4].

Different sweet potato varieties have different concentrations of beta-carotene. Orange-fleshed sweet potato roots have a nutritional advantage over white- or cream-fleshed sweet potato roots because their beta-carotene, and therefore vitamin A, content is higher. This is evidenced by the deep orange colour of the sweet potato fleshed, which is related to the higher beta-carotene and vitamin A content. The highest beta-carotene and vitamin A content is found in the deepest or most bright orange-fleshed varieties. Orange-fleshed sweet potato roots are also a recommended source of vitamin A because they are inexpensive. Research [5] has found OFSP to be one of the cheapest sources of vitamin. It costs less than one cent per day to meet the recommended daily allowance of vitamin A for a child less than six years through the consumption of OFSP roots. In addition to providing high levels of vitamin A, OFSP roots contain high levels of vitamins B, C, E and K, all of which help protect our bodies and assist in the illness recovery process [6]. Orange-fleshed sweet potato roots also have high carbohydrate content, allowing them to produce more edible energy per hectare per day than other common sources of carbohydrates such as rice and maize.

Information about OFSP varieties have been disseminated to rural farmers in Nigeria through the awareness creation and capacity building efforts of Agricultural and rural Management Training Institute (ARMTI), Ilorin, Nigeria and other collaborating institutions. The aim is to encourage farmers to adopt and derive the full benefits of consuming its products. Adoption, is a decision-making process in which the

potential adopter takes into consideration various factors before making a choice on whether to adopt an innovation or not [7, 8]. Given the potentials of OFSP and the level of awareness created by ARMTI and other institutions, it is expected that farmers in Kwara State should adopt this variety. However, it is important to note that smallholder rural farmers routinely make complex decisions, based on a number of factors, which may either encourage or discourage adoption. Hence, interplay of several factors could affect the adoption and non-adoption of OFSP production. It is therefore necessary to determine factors that influence its adoption in Kwara State, Nigeria. Specifically, this study sought to: determine factors motivating farmers' adoption of OFSP and; identify perceived constraints to the adoption of pro-vitamin A bio-fortified OFSP.

II. MATERIALS AND METHODS

2.1 The Study Area

This study was carried out within Ilorin metropolis. Ilorin is the capital of Kwara State, Nigeria. The metropolis comprises of three 3 Local government areas namely; Ilorin West, Ilorin East and Ilorin South. The choice of Ilorin metropolis for this study was deemed to be appropriate given its antecedent in sweet potatoes production and marketing. Kwara state has a population of about 2,371,089 with a total landmass of 32,500square kilometres, most of which is arable [10]. The State has bimodal climatic seasons, the dry season and wet season with annual rainfall ranging between 1,000 and 1,500 mm while the average temperature lies between 30°C and 35°C. The climate is conducive for fish farming [11]. The rainy season lasts between April and October while the dry season starts in November and ends in March of the following year.

2.2 Sampling Procedure

Multi stage sampling procedure was used to select respondents for the study in Kwara State, Nigeria. The three Local Governments (LG) within Ilorin metropolis, in Kwara State was purposively selected because of the high level of cultivation of sweet potato. Two communities were further selected randomly from each of the local government in the study area. In each of the six 6 communities selected, 20 swetpotato farmers were selected, given a total of 120 (sixty (60) adopters and sixty non adopters of OFSP) sweet potato farmers and this represents 74.53% of the total population of 161 of registered sweet potato farmers in the study area. It is important to note that, the adopters who were interviewed for this study were sweet potato farmers who planted the different varieties of sweet potato (OFSP inclusive) for at least one year. The non-adopters were sweet potato farmers who are aware of OFSP but did not plant the OFSP variety.

2.3 Data Collection and Analysis

The research is based on primary data which was collected through intensive field surveys, using structured questionnaires. Data collected were analysed using the

descriptive statistics such as frequency, mean and percentage for socio – economic characteristics). To ascertain motivating factors to the adoption of OFSP, the adopters were asked to indicate their opinion on a five point Likert-type scale; to a very great extent = 4, to a great extent = 3, to a moderate extent = 2, to a little extent = 1 and no extent = 0. The mean cut-off point was 2.0. Variables with mean scores equal to and above 2.0 were regarded as motivational factors, while variables with mean scores less than 2.0 were regarded as non-motivational factors to the adoption of OFSP. The perceived constraints to the adoption of OFSP by the non-adopters, in the order of severity were determined through 4point severity score analysis

The following scaling points were adopted: very severe (4), severe (3), less severe (2), not severe at all (1).

The severity levels were determined thus;

$$\bar{x}_s = \frac{\sum fn}{nr} \quad \text{-----} \quad (1)$$

Where \bar{x}_s = mean score; Σ = summation; f = frequency; n = severity nominal value; nr = number of respondents.

III. RESULTS AND DISCUSSION

3.1 Socio –economic Characteristics of OFSP Famers in Ilorin, Kwara State.

The socio-economic characteristics of the OFSP farmers in the study area was explored under the following sub headings: Age, Sex, Marital Status, Level of Education, Household Size, and Years of Experience. These were presented in Table 1.

Table 1: Socio-economic characteristics of OFSP famers in Ilorin, Kwara State

Parameter:	Adopters (%)	Non-adopters (%)
Age (years)		
<30		6.8
30-39	7.9	40.9
40-49	30	35.5
50-59	25.6	6.5
>59	36.5	10.3
Mean age	53	42
Sex		
Male	76	66.4
Female	24	33.70
Marital Status		
Married	84.5	96.6
Single	15.5	3.30
Level of Education		
No formal education	5	5
Adult Edu.	12	15
Primary Edu.	20	14
Secondary Edu.	60	63

Tertiary	3	3
Household size		
1-5	10	3.3
6-10	24.5	32.2
Above 10	65.5	64.5
Mean household size	9	9
Years of farming experience		
1-5	4	7.9
6-10	20	10
11-15	15.1	11.2
>15	60.9	70.9
Major crops grown (%)		
Sweet potato	26.7	0%
Yam	17.8	11
Cassava	27.5	35.8
Rice	3.2	6.5
Maize	24.8	46.7

Field Survey, 2021

The mean age of adopters and non-adopters of OFSP was 53 and 42 years, respectively (Table 1). The non-adopters of OFSP were generally younger than the adopters and as such were predominantly in their economically active age and would be more open to accepting innovations. However, the older farmers who are more experienced probably adopted the OFSP variety because of its long-term benefits, especially its health potentials in terms of combating vitamin A deficiency.

The majority of both adopters (76%) and non-adopters (66.4%) of OFSP in the study area were males. The low adoption rate among women may be due to their limited access to information, time constraints, poor education, lack of decision-making power, access to production resources and socio-cultural values and norms. This is in consonant with the finding of [12].

For the adopters, 60% of the farmers had at least secondary school education, while 20% of the respondents had primary school education. While the non-adopters had 63% and 14% secondary and primary education respectively. Educated farmers were found to adopt the improved variety more than the less educated ones. This is expected as education complements ones' ability to receive, decode and comprehend information relevant to making decisions on adopting the OFSP variety. Adeola et al. (2019) [8] found that formal education increased the adoption of improved sweet potato varieties among farmers in Nigeria.

The mean household size for both adopters and non-adopters was nine (9) persons indicating the availability of household labour for the production of OFSP. Although household size generally influences the adoption process positively, non-adopters large household size did not cause them to adopt the

OFSP. This situation buttress the fact that a single factor does not determine adoption.

Furthermore, 26.7% of the adopters cultivated sweet potato as a major crop alongside cassava and maize. However, all non-adopters indicated cultivating sweet potatoes as a minor crop. This may be the reason why they have not adopted the OFSP variety.

Table 2: Knowledge of adopters and non-adopters on OFSP production techniques

Knowledge statement	Adopters (%)	Non-adopters (%)
OFSP propagation involves the use of vine cuttings	98	98
Land preparation for OFSP production involves clearing so as to remove weeds and also limit the impact of some weed-borne pest	98	96.8
OFSP vines can be generated from OFSP roots	97.9	86
OFSP is grown on ridge or mound	90	85.5
It is good to plant OFSP one month before rainy season and without watering.	25.6	6.5
OFSP vines should be planted horizontally in the soil.	73.4	53.3
Plants should be spaced at about 30 cm apart in rows and 100 cm between rows	80	70
It is good to water OFSP vines after planting to avoid death.	97	96
It is not good to add manure before planting but can be added after planting.	76	66.4
It is good to stop watering one month before harvest to avoid root rot and delay in enlargement of root.	54	33.70
Manual weeding is the only means of removing weed.	80	70
To prevent disease and pest incidence, it is good to rotate OFSP with other crops every year.	84.5	66.6
Planting a green manure crop after harvest helps to suppress any re-growth of weeds and add to soil nutrient.	56.5	63.30
Planting disease free vines cannot control disease	44	33
Use of every kind of inorganic fertilizer is recommended	60	30
Earthening-up practice is not good for OFSP production	60	50
Rain-fed production of OFSP involves planting around February and March	58	43
It is only long vine cuttings that have 10-20 nodes should be used in propagation	60	63
OFSP is mature for harvest 3 months after planting.	70	33
Any diseased plant should not be planted	93	80
It is better to store OFSP in a less-ventilated place and high temperature.	32	33.3

Field Survey, 2021

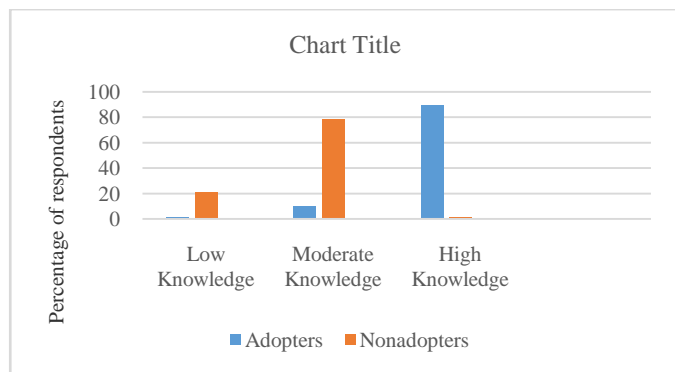


Fig. 1: Knowledge level of respondents

Figure 1 shows the knowledge level of adopters and non-adopters on OFSP production. The majority (89%) of adopters had high knowledge while 10% of them had moderate knowledge of OFSP production. very little (1%) of them had no knowledge of OFSP production techniques. On the other hand, the majority (78.0%) of the non-adopters had moderate knowledge while 21.0% of them had low knowledge of OFSP production techniques. The adopters have a relatively higher knowledge of OFSP production techniques than the non-adopters. Also, the non-adopters had a fairly high knowledge of OFSP production techniques. Most of the non-adopters cultivated sweet potato as a minor crop hence the reason for the high knowledge recorded by the non-adopters. This indicate that, their inability to adopt OFSP production is not based on low knowledge of sweet potato production practices but probably for other reasons. The adopters of OFSP variety with no knowledge of OFSP were part-time farmers who viewed farming as a hobby and not necessarily a means of livelihood.

Table 3: Motivational factors influencing the adoption of OFSP production

Variables	Mean	Std deviation
Combats vitamin. A deficiency	1.27	0.653
Nutrient content of OFSP roots	2.88*	0.573
High yield of OFSP	2.93*	0.721
Pleasant taste of OFSP of roots	2.90*	0.661
Profit from sale of OFSP roots	2.17	1.351
Early maturing	2.66	0.738
Profit from sale of OFSP vines	1.27	0.650
High consumer preference	0.38	0.991
Availability of market for the sale of OFSP product	1.83	1.841
Adequate knowledge of OFSP	1.40	0.872
Relative cheaper cost of innovation	0.53	1.434
Simplicity in using the recommended production practices	1.98	1.871
Moderate price of herbicide	0.78	1.761
Moderate price of inorganic fertilizer	0.91	1.88
Access to OFSP vines	0.13	0.731

Availability of OFSP vines	0.41	1.293
Availability of credit	0.81	1.788
Availability of labour	0.13	0.507
Other health benefits of OFSP	0.16	0.771

*Mean cut off point ≥ 2

Some of the factors that influence the adopters' interest in OFSP production include high nutrient content, pleasant taste and higher yields than other sweet potato varieties. The high yield of OFSP variety increases the farmer's chances of profit. Findings [13, 14] have highlighted that a key determinant of the adoption of a new technology is the net gain to the farmer. Studies [13, 14,] also noted that farmers would be motivated to adopt sweet potato varieties with higher yield potential, pleasant taste and earlier maturity date, in addition to other favourable characteristics. Furthermore, this study reveals that, adopters of the biofortified OFSP cultivate the variety not necessarily because of its health benefits, in terms of combating vitamin A deficiency (one of the major reasons for promoting its adoption).

Table 4: Perceived constraints to the adoption of OFSP among non-adopters

Variables	Very serious	Moderately seriously	Not serious	Rank
Low consumer preference associated with OFSP roots	30(50)	30(50)		9 th
Low consumer preference associated with OFSP product	28(46.7)	20(33.3)	12(20)	10 th
inadequate market for increased quantity of OFSP produced	49 (81.7)	11(18.3)	-	5 th
Unpleasant taste of OFSP	20(33.3)	25(41.7)	15(25)	11 th
Inadequate capital to carry out necessary farm activities	55(91.7)	03(5)	02(3.3)	1 st
Low soil fertility	45(75)	7(11.7)	8(13.4)	6 th
High cost of OFSP vines needed for planting	40(66.7)	20(34.3)	-	7 th
High cost of inputs (herbicide, inorganic fertilizer)	50(83.34)	08(13.3)	02(3.3)	2 nd
Difficulty in integrating OFSP production technologies into existing production system	50(83.3)	07(11.7)	03(5)	3 rd
Lack of knowledge of OFSP	35(58.3)	20(33,3)	5(8.4)	8 th
High cost of labour	45 (75)	7 (11.7)	8(13.4)	4 th

Source: Field Survey, 2021. Values in parenthesis are percentages

Farmers' perception about the characteristics of an innovation may either encourage or hinder its adoption [14]. Perceived

difficulties in innovation can hinder its adoption. The non-adopters of OFSP production in the study area cited the inadequate capital to carry out necessary farm activities in the production of OFSP as well as high cost of inputs (herbicide, inorganic fertilizer and OFSP vine) as major barriers hindering their adoption of OFSP production. The difficulty in integrating OFSP production into existing production system is another factor militating against farmers' adoption of OFSP. The non-adopters of OFSP noted that the high costs of labour as well as perceived inadequate market for OFSP discouraged them from adopting it.

IV. CONCLUSION AND RECOMMENDATIONS

High yield, profit from sales of OFSP as well as the pleasant taste of OFSP are main among the factors that encouraged adoption of OFSP. The non-adopters were constrained to adopt production of OFSP by inadequate capital to carry out necessary farm activities in the production of OFSP as well as high cost of inputs (herbicide, inorganic fertilizer and OFSP vine). Difficulty in integrating OFSP production into existing production system and high costs of labour as well as perceived inadequate market for OFSP roots are other factors militating against farmers' adoption of OFSP production. The major motivating factors for adopting OFSP showed that adopters of the biofortified OFSP cultivate the variety not necessarily because of its health benefits, in terms of combating vitamin A deficiency (which is one of the major reasons for promoting its adoption), but for other reasons. Hence it is recommended that, government should include OFSP in the mandate of extension workers and provide adequate incentives to them so that they can sensitise farmers on the importance of this crop. Also, farm inputs should be subsidised for farmers in order to promote OFSP production. Also, farmers should be properly educated by extension agents on the benefits and advantages of OFSP especially as it concerns reducing VAD deficiency among pregnant women and children under five years of age. This will encourage more farmers to adopt and scale up production of OFSP.

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