

Improving Farmers' Propensity to Innovate for Up Scaling Orange Fleshed Sweet Potato Varieties in Benin

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ABSTRACT

The aim of the study was to analyze the influence of farmers' propensity to innovate on their choice to adopt Orange Fleshed Sweet Potato (OFSP) varieties following the awareness campaign. One hundred and eighty farmers were interviewed using a questionnaire. Descriptive and logistic regression analyses were carried out. Most farmers had an average propensity to innovate. The level of propensity to innovate and adoption rates increased after the campaign. The logistic regression model revealed that the age of the farmers, their involvement in the awareness campaign, the extent of area allocated to sweet potato farming and their level of propensity to innovate influenced the adoption decision. Older farmers who participated in the awareness campaign, cultivated sweet potatoes on small areas and had a relatively high propensity to innovate were more likely to adopt the OFSP. Despite adoption, OFSP acreage remains low. Popularizing OFSP varieties is still needed to create demand and increase production.

Keywords: Farmer innovation, Orange-fleshed sweet potato, Propensity to innovate.

INTRODUCTION

Local underused crops remain of marginal importance in production systems (El Bilali et al., 2024). They are usually not widely adopted by farmers or are only produced in small quantities. However, they represent the future of agriculture and should be massively grown (Gregory et al., 2019) owing to food insecurity. Achieving food security is an increasingly crucial challenge, particularly with respect to climate change. The prevalence of undernourishment, which had remained roughly stable for five years, increased by 1.5 percentage points in 2020 to approximately 9.9 percent, and the covid-19 pandemic has made the challenge even more difficult (FAO et al., 2021). In the context of climate change, productivity is decreasing, crop quality is declining, food is scarce, and prices are rising, depriving part of the population of adequate nutrition. In response, farmers are using intensive farming methods that further deteriorate soil and climate (Kakpo, 2021). The result is a vicious circle that affects African populations, especially poor communities, who are the most vulnerable to this situation. Given this critical situation, the valorization of underused or neglected crops is strongly encouraged (Akinola et al., 2020; Gregory et al., 2019; Baldermann et al., 2016)

Neglected crops are those that have been ignored by agricultural policies and the scientific research community for a long time (Imathiu, 2021; Tadele, 2019). They have been cultivated for centuries by local communities and are, therefore, of symbolic importance (Kumaresan et al., 2024, Akpavi et al., 2013). To survive, these crops must adapt to local conditions and grow under harsh conditions. They are often used as bridging crops or as insurance and sold in the case of unforeseen circumstances (Talucder et al., 2024). Therefore, the promotion of neglected crops has many nutritional and economic advantages (Borelli et al., 2020). Policies and projects are increasingly moving in this direction; however, scaling up these crops is a difficult task. Communities have ensured the survival of neglected crops but only in small quantities. They tend to focus on the more lucrative main crops, whose cultivation is institutionalized and therefore less risky. To promote a neglected crop sector, farmers need to be innovative in addressing technical and economic challenges (Fadeyi et al., 2022; Low and Thiele, 2020; Moumouni et al., 2019, Baco et al, 2013, Egah et al, 2012).

In West Africa, small-scale farmers play an important role in the knowledge management and innovation

processes (Kommey and Fombad, 2023; Labarthe and Moumouni, 2008). When an innovation is introduced, farmers are responsible for adopting and adapting it (Sui and Gao, 2023; Toillier et al., 2018). The widespread adoption of innovation will lead to growth in the agricultural sector. Rogers (1962) mentioned in his theory of the diffusion of innovations that farmers' adoption of innovations was linked to their tendency to innovate, known as propensity. Differences in propensity levels explain variations in the decision to adopt (Dosso et al. 2023; Kapoor et al., 2014). Nevertheless, farmers' propensity to innovate is generally not considered in recent theories of innovation adoption (Foguesatto et al., 2020). This study aims to establish the extent to which propensity is a factor in adoption. In this study, farmers' propensity to innovate was defined as their predisposition to adopt OFSP varieties.

In sub-Saharan Africa, sweet potato is a staple crop, which is an important source of energy in the human diet owing to its high carbohydrate content. It offers many advantages owing to its ability to adapt to different environments and agro-systems, its productivity, and its short growth cycle (Kumaresan et al., 2024; Sanoussi et al., 2016). OFSP varieties are particularly interesting. They are extremely rich and nutritious and are recommended for pregnant women and children under five (Mulwa et al., 2023; Low et al., 2009). They have a high content of provitamin A, carotenoids, and are easily absorbed by humans. Therefore, they can be used to combat certain diseases such as blindness or stunted growth. Therefore, OFSP varieties are recognized for their usefulness in the fight against food insecurity and are increasingly attracting the interest of researchers (Girard et al. 2021; Jenkins et al., 2018; Low et al., 2017). However, in West Africa, only white-fleshed varieties are widely produced by farmers and are consumed by communities (Sohindji et al., 2022).

To address this shortcoming, the sweet potato project was implemented in Benin, Niger, and Nigeria. Launched in 2019, it aims to strengthen the biofortified sweet potato value chains to improve the nutrition of women and children. Previous studies have shown that OFSP varieties grow little, particularly in Benin. In addition, the sweet potato farming sector remains traditional. Therefore, an awareness-raising campaign was launched to reach communities and bring about change. Specifically, the goal was to improve farmers' propensity to innovate and encourage them to adopt OFSP varieties.

This study was conducted to analyse the influence of farmers' propensity to innovate on their decision to adopt OFSP varieties in response to the awareness campaign. The research questions were as follows: How do awareness campaigns enhance farmers' propensity to innovate in the OFSP sector? What factors influence farmers' decisions to adopt OFSP varieties?

METHODOLOGY

Study area

This study was conducted in the Benin Republic of West Africa. The country is located between latitude 9.322048 and longitude 2.313138, with 12 departments organized into seven agricultural development regions. Agriculture is mainly rainfall-dependent and generates approximately 70% of employment and 30% of GDP. Cotton, cashew, and soyabean are the most important export crops, whereas maize, cowpea, cassava, and rice are the main food crops.

This study was conducted in the Sweet Potato project intervention areas: Alibori, Atlantique, and Oueme. The department of Alibori is in the northeast and has a Sudano-Guinean climate. Atlantic and Oueme, however, are in the south and have a sub-equatorial climate. The choice of region helped us understand the national picture.

Sweet potatoes are grown on ridges in the south and mounds in the north. Regardless of region, sweet potato production requires little investment and is generally performed by small-scale producers over small areas. Production in the three departments is 27,366 tons in 2022, with a sown area of 4,087 hectares, around half of the national production (56,590 tons on 10,597 hectares). It is known as an "emergency crop" and is therefore mainly grown for home consumption. Farmers often sell it to meet unforeseen expenses (illness, accidents, ceremonies, etc.), even though some farmers decide to grow sweet potatoes with the intention of marketing. However, sales are limited by difficulties with root conservation. There are various local varieties of different colours, but the most widely eaten are white-fleshed.

The Sweet Potato project carried out an awareness-raising campaign in each area. This involved meeting influential members of the community to explain the project, its objectives, and its activities. Key farmers were identified, and the benefits of OFSP production, commercialization, and consumption were exposed. Finally, three interviews with experts were broadcast in local languages twice a week for one month on the radio. Expert interviews addressed the benefits of OFSP varieties, production techniques, consumption habits, and myths. The themes were selected based on stakeholders’ needs assessment.

To analyse OFSPs’ adoption, farmers who grew sweet potatoes (white-fleshed and orange-fleshed varieties) were interviewed. In each area, 60 farmers were randomly selected, for a total of 180 farmers. Half of the participants were involved in awareness campaigns. They were identified by extension agents as being able to induce changes in OFSP production systems. They previously received visits from agents, providing them with information about the advantages of OFSP varieties. They were also informed of the broadcasting of OFSP varieties, farming practices, and consumption habits. They were registered in the project directory and identified through random sampling. The other farmers were identified by snowball sampling because of the lack of a list of sweet potato farmers in the intervention areas, meaning that the interviewed farmers were requested to provide information on the next.

Data collection

The data were collected using structured questionnaires. The questionnaire was uploaded to the kobo collection to facilitate access and creation of the database. To establish a comparison, farmers’ propensity to innovate and the rate of adoption of OFSP varieties were assessed before and after the awareness campaign. The data were collected in two stages. The survey involved three interviewers (one per area) and was conducted over two weeks.

The data collected included the socio-professional characteristics of farmers, their propensity to innovate, and the intention to adopt and consume OFSP varieties. The propensity to innovate was assessed using a Likert scale. The scale used to measure the propensity to innovate included six items with possible answers ranging from 1, which does not correspond at all, to 7, which corresponds very strongly.

The first step in data analysis was to process the data using a Likert scale. Sampling adequacy (Kaiser-Meyer-Olkin index: KMO), internal cohesion (Cronbach's alpha), and Bartlett's test of sphericity were tested. The KMO score was excellent (P = 0.82). Cronbach's alpha was accepted as equal to 0.90, and Bartlett's sphericity test was significant (p=0.003). The items were therefore validated and then aggregated into a single variable "propensity". The propensity to innovate, decision to adopt OFSP, and decision to consume OFSP were first processed using descriptive statistics, including figures. In the second step, logistic regression was used to analyse the factors influencing farmers’ decisions to adopt OFSP varieties. Table 1 shows the variables included in the logistic regression model and the meaning or measurement levels.

Table 1: Variables included in the logistic Regression Model and Hypotheses

Variables	Measurements	Hypotheses
Age	Number of years	Older people may reject OFSP because of conservative attitude
Sex	Female (0) or Male (1)	Female farmers may adopt OFSP because of its nutritional value exceptionally important for women and children
Presence of children under five in the household	No (0) or Yes (1)	The heads of households with children under five may be more willing to adopt OFSP for its nutritional value for these children

Area allocated to sweet potato	Number of hectares	Farmers allocating more land to sweet potato may be willing to adopt OFSP for its commercial value
Involvement in the awareness campaign	No (0) or Yes (1)	The awareness campaign may determine farmers' intention to adopt OFSP by enhancing their knowledge on its values
Propensity to innovate	Extremely low (1), Very low (2), Under average (3), Average (4), Above average (5), Very high (6), Extremely high (7)	Higher propensity to innovation may result into decision to adopt OFSP
Decision to adopt OFSP	No (0) or Yes (1)	

RESULTS AND DISCUSSION

Impact of the Campaign on Farmers' Propensity Level

Figure 1 shows that 35.7% of farmers had an average propensity level, and 38.8% had an above-average level before the awareness campaign. The propensity level of the farmers who participated in the awareness campaign increased after the activities. 56% of them had an above-average propensity to innovate after the campaign. Furthermore, 8% of the participants had a very high level, as opposed to 1.6% of the farmers before the campaign. For farmers who did not participate in the awareness campaign, the propensity level remained the same before and after the activities. Therefore, awareness campaigns have increased the propensity of farmers.

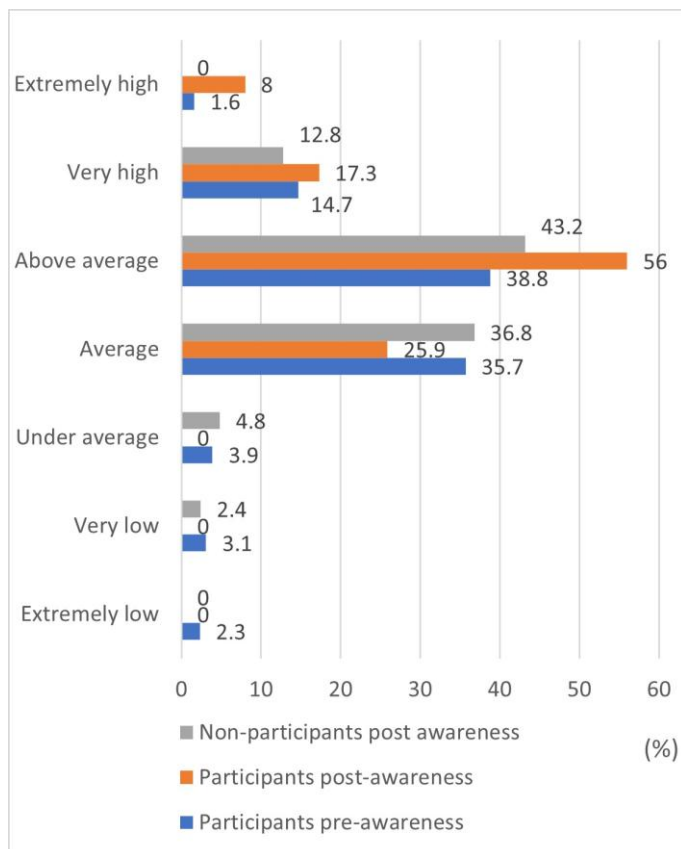


Figure 1: Impact of the Campaign on Farmers' Propensity Level

The campaign provided the information and knowledge needed to reassure farmers and encourage them to adopt and consume OFSP varieties.

Farmers’ decision to adopt and consume OFSP

Figure 2 shows that 71.5% of the farmers who decided to grow OFSP varieties attended the awareness campaign. The tendency to consume OFSP was more balanced. In fact, 54.5% of the campaign participants decided to consume OFSP.

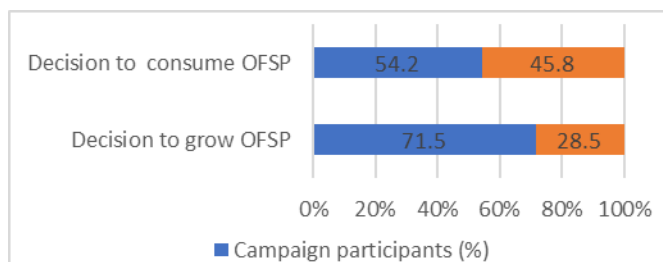


Figure 2: Farmers’ Decision to adopt and consume OFSP

Factors influencing the Decision to adopt OFSP Varieties

The logistic regression model used to analyze the influencing factors was valid (likelihood ratio test = 206.38, Hosmer and Lemeshow=0.57, $R^2=0.35$). 35% of the observed variations in farmers’ decisions to adopt OFSP were explained by selected independent variables. The factors influencing the decision to adopt OFSP varieties were the age of the farmers, their involvement in the awareness campaign, the extent of the area allocated to sweet potato farming, and their level of propensity to innovate (Table 2). Gender and the presence of children under five years of age in the household were not significant.

Table 2: Factors influencing the Decision to adopt OFSP Varieties

Predictors	B	Exp (β)	Sig
Constant	-4.72	0.01	0.00*
Age	0.52	1.68	0.03*
Sex	0.33	1.39	0.48
Presence of children under five in the household	-0.29	0.75	0.51
Area allocated to sweet potato	-0.35	0.71	0.03*
Involvement in the awareness campaign	1.08	0.34	0.00*
Propensity to innovate	0.79	2.2	0.00*

*: Significance at 5%.

Adoption decisions did not vary across genders, meaning that farmers intended to adopt OFSP regardless of their sex. The nutritional value of OFSP does not make it a crop of interest for women only. Older farmers were surprisingly more likely to adopt OFSP because they had more experience. One would think that children’s nutrition is a common focus for all household members. However, the presence of children under five years of age did not significantly influence OFSP adoption. Sweet potato varieties are generally valued by local communities because of their high energy. Their contribution to food security is also acknowledged given that they are considered hunger gap crops.

Farmers growing sweet potatoes over large areas are less likely to adopt OFSP varieties. They generally grow sweet potatoes in the market. They prefer varieties that are already well known to buyers and consumers to avoid

the risk of mis-sale.

Farmers who participated in the awareness campaign were more likely to grow OFSP variety. The awareness campaign played a key role in enhancing people's knowledge of good agricultural practices and the nutritional value of OFSP. Subsequent changes in farmers' representation have resulted in a high propensity to innovate. Farmers with a relatively high propensity to innovate were more likely to grow OFSP varieties with project support.

In summary, the results of this study show that older people who grew sweet potatoes in small areas and were exposed to sweet potato project awareness campaigns were likely to adopt OFSP varieties because their propensity to innovate increased.

Constraints against youth involvement in sweet potato production include poor motivation and poor access to information from extension agents (Onu et al. 2024). Like most underutilized crops, OFSP varieties have long been neglected in research and extension services. OFSP is usually considered a poverty-poor crop, which is useful only for periods of food shortage periods (Uzokwe et al., 2021; Low et al., 2009). Farmers lack new technologies to improve their production systems (Tadele, 2019). To address this shortcoming, local communities use indigenous knowledge to ensure the survival of their varieties (Kumaresan et al., 2024).

The lack of knowledge on good agricultural practices therefore limited the development of the OFSP sector (Kumaresan et al., 2024; Sanoussi et al., 2017). The awareness campaign enhanced farmers' knowledge of advanced farming practices and nutritional value of OFSP. This campaign played a crucial role in encouraging farmers to adopt OFSP variety. According to Houaga and Moumouni-Moussa (2023a), enhancing farmers' knowledge improves their feelings of competence, strengthens their attitude toward seeking opportunities, and, subsequently, their propensity to innovate. The propensity to innovate is a key element in understanding farmers' technology adoption decision-making processes (Houaga and Moumouni-Moussa, 2023b).

Despite the success of the awareness campaign, most farmers tend to grow more white-fleshed sweet potatoes, which are popular among consumers (Brouwer, 2021; Doussoh et al. 2016). Consequently, the OFSP acreage remained low. The Sweet Potato Project aimed to improve the food situation of the most vulnerable communities in rural areas. However, our study reveals that OFSP varieties can be successfully scaled up if the commercial value is enhanced in farmers' communities. Farmers' decisions to adopt new varieties are significantly influenced by their access to the market (Tekeste et al., 2023). The popularizing nutritional value of OFSP for everyone, not only women and children, can foster demand (Brouwer, 2021; Adesina et al., 2017).

OFSP varieties are particularly interesting because of their high food and nutritional potential, which can help achieve food security. They are particularly beneficial for women and children (Sohindji et al., 2022). However, these advantages are not sufficient for farmers to foster the development of value chains associated with the crop, explaining why the presence of children under five in the household did not significantly influence OFSP adoption. All varieties of sweet potatoes are valued in local communities because of their high energy. Their contribution to food security is also acknowledged, given that they are considered hunger gap crops (Uzokwe et al., 2021; Dansi et al., 2012). Awareness-raising efforts need to continue to enhance the knowledge of more people regarding the specific value of OFSP, foster local demand, and increase the commercial value of OFSP. Perceived capability significantly predicted household decisions to grow orange-fleshed sweet potatoes (Sulaiman et al., 2020). Therefore, combining an awareness-raising approach with other extension services such as technical capacity building and knowledge sharing can strengthen farmers' innovation propensity (Dosso et al, 2024; Moumouni and Labarthe, 2013).

CONCLUSION AND RECOMMENDATIONS

This study demonstrates the role of the propensity to innovate in the adoption of OFSP varieties. The findings show that, although farmers' propensity to innovate is average, it is a significant factor explaining the adoption of OFSP varieties. However, the adoption rate increased when farmers had access to relevant information and knowledge of OFSP production systems. Therefore, strengthening farmers' capacity to innovate is also important for the propensity to innovate to enable the wider adoption of OFSP varieties. Additionally, fostering local

demand among the wider public is required to bring about sustainable changes in the OFSP sector.

Future studies could examine farmers' propensity in multiple regions or countries based on comparative approach and provide deeper insight into the topic. Furthermore, the analysis of longitudinal data would provide a clearer picture of long-term adoption trends and sustainability of innovations among farmers.

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