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ADOPTION OF PARABOLIC SHAPED SOLAR DRYER FOR DRYING UNRIPED PLANTAIN CHIPS IN OBIO-AKPOR LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA

*Elemasho, M.K., ** Alfred, S.D.Y., ** Fasina, O.O., *Abdulbaki, M.K., *Nwahia, O.C., *Aneke, C.C., * Iordekighir, A.A., *Salami, D.O., *Chugali, A.J.C and Mandu, I.E.
*Nigerian Stored Products Research Institute, Port-Harcourt, Rivers State, Nigeria
** Federal University of Technology, Akure (FUTA).
E-mail: emulkat@gmail,com, 08166991167

Abstract
The study focused on adoption of NSPRI Parabolic shaped dryer for drying of unriped plantain chips in Obio-akpor Local Government Area (L.G.A) of Rivers State, Nigeria. The Population for this study consisted of all plantain farmers in Obio-Akpor Local Government Area of Rivers State. Purposive and snow-ball sampling techniques were used to select 108 unriped plantain chips processors in Obio-akpor L.G.A as sample size. A structured questionnaire was used to obtained information from the respondents and analyzed using percentages and mean. The result from the study revealed that, 44.4% of respondants was aware of the technology. Co-processors (25.4%) were the major source of awareness of the technology. The results further revealed that, 35.2% of the respondents adopted the technology. The Technology adoption level was low with 48% adoption rate. The major constraint to adoption was lack of awareness of the technology. Therefore, extension department in NSPRI should intensify efforts in awareness campaign of the Institute's technologies to improve on the level of awareness of this NSPRI technology.
Keywords: Adoption, solar-dryer, Undriped plantain, chips, drying

1.0 Introduction

Improper drying of agricultural produce has been identified as one of the major causes of spoilage of agricultural crop produce in Nigeria. Barbara (2019) stated that one of the major challenges of Agricultural produce after harvest is high level of moisture contents and if not properly processed by adequate drying to a safe moisture content, it could result to high rate of post-harvest losses. Sun drying is one of the traditional methods adopted by most processors in processing agricultural produce to safe moisture content

level in developing countries. The reason could be because sun drying method is cheaper, and does not required the need for technical know-how and has unlimited space for drying (Okonkwo, 2022). Sun drying method involves exposure of the agricultural crop produce to the air under sun or in shade to achieve desired moisture content in crop produce. Generally, traditional methods of drying crops are known to be slow, inefficient and lack of quality assurance due to prolonged exposure to climatic factors, insect pest attack and destruction by micro-organisms (Elemasho et al., 2022), especially in high humidity areas.

Meanwhile, Rivers State is known for its high humidity, being among the coastal States in Niger Delta Region of Nigeria. Niger Delta is known as one of the largest wetlands of the world and characterized with high humidity (Elekwachi et al, 2019). In order to enjoy drying of agricultural produce to safe moisture contents and without contaminating the quality of agricultural produce to be used in the coastal area, improved methods of drying need to be employed.

Solar drying method is one of the improved drying methods for agricultural crop produce. Solar dryer is a technology that can harness the solar energy to dry agricultural crops for preservation or a device which makes use of solar energy and tap it to dry different kinds of agricultural produce, specifically food. Solar dryers make use of the heat from the sun to reduce the food's moisture contents (Kamran, 2022).

Plantain (Musa parasidiaca) is one of the agricultural crops that is predominant in Southern State of Nigeria, with Rivers State inclusive. Plantain is highly important and valued within the State, as such it can be consumed in different forms such as plantain chips (fried unriped), “booli” (roasted unriped) and “dodo” (fried riped) and plantain

flour (flour from dried unripe plantain chips). In Rivers State, Plantain is among the foods that must be served during occasions/ceremonies in the State, be it birthday, burial or wedding ceremonies. But, one of the limitations of plantain, is that it deteriorates immediately after ripening if not consumed or processed, and the worse thing, is that the nutritional value decreases the more it ripens. It has been revealed that post-harvest losses in plantain were mostly caused by inadequate processing and storage facilities, poor access to information by the farmers, and inability to adopt new agricultural technologies (Kainga *et al.,* 2019).

1.1 Statement of the Problem

Nigerian Stored Products Research Institute (NSPRI) Management invented a solar dryer in Rumueme community in Obio-akpor L.G.A of Rivers State as a community intervention project on post-harvest losses reduction plan. The usage of the technology is free to the users, in order to encourage maximum utilization of the solar dryer by all Obio-akpor communities. Plantain being one of the staple food that deteriorates easily after harvest, needs post-harvest support technology to reduce post-harvest losses. In spite of this effort, it has been observed during preliminary study that, large quantity of the plantains harvested in the study area, become over ripped and rotten due to lack of adoption of improved technology for proper drying/processing. It is on this basis that this research work is set to carry out research on adoption of NSPRI Parabolic Shaped dryer in Obio-akpor L.G.A. of Rivers State, Nigeria.

2.0 Objectives of the Study

The broad objective of this study was to assess adoption level of NSPRI Parabolic Shaped dryer for drying of unriped plantain chips in Obio-akpor L.G.A. of Rivers State,

Nigeria. The specific objectives were to;

i. ascertain the awareness of the respondents on NSPRI parabolic shaped dryer;
ii. identify sources of awareness of NSPRI parabolic shaped solar dryer;
iii. determine adoption level of NSPRI parabolic shaped solar dryer; and
iv. identify constraints to adoption of improved plantain solar dryer in the study area.

3.0 Methodology

The study was carried out in Obio-akpor Local Government Area (L.G.A.) of Rivers State, Nigeria. It is located between latitudes $4^0 45^{'}$N and $4^0 60^{'}$N and Longitudes $6^0 50^{'}$E and $8^0 00^{'}$E. Multistage sampling procedure was used for this study. The first stage involved purposive selection of a ward (Ward 11 was selected) within Obio-akpor L.G.A. In the second stage, 4 communities were selected from ward 11(Rumueme, Rukpakani, Akwaka and Rumuchiorlu), because these were areas where plantain production is high, and also they were among the communities closer to the technology. Lastly, due to lack of registered list of members of unriped plantain chips processors within the selected communities, a snow-ball sampling technique was used to develop a list from where twenty-seven unriped plantain chips processors were selected from each community, to give a total of 108 respondents for the study. The data were collected using structured questionnaire, and analyzed using descriptive statistics such as percentages and mean.

4.0 Results and Discussion

4.1 Awareness of NSPRI parabolic shaped solar dryer

The awareness of NSPRI parabolic shaped solar dryer was analyzed using descriptive

statistics and presented in Table 1. Table 1 shows that more than half (55.6%) of the respondents were not aware of the NSPRI parabolic shaped solar dryer. This implies that many of the respondents did not know that such a technology was in existence, Awareness plays a key role and it is the first stage in adoption process (Awareness, Interest, Evaluation, Trial and Adoption). All the stages of adoption are very important to determine whether an innovation will be adopted or rejected. This support the findings of Congbin et al. (2023) that awareness of a new idea triggers the need for such innovation.

Table 1: Awareness of Unriped Plantain chips Processors on NSPRI Parabolic Solar Dryer (N=108)

Awareness of Processors on NSPRI Parabolic Shaped Dryer	Percentages (%)
Not Aware	55.6
Aware	44.4
Total	**100**

Source: Field Survey (2022).

4.2 Sources of awareness of NSPRI parabolic shaped solar dryer

Table 2 depicts that 25.4% of the respondents got aware of NSPRI Parabolic shaped dryer through co-processors and friends, while 22.4% were aware through community meeting and some (7.5%) of the respondents got aware through NSPRI Extension Officers. No respondent had awareness of the NSPRI parabolic shaped solar dryer through radio and television. This implies that there is a poor linkage between research, extension and processors in the study area and this could prevent the processors from accessing vital information on post-harvest losses reduction strategies. This could be as a result of low number of extension officers to the coverage area. Co-processors or friends as a source of awareness had the highest percentage in the study area. This implies that, there is a cordial relationship among the processors, which could promote unity and

community development, through sharing of information that will reduce post-harvest losses and increase the income of the beneficiaries. Lack of awareness could mean lack of information, which could prevent adoption of useful technologies in the study area (Asante et al., 2021).

Table 2: Sources of Awareness on NSPRI Parabolic Shaped Solar Dryer (N=108)

Sources	Percentages
NSPRI Extension Officers	7.5
Community meetings	22.4
Co-Processors	25.4
Television	0
Radio	0
No awareness	44.7
Total	**100**

Source: Field Survey (2022).

4.3 Adoption of NSPRI's parabolic shaped solar dryer

Table 3 reveals that majority (64.8%) of the respondents did not adopt the technology and only 35.2% of them adopted the technology in the study area. This corroborates with the result of Kifie et al. (2023) who reported that 29% of the respondents adopted the improved seeds. Meaning that Agriculture in Nigeria is still using simple tools and traditional methods of production and processing which will not bring effective development in agricultural sector. Most of Agricultural produce are lost at post-harvest stages due to lack of post-harvest technologies adoption (Naomi et al., 2019).

Table 3: Adoption of NSPRI Parabolic Shaped Solar Dryer by Unripe plantain processors (N=108)

NSPRI Parabolic Solar Dryer	Percentages (%)
Adopted	35.2
Not Adopted	64.8
Total	**100**

Source: Field Survey, (2022)

Table 4 shows that level of adoption is low since the adoption rate is 48%. This implies that, less than 50% of the respondents adopted the technology. This indicates that the level of adoption of NSPRI parabolic solar dryer for drying unripe plantain in the study area was low. This is not encouraging because the usage of the technology is free in the study area. From all indication, sun drying is still prevalent in the study area, therefore there could be high tendency of post-harvest losses of unripe plantain chips, giving that sun drying is very slow due to high level of humidity in the area. Also, contamination of unripe plantain chips could occurred due to high exposure of the products through sun drying. This supports the findings of Aderemi *et al*. (2021), who revealed that despite the fact that sun drying is cheap, it contaminates the drying produce with dust, bacteria and exposes the produce to insect attack. Likewise, low level of adoption in the study area could be due to lack of extension staff as a source of awareness, and it could also be attached to low ratio of extension staff per clients in Nigeria (Ifeanyi-Obi & Corbon, 2023) Ibrahim (2023) stated that, for high level of adoption to be maintained on technology and innovation, farmers need to be encouraged through extension services delivery.

Table 4: Level of adoption of NSPRI's Parabolic Shaped Solar Dryer by unripe plant chips processors (N=108)

Level of Adoption	Freq	Percentage
Low	50	100
Medium	50	0
High	50	0
Total		**100**

Source: Field Survey(2022).
NB: Low Adoption=Adoption rate of Technology < 50%, Medium Adoption= Adopti rate of Technology = 50%, High Adoption = Adoption rate of Technology > 50%

4.5 Constraints to Adoption of NSPRI Parabolic Solar Dryer.

Table 5 shows that the constraints were as follows; lack of awareness ($\bar{x}$=2.85), High cost of personalizing the technology ($\bar{x}$=2.79), Lack of fund ($\bar{x}$=2.76), Small processing capacity ($\bar{x}$= 2.73), Poor Environmental Adaptation ($\bar{x}$=2.16) and Technology in-appropriateness ($\bar{x}$=1.08). This implies that the constraints of unriped plantain chips processors in the study area were low level of awareness, High cost of personalizing the technology, lack of fund to buy unripe plantain and small processing capacity, while, technology unavailability and technology inappropriateness were not constraints to cassava processors in the study area. This supports the findings of Ewebiyi *et al.* (2020) that the constraints to cassava processors in their study area were, inadequate fund, lack of technical know-how, lack of information and high cost of purchase.

Table 5: Constraints to adoption of NSPRI Parabolic Shaped Solar Dryer (N=108)

Constraints	Mean	Standard deviation
Low level of awareness on technology	2.85	0.35
High cost of personalizing the technology	2.79	0.44
Lack of fund to buy unriped plantain	2.76	0.50
Small processing capacity	2.73	0.54
Poor environmental Adaptation	2.16	0.88
Technology inappropriateness	1.08	0.30

Source: Field Survey,(2022)

5.0 Conclusion and Recommendations

5.1 Conclusion

Conclusively from the study, the adoption level of NSPRI Parabolic solar dryer by the unripe plantain processors in the study area was low.

.2 Recommendations

It is recommended that the institute's extension Department should address awareness and campaign for improved post-harvest technologies, using the necessary media such as

Radio jingles, Face Book, Twitter and WhatsApp so as to reach a large number of beneficiaries.

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