ADOPTION OF PURDUE IMPROVED CROP STORAGE BAGS FOR MITIGATING POST HARVEST LOSSES OF SELECTED LEGUMINOUS CROP PRODUCE AMONG RURAL FARMERS IN BENUE AND TARABA STATES, NIGERIA.

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Abstract
This study was conducted to assess adoption of Purdue Improved Crop Storage (PICS) bags among rural farmers in Benue and Taraba States, Nigeria. The population of the study consisted of all leguminous crop farmers, and due to the largeness of the population, 300 respondents were selected as sample size using stratified, purposive and simple random sampling techniques. Data collected were from primary source with the use of structured questionnaire and were analyzed using both descriptive and inferential statistics, particularly frequency, percentages, Factor analysis and Kruskal Wallis. The study reveals that Socioeconomic factors such as level of education (71.0%),farm size (89.3%), marital status (78.3%) had influence on farmer's decision to reject or adopt pics bags technology. The results also revealed that (15%) of the respondent source of supply of pics bags was from dealers of pics bags, 13% of the respondents was from Ministry of Agriculture, aged 11.7% was from Agricultural extension agents. The study observed that most 36.6% of farmer in Benue and Taraba states were aware of the pics bag and of this group (2.5%) adopted pics bags within three years of introduction. It was also found that there was no significant difference($p > 0.05$) across the three agricultural zones in Benue and Taraba States, in term of factors influencing adoption of pics bags, Based on the findings of this study It can be concluded that this has played a significant effect in mitigating post harvest losses of leguminous crops produce. The study concluded that farmers who adopted pics bags experienced notable reduction in pest infestation, grain also deterioration and quantitative losses compared to those using traditional storage methods. It was recommended that farmers should be encouraged to form more cooperatives and more awareness on economic benefit of pics bags should be circulated to enable more farmers to adopt pics bags.

***Keywords**: Adoption, Purdue, post-harvest, Mitigation, Leguminous*

Introduction

Agriculture is one of the major sources of the Nigeria economy. In the course of carrying out agricultural activities in Nigeria and Benue State in particular, farmers have been adopting unacceptable agricultural practices such as traditional methods of agricultural production using hoes and cutlasses in weeding instead of using herbicides They also adopted traditional methods of storage, instead of adopting Purdue Improved Crop Storage (PICS) bags for mitigating post-harvest losses of leguminous crop produce among rural farmers in Benue and Taraba States.(Chikoye *et al.,* 2018).

According to Age.(2017), Post-harvest losses can be defined as measurable quantitative and qualitative damages or spoilage in the post-harvest value chain caused by natural or artificial phenomena. These losses affect both the quality and quantity of crop produce, thus reducing their economic value and the total income of the producers. Albeit the Pan capita agricultural productivity of leguminous crop producers seems to be on the increase in Nigeria these days, almost half of what is produced is lost due to poor handling, processing, preservation,storage,and transportation to the

markets where majority of consumers are found (Age,2017). From Agricultural extension perspective, post-harvest losses can be conceptualized as all the natural and artificial damages that occur to agricultural crop produce after harvest and can be traced from pre-harvest production value chain to post-harvest value chain, culminating at the stage of retail marketing. In modern agriculture, application of science and technology is critical,hence rural farmers are encouraged to adopt Purdue Improved Crop Storage (PICS) bags for mitigating post-harvest losses of leguminous crop produce among rural farmers and by so doing, it could lead to measurable impact in ensuring food security and long term sustainable food production (Ajayi *et al.,*2021).

The challenges of food shortage would be as a result of pest infestation ,which leads in to poor nutrition , poor income, poor state of mind,which also results to high blood pressure of so many farmers. This development is worrisome, loathsome and despicable, considering the teeming population of our country Nigeria to be fed with what is domestically produced. (Boaua *et al.,*2014). To address this issue, the Purdue improved crop storage bags (PICS) technology was developed as a cost effective, triple hermetic storage solution that enables farmers to store grains without the use of insecticides. The PICS bags have been promoted across various States in Northern Nigeria with a virus to reduce post-harvest losses and improve food security among rural farmers (Ayertey *et al.,*2020).

In an attempt to encourage agricultural production and alleviate poverty level of farmers, there is need for farmers to adopt Purdue improved crop storage bags for mitigating post-harvest losses of leguminous crop produce among rural farmers in Benue and Taraba States. Purdue improved crop storage bags are manufactured to protect leguminous and cereals crop produce from pest infestation, which reduces post-harvest losses and income generation of farmers (Fulton *et al.,*2009).

To address these challenges, Purdue improved crop storage (PICS) bags had been introduced since 2007 as a promising solution. Although a lot of research work has been carried out on post-harvest losses of leguminous crop produce by providing solution on Purdue improved crop storage bags in various parts of Nigeria, not much work has been done on adoption of Purdue improved storage bags for mitigating post-harvest losses of leguminous crop produce among rural farmers in Benue and Taraba States, Nigeria. Consequently, upon this, there is a research vacuum that ought to be filled by assessment of adoption of Purdue improved crop storage bags for mitigating post-harvest losses of selected leguminous crop produce among rural farmers in Benue and Taraba States, Nigeria.

Objectives of the Study

The broad objective of this study was to assess adoption of Purdue improved crop storage bags (PICS) for mitigating post- harvest losses of selected leguminous crop produce among rural farmers in Benue and Taraba States, Nigeria.

The specific objectives were to:

i. describe the socioeconomic characteristics of the respondents in the study area;
ii. ascertain sources of supply of Purdue improved crop storage bags among rural farmers in the study area;
iii. ascertain the rate of adoption of Purdue improved crop storage bags among rural farmers in the past four years (2021-2024) in the study area;
iv. determine factors influencing adoption of Purdue improved crop storage bags among rural farmers in the study area;

Methodology

The Study Area

This study was conducted in Benue and Taraba States, Nigeria. Benue State derives its name from River Benue, the second largest River in Nigeria .The State was created in 1976 and is located in the middle belt region, which is a transition zone between the northern and southern parts of Nigeria. It lies between longitudes 6^o31'E and 10^oE of the green witch meridian and latitudes 6^o30'N and 8^o10'N of the equator Benue State Agricultural and Rural Development Authority BNARDA, 2005). Benue State shares boundaries with other States, namely; Nasarawa to the North, Taraba to the East, Kogi to the West, Enugu to the South- West, and Cross River to the South. It also shares international boundary with the Republic of Cameroon on the South East BNARDA. (2005). Benue State has a land mass of about 33, 955km^{2}with 23 Local Government Areas. The State is divided into 3 agricultural zones, namely; Zone A (Katsina Ala, Ukum, Ushongo, Vandeikya, Logo, Kwande and Konshisha Local Government Areas), Zone B (Gboko, Tarka, Buruku, Gwer, Gwer West, Guma and Makurdi Local Government Areas) and Zone C (Ado, Otukpo, Ohimini, Obi, Ogbadigbo, Okpokwu and Oju Local Government Areas).

According to the National Population Commission .(2006), Benue State has a population of 4.219.244 million, given the annual growth rate of three percent, the World Bank (2024), that the estimated population of the State in 2017 was 5.84 million, There are three major ethnic groups in the State, namely, Tiv, Idoma and Igede, other ethnic groups are Etulo, Abakpa, Ofia and Jukun. There are also non-indigenes like the Hausa, Ibo and Yoruba (BNARDA, 2005).

The State has favourable agro-climate ecologies for arable crops, tree crops and livestock production and enjoys two distinct seasons, wet and dry seasons. The rainy season begins from April to October, while the dry season starts from November to March. Annual rainfall records varies from 1700mm in the southern to 1250mm in the Northern part with an annual temperature variation of 30^oC and 38^oC According to (BNARDA.2005) These features create favourable conditions for the cultivation of crops, such as yam, cassava, sweet potato, maize, millet, rice, soyabean, groundnut, cowpea, beans beniseed, fruit crops and vegetable crops. Livestock such as sheep, cattle, goats, pigs and poultry are kept in the State.

Benue State is blessed with abundant mineral resources in the North Central geopolitical zone in Nigeria and has many untapped mineral resources within it's territory, and these mineral resources can be found in various Local Government Areas of the State. According to BANARDA.(2005), limestone can be found in Tsekucha, near Gboko and caolinite at Otukpo are the major mineral deposits that have been commercially exploited by Dangote cement PLC, Other untapped resources in Benue State are baryte, feldspar, limestone, gypsum, natural gas, salt, petroleum, clay, coal, calcite, gemstone and magnate.

Taraba State was created out of the former Gongola State on 27 August, 1991 by the military Government of General Ibrahim Badamosi Babangida. The State is an amalgam of three former divisions, Wukari, Mambilla and Muri Divisions. Taraba State is a State in the North-Eastern Nigeria, named after the Taraba River, which traverses the Southern part of the State, and the State capital is Jalingo. Taraba State lies between latitude 6^o30' and 9^o36' and Longitude 9^o10'50' East. It has total land mass of 54.473km^2(21,032^{2}m) and world bank growth of 2024 to estimate the population of 2,294,800 based on 2006 census. The State is bounded in the North by Bauchi, Gombe and Adamawa on the North West by Plateau. The State is further bounded to the East by both Nasarawa and Benue States, while it shares an international boundary with Republic of Cameroon to the South and South East (Taraba State Catholic Relief Service .2017).

Taraba State consists of 16 Local Governments Areas, namely Bali, Ibi, Gassol, Donga, Wukari, Takum, Kurmi, Sarduna, Jalingo, Gashaka, Ussa, Ardo-Kola, Zinng, Yarro, Lau and Karim-Lamido. The major occupation of the people of Taraba State is agriculture. Cash crops produced in the State include coffee, tea, cowpea, beans, groundnut, cotton. Cash crop such as rice, maize, sorghum, millet and yam are also produced in commercial quantities (Taraba State Catholic

Relief Service, 2017).

In addition, cattle, sheep and goats are reared in large numbers, especially on the Mambilla plateau and along Benue and Taraba valleys. They also undertake livestock production like poultry and rabbit breeding on large scale. Communities living on the bank of River Taraba, River Donga and Ibi engage in fishing all year round. Other occupational activities such as pottery, cloth weaving, dying, mat making and blacksmiths are also carried out in various parts of the State, (Taraba State Catholic Relief Service, 2017).

Taraba is called the nature's gift to the nation as the State is rich and has many ethnic groups including; Jenjo, Ketub, Chamba, Mumuyes, Mambila, Wurkun, Jibu, Fulani, Jukun, Ichen, Tiv, Daka, Yandang, Tigun, Hausa and Ndola. The Northern part is mainly dominated by the Fulani and Mumuye. The Southern parts are dominated by Jukun, Chamba, Tiv, Kuteb and Ichen. The Central region is mainly occupied by Fulani, Mumuye, Ndola, Tigun, Jibu, Wurbo, and Daka people (Taraba State Catholic Relief Service, 2017).

The climate in Taraba State is marked by dry season between (November - March) and rainy season between April - October. It has an average annual rainfall ranging from 800mm - 1525mm.

The agrarian nature and rich alluvial track of soil found in most parts of the State makes the State conducive for growing of various food crop. Majority of inhabitants are farmers, civil servants and traders, some inhabitants engage in farming as a secondary occupation. The basic amenities available are schools, hospitals, electricity, Minerals and communication service among others. Some of the minerals found in Taraba State include: Limestone-used in cement production and construction, Gypsum-Essential for cement manufacturing and soil treatment, Bauxite, Granite-used for construction and decorative stone purposes, Lead/Zinc-used in batteries and metal alloys, Tin, Barite , Marble, Gold and Kaolin.

The population of this study consisted of all leguminous crops producers in Benue and Taraba States. Due to the largeness of the population of the study, a total of 300 respondents was selected as sample size using stratified, purposive and simple random sampling techniques. Firstly, Benue and Taraba States were purposely selected from the North Central, Nigeria due to high production of leguminous crop produce. Secondly, in each of the State, the population of the study was stratified into 3 agro ecological zones. In Benue State, three zones (A, B and C) were selected based on the existing structures due to heterogeneous nature of the States. In Taraba State, the stratified zones include Southern, Central and Northern zones.

Finally, in each of the States, a sampling frame was developed for each of the rural communities in their respective LGAs and using proportional allocation of 1percent (0.01) across board, a total sample size of 300 respondents was selected for the study, thereafter, each stratum was subjected to simple random sampling technique in order to arrive at the total sample size of 300 respondents

Data for this study were collected from primary sources with the use of structured questionnaire. This questionnaire consists of (4) four sections, namely; A,B,C,and D. Section A dealt with socioeconomic characteristics of the respondents in the study area. Section B centred on sources of supply of Purdue improved crop storage bags among rural farmers in the study area, Section D focused on factors influencing adoption of Purdue improved crops storage bags among rural farmers in the study area. Section C talked about the rate of adoption of Purdue improved crop storage bags among rural farmers in the past four years [2021-2024] in the study area, respectively.

Data were analyzed using descriptive and inferential statistics. Descriptive statistics such as frequency, percentage and mean score were used to analyze specific objectives (i), (ii), and (iii) Kruskal Wallis (H) test was used to analy]ze specific objectives iv The null hypotheses (i and ii) were tested using Kruskal Wallis (H) test at 0.05 level of significance.

Results and Discussion

Socio-economic Characteristics

Table 1 shows that majority (52.0%) of the respondents were males, while 48% were females. This indicates that men often have greater control over cash, market transactions and formal extension contacts, women often handle household at storage level and daily food management, (Mudege *et al.,*2018).

Purdue improved crops storage (PICS) bags depend on who controls, purchase, and take decisions, who stores the legumes and who received extension messages. If women are primary managers of store grain but lack decision making power cash uptake will be low even if they prefer the bags (Nkere *et al.*,2020).

Also if male were more involved in cultivation of leguminous crops, they will also adopt PICS bags to store their grains to prevent pest infestation against their crop produce. It may also be linked to cultural background of many African communities, where adoption of any innovation decision are commonly regarded as a man's responsibility as the head of the family(Ojo et al.,2021).

Table 1 also shows that most (32.%) of the respondents were within the age range of 41-50 years. About 25.% of the respondents were within the age range of 31-40 years. This implies that younger farmers within the age range of 30-50 years are more open to adopt new technologies and iquicker to experiment.They may also have the resources to adopt, while very old farmers may be more conservative to adopt innovations (Nkere *et al.,*2020).

Majority (78.3%) of the respondents were married, while 11.3% were widowed, 1.67% were single 3.0% were divorced, widowers were 5.67%. Married households usually have larger household production and consumption needs and more combined labour/capital than single or widowed (Baributsa et al.,2016). Married households may have higher storage needs and greater incentives to invest in storage. This called for speedy adoption of Purdue improved crop storage (PICS) bags for mitigating post-harvest losses of leguminous crop produce among rural farmers in Benue and Taraba States (Ayertey et al.,2020).

Majority (71.0%) of the respondents had secondary school education, 15.67% had primary education, 11.3% had tertiary education, while 1.99% had post-graduate education This implies that, the respondents were able to contribute effectively to agricultural activities in both States due to technical knowledge and skills they possessed This finding agrees with Okoye et al.,2014 and Anonguku (2014). who stated that it is critical to understand the value and adoption of innovation thereby fast-tracking development.

Analysis of household size indicates that majority (65.67%) of the respondents had 6-10 household members, (22.67%) of the respondents had 1-5 household members, while (8.3%) had more than 10 persons. Household size plays a significant role in providing family labour for agricultural production. Larger households size produce and consume more and may therefore have greater storage needs, but also greater labour availability for handling storage of produce, (Alhassan et al.,2019). This finding agrees with that of Ayertey et al.(2020) who stated that the greater the storage needs, the greater the needs for adoption of PICS bags for mitigating post-harvest losses of selected leguminous crop produce among rural farmers in Benue and Taraba States.

Majority (69%) of the respondents in both Benue and Taraba States were farmers. About (19%) of the respondents were traders, (8.67%) of the respondents were teachers, while (3.3%) of the respondents were civil servants. This implies that the primary occupation of the respondents was farming. This agrees with Sanusi *et al.(*2020) who stated that more than (70%) of the rural farmers in Benue and Taraba States engage in farming, mostly on a large-scale leguminous crop farming, There is demand for greater storage needs which call for adoption of Purdue improved crop storage (PICS) bags to prevent pest infestation against leguminous crop produce among rural farmers in Benue and Taraba States (Mudege et al.,2018).

Table 1 also shows that (65.33%) of the farmers had 6-10 years of farming experience. About 21.0% of the respondents had 1-5 years of farming experience, while 9.0% of the respondents had 11-20 years of farming experience. This finding reveals that experienced farmers were ready to adopt improved technologies such as PICS bags for mitigating post harvest losses. Therefore, experienced farmers have been reported to have high technical efficiency (Kumar et al.,2017). This finding agrees with Chikoye et al. (2018) who stated that inexperienced farmers may be conservative, while experienced farmers may adopt proven tools to reduce post-harvest losses and be open to new technologies to mitigate post-harvest losses of leguminous crop produce among rural farmers in Benue and Taraba States (Baributsa et al.,2014).

Table 1 further shows that most (45%) earned an annual income ranging from ₦1,000,000 – ₦1,800,000 in Benue and Taraba States. About 27.0% of the respondents earned ₦1,500,000 – ₦1,600,000, while 18.3% of the farmers earned above ₦1,800,000. The main source of income is said to influence farming decisions, as farming practices depend on capital investment, which is dependent on income (Mathange and Schirly.,2008).

It was found that (89.3%) of the respondents cultivated 6-10 hectares of farm land; about 5.0% of the respondents cultivated 1-5 hectares of farm land, while 2%s cultivated 11-20 hectares. This indicates that farmers in both States are willing to engage in agriculture on a large-scale, and therefore can spread the unit cost of PICS over more produce (Alhassan et al.,2019). It also implies that any meaningful agricultural development project introduced will likely be embraced to improve their socioeconomic status. Ajayi et al. (2021) stated that the larger the farm size, early the adoption of improved technologies to ease the production capacity of rural farmers.

Table 2: Distribution of respondents based on Socioeconomic Characteristics (n=300)

States	**Benue**		**Taraba**		**Pooled**	
Variables	**Freq**	**%**	**Freq**	**%**	**Freq**	**Pooled**
Sex						
Male	78	52	78	52.0	156	52.0
Female	72	48	72	48.0	144	48.0
Age (years)						
≤ 30	5	3.33	--	--	5	1.67
31-40	39	26.0	37	24.67	76	25.33
41-50	45	30.0	51	34.0	96	32.0
51-60	32	21.33	30	20.0	62	20.67
≥ 61	29	19.33	32	21.33	61	20.33
Marital Status						
Single	4	2.7	1	7	5	1.67
Married	113	75.3	122	81.3	235	78.33
Widowed	19	12.7	15	10.0	34	11.33
Divorced	5	3.5	4	2.7	9	3.0
Widower	9	6.0	8	5.3	17	5.67
Level of Education						
Primary school	23	15.3	25	16.7	47	15.67
Secondary school	104	69.3	109	72.7	213	71.0
Tertiary	20	13.3	14	9.3	34	11.33
Post-graduate	3	2.0	2	1.3	6	1.99

Household Size (persons)						
1-5	39	26.0	29	19.3	68	22.67
6-10	85	56.0	112	74.7	197	65.67
11-15	16	10.7	9	6.0	25	8.3
16-20	9	6.0	--	--	9	3.0
21-30	1	0.7	--	--	1	0.33
Major occupation						
Farming	102	68.0	105	70.0	207	69.0
Trading	25	16.7	32	21.3	57	19.0
Hunting	7	4.7	3	2.0	10	3.33
Teaching	16	10.7	10	6.7	26	8.67
Farming Experience (years)						
1-5	35	23.4	28	18.7	63	21.00
6-10	86	57.3	109	72.7	196	65.33
11-20	18	12.0	9	6.0	27	9.00
21-30	9	6.0	3	2.0	12	4.00
31 and above	2	1.3	1	0.7	2	0.67
Annual income (Naira)						
100,000 - 1,200,000	17	11.3	4	2.7	21	7.0
1,200,000 - 1,400,000	8	5.3	44	29.3	8	2.67
1,400,000 - 1,600,000	37	24.7	79	52.7	81	27.0
1,600,000 - 1,800,000	57	38.0	23	15.3	135	45.0
Above 1,800,000	31	20.7	--	--	55	18.3
Farm size (Hectares)						
1-5	8	5.3	7	4.7	15	50.0
6-10	125	83.3	143	95.3	268	89.33
11-20	7	4.7	--	--	6	2.00
21-30	6	4.0	--	--	4	1.33
31-40	4	2.7	--	--	--	--

Source: Field Survey (2025).

Sources of Supply of Purdue Improved Crop Storage (PICS) Bags

Table 2 shows that most (15%) of the respondents' source of supply of PICS bags in Benue State was from dealers of PICS bags 13.3% of the respondents' source of supply of PICS bags was from the Ministry of Agriculture. 11.7% of the respondents' source of supply was from Agricultural Extension agents. About 10.0% of the respondents' source of supply was from both farmers' association and young farmers' clubs 8.3% of the respondents' source of supply was from contact farmers, while 7.7% of the respondents' source of supply was from farmers' cooperatives. This finding agrees with Peterman *et al* (2014) who stated that cooperative societies and farmers' groups are the source of supply of PICS bags. Many rural farmers are part of cooperative societies that pool resources together and buy PICS bags in bulk, making PICS bags more affordable for the rural community.

In another development, the Federal Ministry of Agriculture and Rural Development In conjunction with the Ministry of Agriculture are also a source of supply. They sometimes procure PICS in bulk for distribution among rural farmers, particularly during harvest seasons, as part of initiatives to reduce post-harvest losses of leguminous crop produce Ngigi .(2009).

Table 3: Sources of Supply of Purdue Improved Crop Storage Bags (n=300)

States	Benue		Taraba		Pooled	
Variables	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Open market	6	4.0	6	4.0	12	4.0
Agricultural extension agents	17	11.3	18	12.0	35	11.7
Ministry of Agriculture	20	13.3	20	13.3	40	13.3
Women in Agriculture						
Seminars | workshop	4	2.7	4	2.7	8	2.7
Conferences	2	1.3	3	2.0	5	1.7
Young farmers club	5	3.3	5	3.3	10	3.3
Farmers co-operatives	10	6.7	10	6.7	20	6.7
Dealers of PICS bags	23	15.3	22	14.7	45	15.0
Contact farmers	13	8.7	12	8.0	25	8.3
Farmers' association	15	10.0	15	10.0	30	10.0
Churches | mosques	5	3.3	5	3.3	10	3.3
Friends | relatives	2	1.3	2	1.3	4	1.3
Radio stations	7	4.7	7	4.7	14	4.7
Local chiefs | leaders	7	4.7	6	4.0	13	4.3
Internet	11	7.3	12	8.0	23	7.7

Source: Field Survey (2025).

Rate of Adoption of PICS Bags Among Rural Farmers in Taraba and Benue States

Table 3 shows that in 2021 in Benue State 16.7% adopted, while in Taraba State 16.7% of the respondents also adopted pics bags. In 2022 in Benue State 20.0%, while in Taraba State(23.3%) of the respondents adopted pics bags. In 2023 in Benue State (23.3%) adopted, while in Taraba State(26.7%) of the respondents adopted pics bags. In 2024 in Benue State (40.0%) adopted ,while in Taraba State (33.3%) of the respondents adopted the pics bags. According to Research conducted by (Baributsa *et al.,*2017) opined that the adoption rate of PICS bags in Northern Nigeria varied significantly depending on factors such as awareness, access to training, and financial capacity.

This study observed that (36.6%) of farmers in Benue and Taraba States were aware of the PICS bags and of this group, about (25%) adopted PICS bags within three years of introduction. Another study by (Alhassan et al.,2019) highlighted that adoption was quicker among younger farmers who were more open to new technologies in Benue and Taraba States. However, adoption began accelerating after initial field demonstrations in communities.Table 4 shows that there was a gradual increase in adoption of Purdue Improved Crop Storage bags from (16.7%) in 2021 to (36.6%) in 2024. This increase in adoption may be as a result of farmers' awareness of the benefits of PICS bags to reduce pest-infestation and post-harvest losses of leguminous crop produce.

Table 3: Rate of Adoption of PICS Bags Among Rural Farmers in Benue and Taraba States (n=300)

States	Benue		Taraba		Pooled	
Years	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
2021	25	16.7	25	16.7	50	16.7
2022	30	20.0	35	23.3	65	21.7
2023	35	23.3	40	26.7	75	25.0
2024	60	40.0	50	33.3	110	36.6
Total	150	100%	150	100%	300	100%

Source: Field Survey (2025)

Factors Influencing Adoption of Purdue Improved Crop Storage Bags in Benue and Taraba States

Table 4 shows that here was no significant difference across the three agricultural zones in Benue and Taraba States (P>0.05) in terms of factors influencing adoption of Purdue Improved Crop Storage bags.

Kruskal Wallis (H) test conducted shows that H.Cal. (-180.9) $<x^2$ Tab (11.1) at 0.05 level of probability. It also reveals that $\sum R_1=170.0$, $\sum R_2=153.0$, $\sum R_3=85.0$, $\sum R_4=170.0$, $\sum R_5=154.0$ and $\sum R_6=82.0$.

This finding implies that factors influencing adoption of Purdue Improved Crop Storage (PICS) bags among rural farmers in Benue and Taraba States were similar or more or less the same. For instance, lack of awareness, lack of accessibility or availability and lack of extension services were highly ranked in both Benue and Taraba States.Before rural farmers can adopt innovation, they must be aware of its advent. They must also have economic access to it, and such an innovation must be physically available. In Benue and Taraba States, majority of rural farmers are not aware of the advent of Purdue Improved Crop Storage bags up till now, hence there is low adoption in both States.

This finding agrees with Age (2015) who stated that farmers will adopt Purdue Improved Crop Storage bags for mitigating post-harvest losses if they know of its existence and understand how it functions. If they are persuaded and form a favourable attitude towards it, and if they are completely convinced and have made up their minds to adopt it or reject the innovation. Also, Ayertey *et al*. (2020) is of the same view. After becoming aware, the farmers gather information about the innovation of Purdue Improved Crop Storage bags (PICS) that have just been introduced and this influences the farmer's decision, as they believe that the new practice would help in mitigating post-harvest losses of leguminous crop produce among rural farmers in Benue and Taraba States.

Table 5: Kruskal Wallis Analysis of Factors Influencing Adoption of Purdue Improved Crop Storage (PICS) Bags in Benue and Taraba States

States:	Benue						Taraba					
Responses	SA		AG		SD		SA		AG		SD	
Variables	Freq	R1	Freq	R2	Freq	R3	Freq	R4	Freq	R5	Freq	R6
Lack of awareness	159	24.0	6	7.5	5	6.0	350	--	--	--	--	--
Affordability of PICS bags	6	7.5	144	26.0	--	--	4	5.0	145	27.0	1	2.0
Lack of access/availability	126	21.5	24	115	--	--	121	19.0	29	4.0	--	--
Technical factor	--	--	150	350	--	--	--	--	150	35.0	--	--
Compatibility	--	--	150	350	--	--	--	--	150	35.0	--	--
Complexity of PICS bags	104	17.0	46	160	--	--	109	18.0	41	15.0	--	--
Lack of perception and attributes	150	35.0	--	--	--	--	148	28.0	2	4.0	--	--
Lack of trust	150	35.0	--	--	--	--	149	29.0	1	2.0	--	--
Lack of technical know how	24	45	126	23.0	--	--	27	130	123	20.0	--	--
Extension services	140	25.0	--	--	10	9.0	136	23.0	1	2.0	13	10.0
Economic benefits	--	--	--	--	150	35.0	--	--	--	--	150	35.0
Durability	--	--	--	--	150	35.0	--	--	--	--	150	35.0

H.cal=-180.9, x^2tab (11.1) at 0.05,$\sum R_1 = 170.0$, $\sum R_2 = 153.0$, $\sum R_3 = 85.0$, $\sum R_4 = 170.0$, $\sum R_5 = 154.0$, $\sum R_6 = 82.0$

Source: Field Survey (2025).
SA= Strongly Agree
AG= Agree
SD= Strongly Disagree

Conclusion and Recommendations

Conclusion

Based on the findings of this study, it can be concluded that this technology has played a significant role in mitigating post harvest losses of leguminous crop such as Cowpea, Groundnut and Soyabean. The study shows that farmers who adopted purdue improved crop storage bags experienced notable reduction in pest infestation, grain deterioration quality and quantitative losses compared to those using traditional storage methods.

Strengthening these measures will not only improve adoption rate but also contribute to food security, income stability and overall resilience of small holder farmers in the areas therefore, promoting widespread use of improved storage technology like pics bags, which is essential for

sustainable post-harvest management and agricultural development in Benue and Taraba States Nigeria.

Recommendation

Based on the findings of this study, the following recommendations were made:

i. Government agencies, research institutions and Non-governmental organization should intensify awareness campaigns and practical demonstrations on the economic benefit and proper use of pics bags. Extension agents should be trained and adequately equipped to disseminate information, and provide technical guidance to farmers at the grassroots level.

ii. Regular training workshops should be organized for farmers to enhance their knowledge of post-harvest handling, proper grain drying, and correct usage of pics bags to ensure maximum efficiency and durability of the storage technology.

iii. Formation of farmers groups and cooperatives should be supported to enable collective access to inputs, credit facilities, and marketing opportunities. This will not only improve adoption of pics bags but also enhance farmers bargaining power and income stability.

References

Age, A. I. (2017). Sustainable Agriculture and Rural Development: Panacea for national security threats and absolute poverty in Nigeria. First published by Kency Printing Press, Makurdi. 102-120.

Ajayi, C.A., Fasae, O.O. and Okoli, A. (2021). Adoption of management of post harvest of cowpea in Nigeria. *International Journal of Agricultural Sustainability , ISSN 1562-3599.*

Alhassan, R., Mohammed, A., Abdulaziz, A. and Affarhood, I. (2019). Factors influencing the adoption of Purdue improved crop storage (PICS) bags among smallholder farmers in northern Ghana. J*ournal of Stored Product Research , 8(2), 673-676.*

Anonguku, I. (2014) Comparative assesment of rural and agricultural project in Benue and Nassarawa states of Nigeria. A Ph.D thesis submitted to Department of gricultural Extension and Communication. Federal university of agriculture, Makurdi pp102-10

Ayertey, N.J., Offori-attah, S., Anthony ,M. and Bosomoen, G. (2020) .Adoption of Purdue improved cowpea storage (PICS) technology in Ghana; what factors explains farmers usage intensity? world development perspective 83: 353-363.

Baoua, I.B., Amadou, L., Ousmane, B., Baributsa, D. and Murdock, L.L. (2014). PICS bags for post harvest storage of maize grain in west Africa. *Journal of Stored Products Research , 58, 20-28.*

Baributsa, D. and Njoroge ,A.W. (2020). The use and profitability of hermetic technologies for grain storage among Smallholder farmers in Eastern Kenya. J*ournal of Stored Products Research , 87, 101-610.*

Baributsa,D., Lowenberg DeBoer, J., Murdock, L. and Moussa B. (2014). Adoption of hermetic Storage for groundnut and cowpea in West Africa and Central Africa. *Journal of stored product research.58;35-42.*

Benue State Agricultural and Rural Development Authority, (BNARDA) (2005). BNARDA yield survey report 2005.

Baributsa, D., Lowenberg-ReBoer, J., Murdock, L.and Moussa, B.S. (2012). Profitable chemical-

free cowpea storage technology for smallholder farmers in Africa: Opportunities and challenges. A paper delivered at PICS Product Conference, Portugal. Benue State Government, 2008. Makurdi: Benue State.

Baributsa,D., Lowenberg-DeBoer,J., Murdock,L., Moussa,B. (2010).Profitable chemical free cowpea storage technology for smallholder farmers in Africa; Opportunities and challenges.in;10th international working conference on stored product protection international programs in agriculture,615 West street. Purdue University ,West Lafayette;2010 .pp1046-1052.