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ANALYSIS OF PREFERENCE ON STORAGE METHODS AMONG COWPEA FARMERS IN BAUCHI STATE, NIGERIA

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ABSTRACT
The study examined the preference of storage methods among cowpea farmers in Bauchi State, Nigeria. Multistage sampling techniques were used to select 202 farmers for the study. Data were collected using questionnaires and analyzed using descriptive statistics and logistic regression. The results revealed that a substantial proportion (47.0%) of farmers preferred phostoxin tablet, 32.7% preferred plastic jerrican, 7.9% preferred PICS bags, 5.0% preferred mental drum, 3.9% preferred actellic 25EC, 2.5% preferred rhumbus and 1.0% preferred actelllic 2% dust. The result of the logistic regression showed pseudo R^2 which was 0.847. The results identified among others that quantity stored ($P<0.01$), effectiveness ($P<0.01$), durability ($P<0.05$), availability ($P<0.05$) and simplicity ($P<0.10$) significantly affect the choice decision for PICS bags method of cowpea storage. Also, farming experience and simplicity significantly affect the choice decision of jerrican method of storage at ($P<0.05$) each, educational level, availability, simplicity and effectiveness significantly affect the choice decision of actellic 25EC at ($P<0.10$) each while educational level ($P<0.05$) is the only variable that affect the choice decision of actellic 2% dust. Capital intensiveness, time consuming, poison nature and odour were the major constraints to cowpea storage methods. The study recommended that farmers should be encouraged by extension agents to attend trainings and workshops on cowpea storage method as this will go a long way in improving their knowledge and experience on the use of cowpea storage methods.

Keywords: Cowpea, Farmers, Methods, Preference, Storage

INTRODUCTION
Cowpea (*Vigna unguiculata* **L.** Walp,*)* an annual legume, is also commonly referred to as southern pea, blackeye pea, crowder pea, lubia, niebe, coupe or frijole. Cowpea originated in Africa and is widely grown in Africa, Latin America, Southeast Asia and in the southern United States. (Omoigui *et al.,* 2018). Cowpea is an important staple food in West Africa and it is largely produced for domestic consumption. It is an absolute source of protein and thus capable of providing solution to the protein-carbohydrate imbalance of the nutrition of Nigerians (Tijjani, 2015). The nutritional value of cowpea plant part varies greatly depending on variety. The cowpea grains contain about 23% protein and 57% carbohydrate, while the leaves contain between 27 and 34% protein. These makes it a poor man source of protein therefore there is great need to store the grain so as to have it all year round (Fakayode, 2014).

There are several methods of cowpea protection and preservation technologies being practiced by farmers both at the farm level and storage places to protect the crops against insect's infestation which is one of the most important problems against cowpea production

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and storage. Prominent among them include proper drying before storage, the use of metal drum, jerrican, Rhumbus, PICS (triple bagging) and chemical control. Several measures have been initiated by the Nigerian Government to address some of the problems responsible for food crop loses. For instance, several silos were rehabilitated with new ones established across the geo-political zones, with a combined storage capacity of over 1.5 million metric tons for the storage of assorted grains; beans, maize and millet. In spite of these efforts, post-harvest food loses are still substantial and food import bills have been rising in order to meet the shortfall in food availability. This forces the farmers to look for a preferred alternatives or supplement the use of the available technologies for sustainable and cost-effective product preservation to minimize losses associated with various infestation effects.

According to Baributsa *et al.* (2020) insecticides can be used to control cowpea weevils, although readily available and cheap is much too toxic because famers do often misuse them resulting in health and environmental problems. Other cowpea storage methods include metal drums, widely available and used but there has been a decline in metal drum use due primarily to its cost and inflexibility (Fakayode, 2014).

Therefore, farmers and marketers have adopted several technologies for storing their cowpea beans. Unfortunately, the effectiveness of these technologies used in Bauchi state has not been sufficiently reported. This makes it difficult for stakeholders to make appropriate choice of storage technologies. Therefore, this gab in knowledge needs to be addressed. In addition, there is gap in the literature with respect to particularly on the factors influencing preference of storage methods among cowpea farmers in Bauchi State which also need to be studied and documented. The objectives of the study were to:

i. Identify the most preferred cowpea storage method among farmers and marketers in the study area.
ii. Determine the factors that influence preference on storage methods among the cowpea farmers and marketers.

Identify the constraints associated with different cowpea storage methods among the farmers and marketers.

MATERIALS AND METHODS

The Study Area

This study was conducted in Bauchi State. The State has a population of about 7.057,045 (National Population Commission [NPC], 2018) and it has 20 local government area (LGAs). Bauchi is the capital of the State and is located on the northern edge of the Jos-Plateau with a total land area of 49, 119 km^2 (18,965 Sqm) representing about 5.3% of Nigeria's total land mass. Bauchi State is located between Latitude 9^0 3` and $12^0$3` North and Longitude $8^0$50` and 11^0East with an elevation of 616m with an altitude of 6,920m above sea level (National Bureau of Statistics [NBS], 2017). The annual rainfall ranges between 1,300 millimeters in the Southern part and 700 millimeters in the Northern part. The maximum and minimum temperature was 40.56^{0C} and 22^{0C}, respectively, the relative humidity is highest in August by (66.55) and lowest in February by (10.5%) (BSADP 2016). The state is bordered by seven States, Kano and Jigawa to the North, Taraba and Plateau to the South, Gombe and Yobe to the East and Kaduna to the West. Majority of the people are involved in farming (crop and livestock), fishing, food processing and marketing of agricultural produce.

Sampling Procedure

A multi-stage sampling technique was used for the study. In the First stage**,** two (2) LGAs were purposively selected from each of the three (3) agricultural zones of Bauchi State

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making a total of six (6) LGAs, this is to capture those LGAs with the highest concentration of cowpea production. In stage II, two (2) communities were selected from each LGA using simple random sampling technique making a total of 12 communities. Also, in stage II, two (2) markets were purposively chosen from each of the LGA`s given a total number of 12 markets to capture markets with the concentration of cowpea marketing. Finally, 202 farmers and 144 cowpea marketers were proportionately (10%) selected from each of the communities and markets to give a total sample size of 346 respondents as indicated in Table 1.

Table 1: Sampling selection plan

Bauchi ADP Zone	LGA`s	Communities	Sample frame	Sample size (10%)
Western Zone	Alkaleri	Alkaleri	234	23
		Pali	127	13
	Kirfi	Kirfi	144	14
		Wanka	174	17
Northern Zone	Katagum	Madangala	132	13
		Matsango	148	15
	Misau	Misau	124	12
		Hardawa	194	19
Central Zone	Ningi	Ningi	167	17
		Nasaru	195	20
	Darazo	Darazo	195	20
		Sade	186	19
Total			**2020**	**202**

Source: Field Survey, 2020

Method of Data Collection

Data were collected through the use of structured questionnaires which were administered to the cowpea farmers. The questionnaires were designed for the farmers on cowpea storage which dealt with information on economic activities of the respondents. Also, means score using likert scale was employed to assess respondent's perception. Categorically information collected include; preference among methods, factors influencing preference and constraints with different storage methods.

Method of Data Analysis

The collected data were subjected to descriptive and inferential statistics. Descriptive statistics such as mean, frequencies, percentage and mean score was used to achieve specific objectives i and iii, while Multinomial Logit regression was used to achieve objective ii respectively. Following Karmer (1991), the model use is specified as:

$$\text{Log}\ \frac{Prob\ (yes)}{1-Prob\ (yes)} = \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_9X_9+\beta_{10}X_{10}+u \quad \ldots(1)$$

Theoretically, the multinomial logit regression model is expressed as:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + u \quad \ldots(2)$$

where;

Y = Preferred Storage Methods (Y_1 = PICS bags, Y_2 = Metal drum, Y_3 = Plastic jerican, Y_4 = Rhumbus)

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Y_5 = Actellic 25 EC, Y_6 = Actellic 2% dust, Y_7 = Phostoxin tablet)
X_1 = Age of farmers (Years)
X_2 = Education (years spent in school)'
X_3 = Farming experience (Years)
X_4 = Availability of the storage facility (Yes=1, No=0)
X_5 = Affordability of storage materials (Yes=1, No=0)
X_6 = Simplicity in usage of the storage method (Yes=1, No=0)
X_7 = Durability of the Storage materials (Yes=1, No=0)
X_8 = Effectiveness of storage method (Yes=1, No=0)
X_9 = Quantity of Cowpea stored (Yes=1, No=0)
X_{10} = Advice from extension agent (Yes=1, No=0)
β_0 = constant term
$\beta_1 - \beta_{10}$ = coefficients to be estimated
u = error term

RESULTS AND DISCUSSION

Most Preferred Storage Method Among Farmers

There are several methods of cowpea protection and preservation technologies being practiced by the respondents both at the farm level and storage places to protect the crops against insect's infestation which is one of the most important problems against cowpea production and storage. On the most preferred storage method, Table 2 revealed that the most effective and efficient storage method used by farmers in the study area is phostoxin tablet. The findings corroborate that of the Fakayode *et al.* (2014) who observed that more than half of the respondents (54.4%) used phostoxin to store their cowpea most probably because phostoxin is cheaper and easy to use compare to actellic liquid alternative of cowpea storage practices in Kwara State. However, the findings contradict that of Abdullahi *et al.* (2017) who observed that majority of the respondents (47%) use insecticide to store their cowpea in Ghana.

Table 2: Farmers' Most Preferred Storage Method

Storage Methods	Frequency	Percentage
Pigs bags (triple bagging)	16	7.9
Metal drum	10	5.0
Plastic Jerrican	66	32.7
Rhumbus	5	2.5
Actellic 25 EC	8	3.9
Actellic 2% dust	2	1.0
Photoxin tablet	95	5.0
Total	202	100

Source: Field Survey (2020)

Factors Influencing Preference of Storage Methods among Cowpea Farmers

The result of multinomial logit model is presented in Table 3. The results indicated that, among the 10 hypothesized explanatory variables included in the model, availability, simplicity, durability, effectiveness and quality stored were found to be significantly affecting the choice decision for PICS. (triple bagging) method of cowpea storage at the conventional probability levels in the study area at 5%,10%,5%,1% and 1% respectively. Also, age of farmers and farming experience were found to be significantly affecting the choice decision

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for metal drum method of cowpea storage at the conventional probability levels by farmers in the study area at 10%. Similarly, farming experience and simplicity were the only variables that affects the choice decision of jerrican method of cowpea storage at 5%. Rehman (2010) argues that socio-economic variables may influence the preferred storage method and accessibility to agricultural information of the farmers. Furthermore, educational level, availability, simplicity and effectiveness were found to be affecting the choice decision of adopting the method actellics 25EC at 10% significant level. Also, educational level was the only variable that affect the choice decision of actellic 2% dust at 5% significant level.

The availability significantly predicted whether the farmers preferred PICS method or phostoxin tablet method of cowpea storage (β = 3.597; Wald χ^2 = 9.947; p = 0.002, Exp (B) = 36.490). The coefficient was found to be positive. The result shows that the availability enables the farmer to identify and to select preferred storage method. The odds ratio 36.490 for the PICS (triple bagging) method indicate that keeping the other things being constant, the decision to choose PICS method gets increasing by 36.490 as availability of storage facility increases. A unit increase in the availability of storage facility would result to a significant increase in preference of PICS by 36.490 rather than phostoxin tablet.

Similarly, simplicity of storage facility significantly predicted whether the farmers preferred PICs method or phostoxin tablet of cowpea storage (β = 2.269; Wald χ^2 = 3.574; p = 0.059, Exp (B) = 9.673). The coefficient was found to be positive. The result shows that simplicity of storage facility affects their preference decision of the cowpea storage method they use. The odds ratio 9.673 for the PICS indicate that keeping the other things being constant, the decision to choose PICS method gets increasing by 9.673 as simplicity of storage facility increases. A unit increase in the simplicity of storage facility would result to a significant increase in preference of PICS by 9.673 rather than phostoxin tablet. The study agreed with previous study by Bappah (2016) who observed that education, simplicity, availability of storage facility and knowledge on storage technology positively influence adoption of improved cowpea storage technologies in Gombe State.

Also, durability of storage facility, effectiveness and quantity stored were significant at 10%, 1% and 1% respectively. This indicates that these variables significantly affect the preference decision for PICS. Durability (β = -1.566; Wald χ^2 = 9.603; p = 0.002, Exp (B) = 0.209); effectiveness (β = -2.776; Wald χ^2 = 12.867; p = 0.000, Exp(B) = 0.0625) and quantity stored (β = -2.464; Wald χ^2= 13.128; p = 0.000, Exp(B) = 0.085) methods of cowpea storage respectively. The coefficients capture the sign of negative for both durability, effectiveness and quantity stored. The odds ratio 0.209, 0.062 and 0.085 indicate that keeping the other things being constant, the decision to choose PICS over phostoxin tablet decreases by 0.209, 0.062 and 0.085 as durability, effectiveness and quantity stored increases. A unit increase in the durability, effectiveness and quantity stored reduced the preference of PICS by 0.209, 0.062 and 0.085 rather than phostoxin tablet. The result appeared to align with the position of Bouda (2015) who found that durability, quantity stored and capacity of storage facility significantly influence cowpea storage cost in Sokoto State.

Therefore, age and farming experience significantly predicted whether the farmers preferred phostoxin tablet method or metal drum method of cowpea storage. Age (β = -3.338; Wald χ^2 = 3.232; p = 0.072, Exp (B) = 0.035) and farming experience (β = 1.331; Wald χ^2 = 2.929; p = 0.087, Exp(B) = 3.785). The coefficient for age was found to be negative. The result shows that the age of farmers enables the farmer to identify and to select preferred storage method. The odds ratio 0.072 for the metal drum method indicate that keeping the other things being constant, the decision to choose metal drum method gets decreasing by 0.072 as age of

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farmers increases. Asiabaka *et al.* (2017) reported that farmer's ability to utilize new agricultural information on farm innovation decrease with age. The older the farmer the less he/she is likely to adopt improved agricultural technologies, because the older the farmer, the more likely they are unwilling to put farming related information into practice. Also, the result is similar to the findings of Musa (2019) who reported that age has a negative relationship among paddy rice marketers in Bauchi State.

Also, the odds ratio 3.785 for the metal drum method indicate that keeping the other things being constant, the decision to choose metal drum method gets increasing by 3.785 as farmers' experience increases. The odds ratio indicates that as the farmers experience increased by a unit, the change in the odds of metal drum (rather than phostoxin) is 3.785. Consequently, farming experience and simplicity of storage method is significant at 5% significant level to affect the preference decision for jerrican (β = -3.846; Wald χ^2 = 4.397; p = 0.036, Exp(B) = 0.021) and (β = 17.513; Wald χ^2 = 6.351; p = 0.012, Exp(B) = 40326724.827) methods of cowpea storage respectively. The coefficient for farming experience is negative. The odds ratio 0.021 for the farming experience indicate that keeping the other things being constant, the decision to choose jerrican method over phostoxin tablet decreases by 0.021 as farming experience increase. Similarly, the odds ratio 40326724.827 for the simplicity indicate that keeping the other things being constant, the preference decision for jerrican over phostoxin tablet increases by 40326724.827 as simplicity of storage methods increases.

Also, educational level, availability, simplicity and effectiveness significantly predicted whether the farmers preferred actellics 25EC orpreferredphostoxin tablet method of cowpea storage The odds ratio 2.696, 28.01, 394.10 and 0.047 for the educational level, availability, simplicity and effectiveness indicate that keeping the other things being constant, the decision to choose actellics 25EC method gets increasing by 2.696, 28.01, 394.10 as educational level, availability , simplicity increased and decrease by 0.047 as educational level, availability and simplicity and effectiveness increases.

Finally, educational level significantly predicted whether the farmer prefer actellic 2% dust or PICS triple bagging method of cowpea storage (β = -4.138; Wald χ^2 = 5.133; p = 0.023, Exp(B) = 0.016). The coefficient was found tobe positive. The odds ratio 0.016 for actellic 2% dust indicated that keeping the other things being constant, the decision to choose actellic 2% dust over PICS deceases by 0.016 as farming experience increases. The finding is in line with Abubakar *et al.* (2020), who observed that educational level, age and farm size significantly affect the adoption of improved grain storage technologies in Bauchi State.

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Table 3: Marginal Effect of Explanatory Variable on the Probability of Using Different Storage Method among Farmers

Variable	PICS (Triple Bagging)					Metal Drum				
	Coef.	Std Error	Wald χ^2	Odd	p>z	Coeff.	Std Error	Wald χ^2	Odd	p>z
Intercept	4.504	3.115	2.091		.148 ns	-48.154	67.578	.508		.476 ns
Age	-0.516	.318	2.636	.597	.104 ns	-3.338	1.857	3.232	.035	.072*
Educational Level	-0.055	.145	.141	.947	.707 ns	.634	.423	2.242	1.885	.134 ns
Farming Experience	.283	.206	1.882	1.326	.170 ns	1.331	.778	2.929	3.785	.087*
Availability	3.597	1.141	9.947	36.490	.002**	-1.186	16.293	.005	.305	.942 ns
Affordability	-.071	.563	.016	.931	.900 ns	15.808	31.679	.249	7336733.562	.618 ns
Simplicity	2.269	1.200	3.574	9.673	.059*	25.276	32.670	.599	9493375515 6.122	.439 ns
Durability	-1.566	.505	9.603	.209	002**	-2.286	1.990	1.319	.102	.251 ns
Effectiveness	-2.776	.774	12.867	.062	.000***	1.428	2.930	.237	4.170	.626 ns
Quantity Stored	-2.464	.680	13.128	.085	.000***	3.194	3.220	.984	24.375	.321 ns
Advice from Extension Agent	-.050	.512	.010	.951	.922 ns	-13.928	31.751	.192	8.934E-7	.661 ns

Note: *p<0.10, ** p<0.05, ***p<0.01 and ns not significant; N= 202 Model chi-square = 307.145; p<0.0001, –2 log likelihood = (initial= 535.19; Final=228.013), Pseudo R^2 (Nagelkerke) = 0.847; (Cox and Snell) = 0.801. Overall Percentage Correctly classified = 74.7%. The reference category is phostoxin tablet.
Source: Field Survey (2020)

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Table 3: Marginal Effect of Explanatory Variable on the Probability of Using Different Storage Method among Farmers **Cont'd.**

Variable	Jerrican					Rhumbus				
	Coef	Std Error	Wald χ^2	Odd	p>z	Coeff.	Std Error	Wald χ^2	Odd	p>z
Intercept	9.432	276.932	.001		.973 ns	-429.059	3527.070	.015		.903 ns
Age	-2.318	1.841	1.586	.098	.208 ns	-13.746	36.222	.144	1.072E-6	.704 ns
Educational Level	-.679	.473	2.060	.507	.151 ns	37.805	66.412	.324	2622379635582 6024.000	.569 ns
Farmng Experience	-3.846	1.834	4.397	.021	.036**	21.476	52.800	.165	2122673531.290	.684 ns
Availability	-9.066	99.763	.008	.000	.928 ns	75.316	128.055	.346	5122298516092 3126000000000 0000000.000	.556 ns
Affordability	3.886	4.109	.894	48.712	.344 ns	-10.526	93.918	.013	2.683E-5	.911 ns
Simplicity	17.513	6.949	6.351	4032672 4.827	.012**	7.061	3437.700	.000	1165.930	.998 ns
Durability	19.515	154.888	.016	3.347E-9	.900 ns	-35.399	74.215	.228	4.231E-16	.633 ns
Effectiveness	-6.645	205.982	.001	.001	.974 ns	59.463	139.546	.182	6676920508522 4650000000000. 000	.670 ns
Quantity Stored	7.071	5.658	1.562	1177.147	.211 ns	62.490	115.808	.291	1376871525426 1246000000000 00.000	.589 ns
Advice from Extension Agent	-2.674	1.881	2.021	.069	.155 ns	-50.340	115.702	.189	1.373E-22	.664 ns

Note: *p<0.10, ** p<0.05, ***p<0.01 and ns not significant; N= 202 Model chi-square = 307.145; p<0.0001, –2 log likelihood = (initial= 535.19; Final=228.013), Pseudo R^2 (Nagelkerke) = 0.847; (Cox & Snell) = 0.801. Overall Percentage Correctly classified = 74.7%. The reference category is phostoxin tablet.
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Table 3: Marginal Effect of Explanatory Variable on the Probability of Using Different Storage Method among Farmers **Cont'd.**

Variable	**Actellics 25EC**				
	Coeff.	**Std Error**	**Wald χ^2**	**Odd**	**p>z**
Intercept	-28.045	34.442	.663		.415 ns
Age	-.121	1.002	.015	.886	.904 ns
Educational Level	.992	.589	2.836	2.696	.092*
Farming Experience	-.011	.821	.000	.989	.989 ns
Availability	3.333	1.941	2.949	28.011	.086*
Affordability	.322	1.742	.034	1.380	.853 ns
Simplicity	5.977	3.440	3.019	394.100	.082*
Durability	1.792	2.926	.375	6.000	.540 ns
Effectiveness	-3.057	1.696	3.249	.047	.071*
Quantity Stored	-2.345	1.482	2.504	.096	.114 ns
Advice from Extension Agent	7.627	15.404	.245	2052.279	.621 ns

Note: *p<0.10, ** p<0.05, ***p<0.01 and ns not significant. N= 202 Model chi-square = 307.145; p<0.0001, –2 log likelihood = (initial= 535.19; Final=228.013), Pseudo R^2 (Nagelkerke) = 0.847; (Cox & Snell) = 0.801. Overall Percentage Correctly classified = 74.7%. The reference category is phostoxin tablet
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Table 3: Marginal Effect of Explanatory Variable on the Probability of Using Different Storage Method among Farmers **Cont'd.**

	Actellic 2% Dust				
	Coeff.	**Std Error**	**Wald χ^2**	**Odd**	**p>z**
Intersect	79.554	7784.911	.000		.992[ns]
Age	-6.643	208.189	.001	.001	.975 [ns]
Educational Level	4.138	1.826	5.13	0.016	0.23[**]
Farming Experience	-3.270	233.401	.000	.038	.989 [ns]
Availability	-4.641	288.886	.000	.010	.987 [ns]
Affordability	-10.803	225.681	.002	2.035E-5	.962 [ns]
Simplicity	-21.767	7761.986	.000	3.520E-10	.998 [ns]
Durability	-12.093	124.649	.009	5.598E-6	.923 [ns]
Effectiveness	-16.432	224.542	.005	7.304E-8	.942 [ns]
Quantity Stored	-18.753	90.386	.043	7.176E-9	.836 [ns]
Advice from Extension Agent	-6.838	205.320	.001	.001	.973 [ns]

Note: *p<0.10, ** p<0.05, ***p<0.01 and [ns] not significant *N= 202 Model chi-square = 307.145; p<0.0001, –2 log likelihood = (initial=535.19; Final=228.013), Pseudo R^2 (Nagelkerke) = 0.847; (Cox & Snell) = 0.801. Overall Percentage Correctly classified = 74.7%.*
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Constraints Associated with Different Cowpea Storage Methods

Constraints are inhibiting factors that lead to low preference of a storage method. Table3 indicated that the respondents agreed that PICs bags are capital intensive. However, they were also undecided on whether time consuming, poor durability and container size as constraints associated with PICS bags storage method. However, they disagree that inadequate extension advice is a constraint associated with using the PICS bags storage method. This support previous study by Fliegal and Kivlin (2016) whose study found that storage method perceived as most rewarding, least risky, less costly and is available and simply is preferred mostly quickly. Bolaji (2016) found that lack of credit, awareness and high cost of the PICS bags as constraints impending use.

Metal Drum: The respondents agreed that capital intensive, time consuming and container size are the constraints associated with metal drum as a cowpea storage method. However, they were undecided about inadequate extension advice and poor durability as constraints associated with metal drum as storage method. This is probably why most of the respondents were not using metal drum as a storage method. This support previous study by Murdock *et al.* (2014) who stated that good quality used metal drum are relatively expensive and hard to find in many places, this may limit the spread of the drum technology.

Plastic Jerrican: Table 4 indicates that the respondents were undecided on whether capital intensive, inadequate extension advice and poor durability as constraints associated with using Jerrican as storage method. However, they agreed that time consuming and container size as constraints associated with plastic jerrican storage method. This agreed with the findings of Shaib *et al.* (2016) who stated that adding to the relatively low initial cost, plastic jerrican can be used repeatedly but consume time and even a small opening can admit enough oxygen to allow insect to resume activity and further damage grains.

Rhumbus: From Table 4 it can be seen that the respondents were undecided on whether capital intensive, time consuming, inadequate extension advice, poor container size as constraints associated with using rhumbus as storage method. This implies that all the respondents were undecided to the constraints associated with rhumbus storage method, because it is a traditional storage method that most respondents were not using. Bappah (2016) found that 31.9% of the respondents used metal drum to store cowpea, 24.5% used triple bagging, 20.2% used air tight containers, 16% used chemicals and only 4.2% used rhumbus to store cowpea in Gombe State.

Actellic 25 EC and Actellic 2% Dust: Table 4 shows that the respondents agreed that capital intensive, adour and poison nature of actellic 25 EC and actellic 2% dust were the major constraints associated with using them. However, they were undecided on whether time consuming and inadequate extension advice as constraints associated with the storage method. The major constraint of actellic 25 EC and actellic 2% dust is the poison nature of the chemical which usually arise from misused of the chemical. The treatments, when timed and applied effectively, are generality highly effective, reasonably inexpensive and safe in practiced. According to Ali (2018), the main limitations in effectiveness arise form misused, which may create hazard and accelerate the development of parts resistance or from logistical or formulation problems which may lead to the marketing of poor-quality product.

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Table 4: Respondents based on constraints associated with different cowpea storage methods

	Farmers = 202	
Constraints	**Mean**	**Decision**
PICS Bags (Tripple bagging)		
Capital intensive	3.54	A
Time consuming	2.77	U
Inadequate extension advise	2.43	U
Poor durability	2.64	U
Container size	2.88	U
Metal Drum		
Capital intensive	3.50	A
Time consuming	3.63	A
Inadequate extension advice	2.82	U
Poor durability	2.72	U
Container size	3.58	A
Plastic Jerrican		
Capital intensive	3.03	A
Time consuming	3.52	A
Poor durability	2.81	U
Container size	3.92	A
Rhumbus		
Capital intensive	2.59	U
Time consuming	2.87	U
Inadequate extension advice	3.14	U
Poor durability	3.20	A
Outdated	3.45	A
Actellic 25 EC		
Capital intensive	3.54	A
Time consuming	3.15	U
Inadequate extension advice	2.88	U
Poison nature	3.92	A
Odour	3.60	A
Actellic 2% dust		
Capital intensive	3.56	A
Time consuming	3.01	U
Inadequate extension advice	2.72	U
Poison nature	3.74	A
Odour	3.74	A
Phostoxin Tablet		
Capital intensive	2.38	U
Time consuming	2.28	U
Inadequate extension advice	2.78	U
Poison nature	3.42	U
Odour	4.18	SA

Key: 4.50-5.0=SA; 3.50-4.49=A; 2.5-3.49=U; 1.5-2.49=D; 0-1.49=SD.
Source: Field survey, 2020

Phostoxin Tablet: From Table 4 it can be seen that the respondents agreed that odour is the only constraints associated with using phostoxin tablet. However, they were undecided on whether phostoxin tablet is capital intensive or time consuming. Also, the respondents were undecided on whether inadequate extension advice is a constraint associated with using

phostoxin tablet. This implies that phostoxin tablet has a strong odour that caused difficulty in breathing when exposed to the environment. Most farmers stored their produce in their rooms according to Gbadebo *et al.* (2015) who found that 41.8% of farmers stored grains in their rooms in Ido Local Government Area of Oyo State.

CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it can be concluded that the Phostoxin tablet is the most preferred storage method by the farmers. Based on the result of the multinomial logisticsregression, availability, simplicity, durability, effectiveness and qualitystored were found to be significantly affecting the choice decision for PICS (triple bagging) method of cowpea storage by the farmers; Also, age of farmers and farming experience were found to be significantly affecting the choice decision for metal drum method of cowpea storage. Furthermore, educational level, availability, simplicity and effectiveness were found to be affecting the choice decision of adopting the method actellics25EC and educational level is the only variable that affects the choice decision of actellic 2% dust. The study also concludes that capital intensive, time consuming, outdated, odor, poison nature of the storage method were the major constraints of the cowpea storage method. Based on the findings of the study, the following recommendations were proffered:

1. Farmers should be encouraged by extension agents to attend trainings and workshops on cowpea storage methods. This will go a long way of improving their knowledge and experience on the use of cowpea storage methods.
2. High cost of storage facilities is a major constraint affecting preference of storage methods. Therefore, Government and other stakeholders should encourage cowpea farmers and marketers by providing cowpea storage facilities at a subsidized rate to ease storage activities.
3. Farmers prefer the chemical phostoxin tablet for their cowpea storage. Therefore, extension agents should educate farmers on the duration of storing cowpea with phostoxin tablet to avoid the dangers of eating or selling cowpea with chemicals.

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