

EVALUATING THE MOST PROFITABLE COWPEA STORAGE METHOD IN MUBI NORTH AND SOUTH (LGAs) OF ADAMAWA STATE, NIGERIA

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ABSTRACT

This research work evaluated the most Profitable Cowpea Storage Method in Mubi North and South (LGAs) of Adamawa State. Primary data for the study was obtained from randomly selected cowpea marketers from the main grain markets of the LGAs. The data collected were analyzed using four-point Likers scaling, Gross Margin analysis and Garrett's ranking. The study revealed that majority of the respondents had agreed drum, plastic containers, Purdue Improved Crop Storage (PICS) bags, with 94%, 86%, 64% respectively were more suitable and effective methods of storing cowpea while earthen pots was strongly disagreed by all the respondents in the study area. The Quantity of cowpea stored by PICS bags method had the lowest gross margin ₦413,900.00 while Quantity of cowpea stored with drums method had the highest ₦625,700.00. It shows that marketers who used drum among other methods, incurred more marketing cost ₦52,300.00 but were more profitable. The respondents ranked improper storage practices, absence of adequate storage infrastructure as well as the development of the hard-to-cook (HTC) defect in cowpeas (1, 2 and 3 respectively) as the major hurdles for many smallholder cowpea farmers while lack of awareness of improved storage methods among farmers as minor in the study area. The study therefore, recommends that, government should subsidized cowpea storage equipment's to enhance profitability and cowpea marketers should imbibe the use of airtight containers to avoid excessive loss of quality and profit.

Keywords: Cowpea storage, Drum, Gross Margin, Plastic containers, Profitability,

INTRODUCTION

The insect pests of cowpea such as bruchids is a common Postharvest problem in Nigeria and has often exacerbated the food insecurity and poverty of households. Cowpea (*Vigna unguiculata* L. Walp) is an ancient crop that originated and was domesticated near Ethiopia (Gómez, 2004). Cowpea, widely cultivated in West

Africa, is an important source of protein, and plays a major role in generating income and ensuring food security for many smallholder farmers (Abadassi, 2015; Muhammad, 2018). Being an annual legume, cowpea is also commonly referred to as southern pea, blackeye pea, crowder pea, lubia, niebe, coupe or frijole (Abba, *et al.* 2022). Cowpea is mostly grown by smallholders in the hot, draught-prone savannah and very arid Sahelian agro-ecological zones. Cowpea is a protein-rich grain that complements staple cereal and starchy tuber crops. A major staple crop in Eastern and Southern Africa, the common bean is estimated as the third-largest source of calories and the second-largest source of dietary protein.

Background to the Study

With over 3.41 million tons produces annually (Food and Agricultural Organization Statistics [FAO], 2019), cowpea (*Vigna unguiculata*) play a key role in the agriculture and food supply of Nigeria. The seeds serve as a source of proteins and vitamins for man, feed for animals, and also a source of income. The young leaves and immature pods are eaten as vegetables. Over 90% of the population consume this grain as staple food (International Institute of Tropical Agriculture [IITA], 2009). The high consumption demand, reflects its adoption in meeting food as well as protein-energy requirements both in rural and urban areas. Cowpea is also a critical economic driver, promoting trade between producing and non-producing areas, with nearly 300,000 metric tons of cowpeas traded (Fulton, *et al.* 2009). Adequate and sustainable supply of this crop will guarantee the nation's economic stability by reducing poverty level, improve health conditions and enhance productivity (Ajayi and Ajanaku, 2007; Kalu and Tomasz, 2010).

A widely noticed constraint in cowpea trade and utilization is insect pests' infestation during storage. The most prominent and destructive storage pests of cowpea are bruchids of the genus *Callosobruchus* (Coleoptera chrysomelidea), which infest cowpea grains both in the field and at storage causing extensive grain weight losses through their feeding (Boxall, 2002; Golob, 2002). Losses in dry weight of cowpea due to bruchid damage have been estimated at about 30-40% of stored cowpea in Nigeria (Tapondjou, *et al.* 2002). With direct physical (weight) loss, manifesting in seed perforation causing substantial reductions in market value and germination ability of seeds. Indirect damage includes contamination of their feeding media with faeces, exoskeleton, insect body parts, dead bodies and their own existence in the product is often not commercially desirable. While the risk and

magnitude of losses increases the longer the grain is stored, farmers are limited in strategies to cope with storage loss (Kadjo, *et al.* 2013). Farmers, being faced with high rates of potential losses, selling at harvest may be an optimal strategy to avoid losses due to pest damage. Thus, farmers are consistently forced to sell immediately after harvest when prices are lowest in order to avoid storage losses, and this is a disadvantage to farmers (Moussa, *et al.* 2012). According to Kadjo *et al.* (2013) early sales reduce farmers' profit and the potential for producers to take advantage of price increase after harvest. Afolami (2001) opined that forced early sales can interact with or induce market failure and reduce farmers' market participation, with adverse consequences for the poor. This is because, farmers' market participation is directly related to their ability to generate marketable surplus. It is also observed that without proper storage facilities, high value market will remain largely inaccessible to the smallholder farmers, as this will hinder engaging in temporal arbitrage in the presence of substantial seasonal price fluctuations that increase income (Gilbert *et al.* 2017; Tesfaye & Tirivayi, 2018). When delving into the realm of augmenting market competitiveness, one must acknowledge the widespread consumption of cowpea as a legume in various regions, thereby establishing a competitive landscape within the market for cowpea products. By delving into an in-depth understanding and application of diverse storage methods, marketers can effectively distinguish themselves from competitors by providing superior-quality cowpea characterized by an extended shelf life. This strategic approach can serve to attract a larger customer base and subsequently bolster market share in the competitive arena.

It has been estimated that every insect emergence holes present in 100 seeds reduces the price of the grain by 2.3% (Jones *et al.* 2014; Mishili *et al.* 2011). Apart from the loss of monetary value (lower unit prices paid), storage loss also tightens food market by removing part of the supply from the market, contributing to farm-gate prices spikes. FAO (2018) stated that for every 1% rise in food prices, expenditure on food drops by 0.75% in developing countries. Safe storage of cowpea at the farm level is therefore critical to improve productivity, trade and utilization of cowpea, as this will directly impact poverty alleviation, food security, while improving livelihood and income of smallholder farmers in Mubi North and South (LGAs) of Adamawa State, Nigeria.

Statement of the Problem

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 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 losses. 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 losses 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. In the realm of ensuring food security, it is imperative to recognize the critical role that cowpea plays as a fundamental staple food within numerous communities in Adamawa State, particularly in regions where it holds dietary significance. By conducting a thorough examination of a myriad of storage methods, marketers can significantly contribute to the preservation of food security by mitigating postharvest losses and ensuring a steady availability of cowpea throughout the entire year. According to Baributsa *et al.* (2020) insecticides can be used to control cowpea weevils, although readily available and cheap is much too toxic because farmers 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 (Fakayod *et al.* 2014). Cowpea is a vital crop for food security and a major source of income for farmers, especially during the dry season when it's used as animal feed in Adamawa State, Nigeria. It is one of the cash crops grown in the State, along with cotton, tomatoes, onions, and more. Studies have shown that cowpea farmers in Adamawa State could increase their profitability by using existing Cowpea storage methods more efficiently. However, despite its nutritional and economic significance, cowpea farmers make huge postharvest losses mainly due to poor storage. Though, a lot of studies have been conducted on methods of cowpea

storage but still a lot of tons of the product is being lost every year, as a result of poor storage. Hence, this study is designed to "Evaluate the Most Profitable Cowpea Storage Method in Mubi North and South (LGAs) of Adamawa State, Nigeria" reassess the effectiveness of various methods of cowpea storage being practiced in the study area with a view of finding the best method.

Objectives of the Study

The broad objectives of the study is to Evaluate the Most Profitable Cowpea Storage Method in Mubi North and South (LGAs) of Adamawa State, Nigeria: The specific objectives, were to: assess different storage methods of cowpea used; evaluate the most profitable storage method; identify problems associated with cowpea storage; in the study area.

LITERATURE REVIEW

Methods of Storing Cowpea

PICS Bags

Purdue Improved Crop Storage (PICS) bags, formerly known as Purdue Improved Cowpea Storage bags, are a hermetic storage technology developed by scientists at Purdue University. These bags are specifically designed to reduce post-harvest losses of cowpea due to bruchid infestations in West and Central Africa (Baributsa *et al.* 2012). PICS bags consist of two layers of polyethylene liners and a third layer of woven polypropylene. When each layer is closed separately, it creates a hermetically sealed environment for storing harvested grain. This oxygen-deprived environment kills cowpea weevils (*Callosobruchus maculatus*) and other post-harvest pests (Baributsa *et al.* 2012). Scholars have recognized the effectiveness of PICS bags in preserving cowpea grain. The bags are cost-effective and provide a healthy and clean storage option for farmers. They help maintain the viability of cowpeas for planting, minimize mold growth and accumulation of mycotoxins, and control storage insect pests. PICS bags enable farmers to store their grains without the use of insecticides (Osei-Asibey *et al.* 2022).

Studies have shown that PICS bags are preferred by farmers for their effectiveness compared to other storage methods such as insecticides, ash, and botanicals. Farmers perceive that storing cowpea in PICS bags lowers pesticide-related health risks for both farmers and consumers. However, the non-use of PICS

bags is sometimes attributed to unavailability and high prices (Osei-Asibey *et al.* 2022). The success of PICS bags can be attributed, in part, to the engagement of low-resource farmers at various stages of development, testing, and extension of the technology. PICS bags have been used and reused to store cowpea for up to four consecutive years. Once they are no longer fit for storing cowpea, they can be repurposed for other uses (Murdock and Baoua, 2014). It is worth noting that PICS bags have been primarily developed for cowpea storage, but their uses have extended to other types of grain such as maize, wheat, rice, and peanuts (Murdock and Baoua, 2014).

Earthen Pot

Earthen pots have been traditionally used for various purposes, including storage of food items like grains and pulses. When it comes to cowpea storage, farmers in different regions have employed a variety of containers and structures. According to a study conducted in Northern Ghana, farmers stored their cowpea in different kinds of containers, including pots (Osei-Asibey *et al.* 2022). Similarly, in Kwara State, Nigeria, earthen pots were among the storage materials used by cowpea farmers. The use of earthen pots for cowpea storage can have several benefits. One of the main advantages is that earthen pots provide a natural and breathable environment for the stored cowpea. This can help in maintaining the quality of the grain by allowing proper air circulation and reducing the risk of moisture build up, which can lead to spoilage and contamination (Osei-Asibey *et al.* 2022). Additionally, earthen pots can help in preserving the nutritional value of the stored cowpea, as they cook the food slowly and require a minimum amount of oil, thereby retaining the natural oil and moisture of the grain (Mitticool, 2021).

Drum

One of the containers commonly used for cowpea storage is a drum. Farmers in different regions and countries have different preferences for storage containers, including drums. According to a study conducted in Northern Ghana, farmers stored their cowpea in different kinds of containers, including drums, woven polypropylene (PP) bags, silos, traditional shed/granaries, and other containers like pots, cement bags, jerry cans, and storage baskets/basins (Osei-Asibey *et al.* 2022). The study found that drums were used by farmers in the Upper West region of Ghana, among other containers. Similarly, a study conducted in Bauchi State, Nigeria, revealed that some cowpea farmers preferred using a metal drum as a storage method (Abba *et*

al. 2022). The study found that 5% of the farmers preferred using a metal drum for cowpea storage. It is important to note that the choice of storage container may vary depending on factors such as availability, cost, effectiveness, and personal preference. Different containers may have different advantages and disadvantages in terms of pest control, moisture regulation, and durability.

Problems of Cowpea Storage

Cowpea storage poses numerous challenges and difficulties that are encountered by farmers in the agricultural sector. The development of the hard-to-cook (HTC) defect in cowpeas is another consequence of improper storage conditions. This defect refers to the challenge of achieving the desired softness in cooked cowpeas, even with prolonged cooking. Storage at elevated temperatures can trigger the HTC defect, characterized by the incomplete breakdown of the middle lamella in the beans. The reliance on insecticides and chemical treatments to combat insect pests during cowpea storage introduces health and environmental hazards for farmers and consumers alike. While these chemicals may offer temporary relief from pests, their usage can pose risks to human health and the environment. It is imperative to explore safe and sustainable storage methods that minimize the dependence on chemical interventions (Osei-Asibey, 2022). The absence of adequate storage infrastructure presents a substantial hurdle for many smallholder farmers involved in cowpea storage. The lack of access to suitable storage facilities such as airtight containers or hermetic bags can compromise the freshness and quality of stored cowpea grains. Enhancing storage infrastructure and advocating for the adoption of appropriate storage technologies are crucial steps in overcoming this challenge. Furthermore, Fakayode *et al.* (2014) observed that lack of awareness and adoption of improved storage methods among farmers can impede progress in mitigating postharvest losses. Insufficient knowledge about safe and effective cowpea storage practices may hinder the uptake of advanced storage technologies that could enhance storage outcomes. Educating farmers and offering training on proper storage techniques play a pivotal role in improving storage practices. However, addressing these multifaceted challenges necessitates a comprehensive approach that encompasses the development and dissemination of enhanced storage technologies, capacity-building initiatives for farmers, and the advocacy for sustainable storage practices. Endeavors aimed at reducing postharvest losses, enhancing grain quality, and ensuring food security are paramount for the sustainable storage of cowpea.

METHODOLOGY

The Study Area

Adamawa State is located in the North-eastern part of Nigeria. It lies between latitude 7° and 11° North of the equator and between longitude 11° and 14° east of the Greenwich meridian. It shares boundaries with Taraba State in the Southwest; Gombe state in the Northwest and Borno State in the North. The State has an international boundary with the Cameroun Republic along its Eastern border. It covers a land area of about 38,823.3km². This research was carried out in Mubi-north and south Local Government Area (LGAs) located in the northern agricultural zone of the state, where the former lies on latitude 10° 32' N to 10° 11' N and longitude 13°12' E to 13° 35' E, with a total land size of 926,553 Km². It has a total population of 151,515 with 78,059 male and 73,456 as female. While the later lies on latitude 10° 05' N to 10° 30' N and longitude 13°10' E to 13° 30' E, with a total land size of 424,703 Km². It has a total population of 129,956 with 66,553 male and 63,403 as female (NPC, 2006). The major livelihood of the inhabitant apart from the cattle marketing is crop production with cowpea as one of the notable crop.

Sampling Technique and Sample Size

Simple random sampling technique was used for the study. The sample size was obtained from the proportion of the total number of registered cowpea marketers in each of the selected markets. A total number of fifty (50) questionnaires were administered to the randomly selected registered cowpea marketers in the two selected grain markets in Mubi metropolis. All the questionnaires were successfully retrieved and used for the study.

Sources and Method of Data Collection

The data for this research was drawn from primary source which was gathered by the researcher through the use of well-structured questionnaires. It was collected from the randomly selected respondents in the study area. The data is for 2024/2025 cropping season.

Analytical Techniques

The data collected were subjected to appropriate statistical tools for analysis, where modified four-point liker scale (SA= Strongly Agree, A= Agree, D= Disagree, SD= Strongly Disagree) was used for objectives I and gross margin analysis was used for objective II while Garrett's ranking was used to ranked the problems of cowpea marketing.

The mathematical Equations

Gross margin can be expressed as; $GM = GFI - TVC$ (1)

Where;

GM = Gross Margin (₦/Ha)

GFI = Gross Farm Income (₦)

TVC = Total Variable Costs (₦/Ha)

And $NFI = GM - FC$ (2)

Where;

NFI = Net Farm Income (₦/Ha)

FC = Fixed Cost (₦/Ha)

Garrett's ranking technique can be expressed as:

$$\text{Percentage Position} = \frac{100 (R_{ij} - 0.50)}{N_j} \dots\dots\dots (3)$$

Where, R_{ij} = Rank given for the i^{th} constraints by the j^{th} farmer;

N_j = Number of constraints ranked by the j^{th} individual.

The percentage position of each rank was converted into scores using Garrett's table.

RESULTS AND DISCUSSION

The results presented here were based on the information obtained from the retrieved questionnaires.

Different Cowpea Storage Methods

According to the information in table 1 the use of polyethylene bags, earthen pot, rhumbu, silo and crib to store cowpea in the study area had mean values of 1.74, 1.72, 1.56, 1.64, 1.78 respectively and are less than the grand mean therefore, not suitable

and effective methods of storing cowpea while aluminum bins, hessian bags, Plastic containers, jude bags, and Drums had 2.4, 2.3, 2.6, 2.1, 3.3, mean values respectively and were more than the grand mean therefore, suitable and effective methods of storing cowpea in the study area. This findings concur Abdullahi *et al.* (2023) who reported that majority of farmers asserted that steel drums were the best storage cowpea technique, with the highest mean score of 3.39, while rhomboidal storage techniques had the lowest mean score of 2.15 in the study area.

Table 1: Different Cowpea Storage Methods

S/N	Item Statement	SA	A	D	SD	Mean	St. Dev.
1	Polyethylene Bags	3 (6%)	6 (12%)	16 (32%)	25 (50%)	1.74	0.9
2	Aluminum Bins	6 (12%)	14 (28%)	24 (48%)	6 (12%)	2.4	0.86
3	Hessian Bags	9 (18%)	11 (22%)	15 (30%)	15 (30%)	2.28	1.09
4	Plastic containers	15 (30%)	14 (28%)	9 (18%)	12 (24%)	2.64	1.16
5	Earthen Pot	0 (0%)	5 (10%)	26 (52%)	19 (38%)	1.72	0.64
6	Jute Bag	2 (4%)	7 (14%)	37 (74%)	4 (8%)	2.14	0.61
7	Drum	18 (36%)	27 (54%)	5 (10%)	0 (%)	3.26	0.63
8	Rhumbu	0 (0%)	0 (0%)	28 (56%)	22 (44%)	1.56	0.5
9	Silo	0 (0%)	0 (0%)	32 (64%)	18 (36%)	1.64	0.48
10	Crib	0 (0%)	0 (0%)	39 (78%)	11 (22%)	1.78	0.42
Grand Mean						= 2.12	

DECISION: If the value of the grand mean is greater than the items mean then the storage method is not common in the study area.

Table 2 revealed that majority of the respondents had agreed drum, plastic containers, Purdue Improved Crop Storage (PICS) bags, with 94%, 86%, 64% respectively were more suitable and effective methods of storing cowpea while earthen pots was strongly disagreed by all the respondents in the study area. Aliyu

et al. (2016) also found that air tight containers as one of the most effective method of cowpea storage in Mubi South Local Government Area.

Table 2: Cowpea Storage Method suitable in the study area

S/N	Item Statement	SA	A	D	SD	Mean	St. Dev.	Decision
1	Purdue Improved Crop Storage (PICS) bags	32 (64%)	11 (22%)	7 (14%)	0 (0%)	3.5	0.74	Suitable
2	Earthen pots	0 (0%)	0 (0%)	37 (74%)	13 (26%)	1.74	0.44	Not-Suitable
3	Drum	47 (94%)	3 (6%)	0 (0%)	0 (0%)	3.94	0.24	Suitable
4	Plastic containers	43 (86%)	5 (10%)	2 (4%)	0 (0%)	3.82	0.48	Suitable
Grand Mean						3.25		
=								

DECISION: If the value of the grand mean is greater than the items mean then the storage method is not suitable in the study area.

Table 3 revealed an estimated profitability of cowpea based on the three most widely used methods of Storage (Purdue improved crop storage bags, Drums and plastic containers) with 1,200.00, 1,500.00, 1,300.00 kg respectively. These total quantities, were stored for five months and ~~N~~442,600, ~~N~~667,700, and ~~N~~507, 450 respective revenue were realized. The selling price of cowpea stored ~~N~~ per kg after the five months period in these three methods also differ significantly with ~~N~~1,000 from ~~N~~850 for Purdue improved crop storage bags, and ~~N~~1, 200 from ~~N~~850 for Drums while it increase to ~~N~~1,050 from ~~N~~850 for plastic containers methods.

It is very obvious that cowpea marketers who used drum incurred more marketing cost (~~N~~52,300.00) and were more profitable. This concur with Abdullahi *et al.* (2023) who reported that majority of farmers asserted that steel drums were the best storage technique, in their study on Post-Harvest Problems of Cowpea Faced by Farmers in Madagali Local Government Area of Adamawa State - Nigeria. It is also contrary with what Mohammed and Abdullahi *et al.* (2023) found in their study that Impact of Purdue Improved Cowpea Storage (PICS) bags usage was more profitable and had impt on cowpea storage in Kontagora Local Government Area of Niger State. It implies that drum storage have higher quality storage among the

methods used in the study area. Quantity of cowpea stored by Purdue improved crop storage bags method had the lowest gross margin (N413,900.00) while Quantity of cowpea stored by drums method had the highest (N625,700.00).

Table 3: Estimated Profitability of Cowpea Based on three Methods of Storage

Items	Quantity of cowpea stored by Purdue improved crop storage bags method (N/Kg) A	Quantity of cowpea stored by drums method (N/Kg) B	Quantity of cowpea stored by plastic containers method (N/Kg) C
Cost/ farm gate price of cowpea (N/Kg)	850	850	850
Selling price after storage of cowpea (N/Kg)	1,000	1,200	1,050
Duration of Storage (Months)	5.00	5.00	5.00
Quantity of cowpea stored by all users (Kg)	1,200	1,500	1,300
Quantity of cowpea sold by all users (Kg)	500.00	600	530
Returns			
Total Revenue (R)	452,600.00	667,700.00	507,450.00
Variable Cost			
Transportation	10,200	13,000	11,400
Labour	10,000	14,000	11,500
Chemicals	10,000	6,000	9,000

Security	8,500	9,000	7,800
Total Variable Cost (TVC)	38,700.00	42,000.00	39,700.00
Fixed Cost			
Store Rent	6,200	7,000	6,500.00
Taxes	1,500	1,500	1,500.00
Depreciation on storage bags/equipment's	1,000	1,800	1,350.00
Total Fixed Cost (TFC)	8,700.00	10,300.00	9,350.00
Total Marketing Cost (TMC)	47,400.00	52,300.00	49,050.00
Gross margin for (A, B, C)	413,900.00	625,700.00	467,750.00
Net Income for (A, B, C)	405,200.00	615,400.00	458,400.00

Table 4 contains the responses on the problems associated with cowpea storage in the study area. The table reveals that improper storage practices, absence of adequate storage infrastructure as well as the development of the hard-to-cook (HTC) defect in cowpeas with total mean scores of 3037, 2862, 2802, and were ranked 1, 2 and 3 respectively by the respondents as the major hurdles for many smallholder farmers involved in cowpea storage in the study area. While Lack of awareness and adoption of improved storage methods among farmers with a total mean score of 1888 was ranked as the least problem. The findings concur with Abdullahi *et al.* (2016) who reported inadequate storage facilities, as one of the major problems faced by cowpea marketers in Mubi South Local Government Area, Adamawa State, Nigeria. Similarly, Chibuzo *et al.* (2024) also reported that high susceptibility to pests and diseases from planting to storage phases, low adoption of improved cowpea seed varieties, poor soil fertility, drought, and heat stress as the major problem of cowpea production.

Table 4: Problems associated with Cowpea Storage

S/N	Items Statements	Rank					Total no. of responder	Total Score	Total Mean	Rank
		1	2	3	4	5				
1	Improper storage practices can lead to significant postharvest losses of cowpeas	20	15	5	07	03	50	3037	60.74	1

2	The development of the hard-to-cook (HTC) defect in cowpea is another consequence of improper storage conditions.	13	15	11	08	03	50	2802	56.04	3
3	There is the threat of insect infestation, especially prevalent in regions like sub-Saharan Africa	05	12	09	14	10	50	2345	46.90	4
4	The absence of adequate storage infrastructure presents a substantial hurdle for many smallholder farmers involved in cowpea storage	14	11	20	02	03	50	2862	57.24	2
5	Lack of awareness of improved storage methods among farmers can impede progress in mitigating postharvest losses	04	03	05	16	22	50	1888	37.76	5

Conclusion and Recommendations

The study reveals that the use of polyethylene bags, earthen pot, rhumbu, silo and crib to store cowpea in the study area had mean values of 1.74, 1.72, 1.56, 1.64, 1.78 respectively and are less than the grand mean therefore, not suitable and effective methods of storing cowpea while aluminum bins, hessian bags, Plastic containers, jude bags, and Drums had 2.4, 2.3, 2.6, 2.1, 3.3, mean values respectively and were more than the grand mean therefore, suitable and effective methods of storing cowpea in the study area. It implies that drum storage have higher quality and more profitable storage method used in the study area. Quantity of cowpea stored by Purdue improved crop storage bags method had the lowest gross margin ₦413,900.00 while Quantity of cowpea stored by drums method had the highest ₦625,700.00 and were more profitable. The respondents ranked improper storage practices, absence of adequate storage infrastructure as well as the development of the hard-to-cook (HTC) defect in cowpeas (1, 2 and 3 respectively) as the major hurdles for many smallholder cowpea farmers While Lack of awareness and adoption

of improved storage methods among farmers as minor in the study area. The study therefore, recommends that, government should subsidized cowpea storage equipment's to enhance profitability and cowpea marketers should imbibe the use of airtight containers to avoid excessive loss of quality and profit.

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