FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 7 No. 6, December (Special Issue), 2023, pp 309 -313
DOI: https://doi.org/10.33003/fjs-2023-0706-2195

INFLUENCE OF POSTHARVEST CHALLENGES FACED ON INCOME OF ACHA FARMERS IN PLATEAU STATE, NIGERIA

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ABSTRACT

Acha is widely grown in Plateau State where it provides food, income and employment for many farmers. However, there are postharvest challenges associated with its cultivation which have implications on their income. This study examined the effects that acha postharvest challenges have on the income of acha farmers in Plateau State. The population of this study comprised all the registered acha farmers in two of the three agricultural zones in Plateau State. The two zones are Plateau North and Plateau Central with an estimated 3,143 registered acha farmers according to Plateau Agricultural Development Programme (PADP). Of the population, 400 acha farmers were randomly selected. The study adopted semi-structured questionnaire and Focus Group Discussion (FGD). Data were analysed with frequencies and percentages while the assumption was analyzed with the use of Pearson Product Moment Correlation (PPMC). Findings showed that the main post-harvest challenges facing the farmers were high cost of transportation (95.7%), inadequate harvesting equipment and high cost of labour (93.6%), low quality packaging sacks and lack of access to improved processing equipment (90.5%). On income, 31.5% earned between 41,000 -60,000 while 30.5% earned 81,000 and above. PPMC analysis indicated that challenges faced during threshing and packaging had inverse significant relationship with income of the farmers. The study thus concluded that challenges faced during threshing and packaging adversely affected income of the farmers. Therefore, special extension intervention is needed to assist the farmers to overcome challenges facing acha farmers during threshing and packaging of acha in Plateau State.

Keywords: acha farmers, cost of labour, cost of transportation, income, threshing, packaging

INTRODUCTION

The study sets out to investigate the challenges encountered by acha farmers and their attendant effects on the socio-economic wellbeing of the acha cultivators in Plateau State, Nigeria. Acha is considered as one of the oldest indigenous African cereals with cultivation records dating back to 7000 years (Crutz, 2004). It is cultivated in several African countries particularly in the West African sub-region. The crop is highly nutritious and economically beneficial to farmers and the economy of Plateau State. It serves as staple food, provides income and job opportunity for many, offers medicinal value for diabetic patients. The chaffs and straw of the crop are used as livestock feeds as well as molding of mud blocks for traditional mud hut construction.

Farmers involved in acha production also engaged in other value chain activities including processing, transporting, and marketing. Farmers' involvement in the value chain has made acha production in Plateau State an important crop. The value addition of acha (*Digitariaspp*) includes flour made into thick unfermented porridges, "tuwon acha" and fermented grains cereals used for thin porridges, "Kunu acha", and grains are cooked with vegetables, fish or meat for consumption, "Gwoten acha". It is also prepared like rice, though steamed rather than boiled in water and eaten with stews (Abdurrahman et al, 2015). In some localities in Plateau State, women brew fermented kunu from acha (*Digitaria spp*) for special ceremonies like marriages and births. Acha is also prepared as *Digitaria spp* pies, *Digitaria spp* cake, and bread *Digitariaspp* chapgatti, and *Digitaria spp* moimoi. It is also popped and can be combined with other flours to make bread. Acha is recommended for diabetic patients and breastfeeding moms since it is said to have therapeutic characteristics. The minerals in acha are thought to help diabetics maintain normal blood sugar levels, according to Jideani and Akingbala (1993). According to Sani and Silas (2012), acha contains more nutrients that the body needs to maintain and prevent type 2 diabetes. The resistant starch is a component of various substances that help manage and prevent type 2 diabetes and pre-diabetes. According to a study by Jideani & Jideani (2011), acha cereal grains are currently the subject of renewed interest in Africa and the rest of the world due to their adaptability and nutritional value. The composition of acha proteins is comparable to that of rice, although with substantially greater Sulphur amino acid (methionine and cysteine) content. According to Jideani and Akingbala (1993), acha cereal is a crucial source of amino acids for people with low intake and is essential for maintaining healthy heart and nervous system function. It serves as staple food, provide income and job opportunity, medicinal value for diabetic patients, traditional delicacies, chaffs and straw used as livestock feeds as well as moulding of mud blocks for traditional mud hut construction. Despite the crop's ancient heritage and widespread importance nutritionally and economically, analysis about its farming challenges in relation to the effects on the socio-economic wellbeing of its cultivators remain very scanty. Understanding the challenges faced by acha farmers and their impact on farmers' income is crucial as it will provide insights into the potential effects on local food and wellbeing. Acha's significance as means of sustenance and income requires grasping farmers' challenges and production implications. Analyzing acha farmers' economic wellbeing is essential for understanding livelihood dependence and overall community quality of life. The impact of acha farming on community development, education, and essential services is intertwined with its influence on income. The objectives of this study are to analyze the challenges acha farmers encounter along the

value chain, discuss post-harvest factors responsible for these challenges and suggest how the problems encountered by the farmers can be minimized.

MATERIALS AND METHOD

A cross-sectional design was chosen for this study based on its effectiveness in collecting data on people's views, feelings, attitudes, and perceptions regarding various topics. The study area Plateau State is located in the North Central region of Nigeria. Plateau State is a state located between latitude 08.24'N, latitude 008.32' and longitude 010.38' East, with an area of 26,026 km^2.

The population of this study comprised all the registered acha farmers in two of the three agricultural zones in Plateau State. These two agricultural zones are Plateau North and Plateau Central with a total population of 4,197,315 (NPC Projection, 2021) of which an estimated 3,143 according to Plateau Agricultural Development Programme (PADP) are registered acha farmers. Of the population, only 400 acha farmers were randomly selected using Taro Yamane's formula.

The study adopted semi-structured questionnaire and Focus Group Discussion (FGD). The essence of the semi-structured questionnaire stems from the fact that the educational level of the majority of the respondents is low. Besides, it restricts respondents to limited options provided by the researcher for easy analysis, while Focus Group Discussion (FGD) on the other hand is considered based on its probing ability of gray areas that the questionnaire instrument of data collection might not be able to address.

Data were analyzed qualitatively and quantitatively. Specifically, objectives of the study were analyzed with simple frequencies and percentages while the assumption was analyzed with the use of Pearson Product Moment Correlation (PPMC). With regards to the qualitative analytical method, tape-recorded data gathered from the Focus Group Discussions were transcribed and important expressions and quotation by the respondents were reported verbatim to enrich the findings using thematic content.

RESULTS AND DISCUSSION

Table 1: Average annual income of Respondents

Income range	Frequency	Percentage
Below 40,000	88	23.16
41,000 -60,000	120	31.58
61,000 -80,000	56	14.74
81,000 and above	116	30.53

Annual income realized from acha farming was presented in Table 1. Findings showed that 120(31.58%) of the respondents earned between ₦41,000 and ₦60,000. Also, 116(30.53%) respondents earned between ₦81,000 or more, 56 (14.74) respondents earned between ₦61,000 and ₦80,000. However, only 88(23.16%) respondents earned below ₦41,000 annually. Despite the fact that earning was relatively low, the implication is that farmers cultivating acha in Plateau State could earn more income to create and sustain better living standards. The findings of this study and implication is supported by the findings of Philip and Itodo (2006) that acha serves as food for consumption majorly and secondarily as a source of income. The findings of this study is also supported by Umaru and Hassan (2018) who maintained that acha production is an efficient form of agricultural production and profitable business that contributes significantly to farmers' income. As suggested by Umaru and Hassan, if properly harnessed, acha production has the capacity to significantly raise household income and reduce poverty while providing the needed jobs for the jobless citizens of the producing states of Nigeria.

Table 2: Post-Harvest Factors Affecting Acha Farming

Items	Frequency	Percentage
Difficulty in separating acha from related weed	336	88.42
Inadequate harvesting equipment	356	93.68
High cost of labour	356	93.68
Inadequate threshing tools	220	57.89
Lack of adequate time to separate sand from grain	232	60.79
Low quality packaging sacks	344	90.53
Inadequate packaging implements	284	74.74
Lack of processing knowledge	104	27.37
High cost of packaging materials	208	54.74
Lack of access to improved processing equipment	344	90.53
High cost of improved processing machineries	284	74.74
Poor road condition	311	81.84
High cost of transportation	364	95.79
Inadequate transport services	116	30.53
Multiple taxes during transportation	132	34.74
High infestation of insect/pest/rodents	245	64.47
Field drying	211	55.53
Additional drying	219	55.63
High cost of storage facilities	172	45.26
Inadequate knowledge of the use of storage pesticide	198	52.11
Long distance to acha market	245	64.47
Inadequate market information	172	45.26
Poor market demand	120	31.58
Consumers' preference for other grains like rice	198	52.11

Source: Field Survey, 2022

As presented in Table 2, result on post-harvest factors affecting acha farming indicated that 356(93.68%) respondents lack adequate harvesting equipment and 336(88.42%) respondents faced difficulty in separating acha from related weeds. The respondents agreed that acha farming is crucial for the provision of food and livelihoods of many communities, particularly in Plateau State. However, despite its significance, acha farmers encounter several challenges during the post-harvest phase of production. From the analysis, lack of adequate harvesting equipment and difficulties in separating fonio from related weeds were seen as discouragement to some farmers. As maintained by one of the focus group discussants, there are challenges associated with acha farming as presented thus:

> "Myself, I am still doing my acha work but many people that use to farm it don stop. They complain that the seed is small and the knife we use to harvest make loss to pass the gain. We don't have good tool to harvest our acha and if you farm much, it waste time because you will cut pay people or give them cook food to help you. This is another spending. This farm is hard seriously because even when you plant it and it start to grow, the grasses use to be similar with the acha. You must be careful in weeding. Not everybody will understand the different" (FGD, 2022).

These implied that inadequate harvesting equipment and difficulty in separating acha from related weeds were some of the post-harvest problems facing majority of acha farmers in Plateau State. Acha plants and weeds can often have similar physical characteristics, making it challenging to efficiently separate the valuable grains from the undesirable components. This finding agrees with Okeme et al., (2021) who found that 100% of acha farmers in both Nasarawa and Plateau States were not aware of mechanical harvesting tools but used only manual method in harvesting. The process of manual harvesting introduces stones into the acha produce and thereby reduces its quality and acceptance in the market.

Result presented in Table 2 also revealed that 356(93.68%) respondents indicated high cost of labour. From the responses, it is clear that the respondents look at the operating expenses involved in acha farming as a source of concern. This means that the high cost of labour affects the financial resources of acha farmers especially those who are operating on tight profit margins. If labour costs become prohibitively expensive, the acha farmers will not be willing to commit their finances into it with the fear that they may have financial losses if the yield is poor. Some of the acha farmers operates at subsistence level and may be vulnerable to high labour costs. They might not have the resources to mechanize their operations or absorb the increased labour expenses, leading to a cycle of economic hardship. Similarly, a discussant has this to say:

> "You see, some things you farm them not all you ask people to help you to do work on it. We use to farm here well well. So if you say every work you will pay people from the beginning and harvesting you pay, hmm, it will cost you. Now, all these boys used to charge very high even the women that use to weed don't do like before they collect food and kunu and do the work. Sha, some women association use to still help. For example, myself, I am old so I use to farm acha for my tuwon. So how can I begin to pay from something like ₦10,000 to people after I will still pay them to weed and I will still give money to harvest then I will give money to pound it? It is big money o. Calculate and see yourself. So sometimes I farm only masara and put cow shit and the work is not much like that" (FGD, 2022).

From the above findings, the respondents indicated that acha farming is labour intensive requiring a significant amount of human effort for tasks like planting, harvesting, and threshing. Therefore, high labour costs discourage some of the acha farmers from growing the crop and encourage them to shift to crops that require less manual labour and expenses. Many acha-growing communities experience rural-to-urban migration, with young workers seeking better economic opportunities in Jos city and other towns. This has led to a shortage of available agricultural labour further driving up labour costs for those remaining in rural areas. Acha farmers usually struggle to find enough workers to perform essential tasks during critical times in the farming cycle, such as planting and harvesting. The cost of labour during farming seasons forced some acha farmers to neglect its cultivation, consequently venturing into other crops. The findings of Tanam and Olaoye (2022) concurred that acha harvesting and processing have continued to be a challenge to acha farmers because of its labour intensity.

The findings in Table 2 further showed that 232(60.79%) respondents lacked adequate time to separate sand from grain. The high percent (60.79%) of respondents equally indicated that they lacked adequate time to separate sand from grain in the post-harvest period. This challenge could be related to various factors affecting acha farming during the post-harvest period. The findings showed that the acha farmers still looked at traditional methods of separating sand from acha grains which is labour intensive. If farmers lack adequate help or are unable to hire labour due to financial constraints, the workload could become overwhelming and this alone is a discouraging factor from continuing acha cultivation.

A participant engaged in discussion noted that separating sand from acha grains is a crucial post-harvest task which is time-consuming and labour-intensive:

> Certainly. After the harvest, the grains are used to be mixed with sand, especially if we use traditional threshing methods. This sand needs to be seriously removed before we can store or sell the acha. If you just keep it like that, even you can't eat it. So, this thing use to take much time. It can take many hours of if we use our basket to remove the sand. For person like me that use to farm much, can't I do other things?" (FGD, 2022).

The implication of the above findings showed that the process of manually separating sand from grains is extremely labour-intensive for acha farmers in the study area. The manual separation process is time consuming. Acha farmers have multiple responsibilities on the farm, including planting, tending to crops, and other post-harvest tasks. Spending excessive time on this process detracts from other crucial activities. The manual process is inherently less efficient compared to mechanized or semi-mechanized methods, however, it is not common in households that cultivate acha. The arduous task of separating sand from grain can be discouraging for farmers. It can lead to a sense of frustration and demotivation, especially when they realize that a significant portion of their time is spent on this single post-harvest activity. The results of this study concurred with the findings of Popoola et al. (2020), which examined the constraints on the production of acha in Jos South LGA, Plateau State. It was found that the difficulties encountered during the weeding and throwing processes, the time lost during production, the amount of stress involved, and the decrease in grain quality were all contributing factors to the limitation of acha production, winnowing and loss of grains were the constraints to acha production in Jos South, Plateau State.

Table 2 also indicated that 344(90.53%) respondents lacked access to improved processing equipment and can only access low quality packaging sacks. The findings revealed that majority (90.53%) of acha farmers lacked access to modern and improved processing equipment. Processing equipment include machines for threshing, cleaning, sorting, and milling acha grains. These processes are crucial in ensuring that the harvested grains are cleaned, separated from chaff and impurities, and eventually turned into a usable product. Packaging is crucial for protecting the grains from moisture, pests, and other external factors that could lead to spoilage.

Another discussant also expressed their acha farming challenges during post-harvest season thus:

> "When we don't have access to modern processing equipment, tasks like threshing and winnowing become time consuming and physically demanding. This slows down the entire post-harvest process. And then, when it comes to packaging, the low-quality sacks we have access to might not provide adequate protection for the acha". However, we are lucky to have some companies in our area like Grand Cereals and Oil Mills Ltd and NASCO Group, all in Jos South. Most of them come to our village and purchase the grains in large quantity" (FGD, 2022).

Table 2 further illustrated that 284(74.74%) respondents indicated high cost of improved processing machineries and do not have access to adequate packaging implements. This finding revealed that the high cost of modern processing machinery means that many acha farmers are unable to invest in equipment that could improve the efficiency of post-harvest processing. Some of the discussants wished that they have access to efficient machinery that could help them in tasks like threshing, cleaning, and milling acha grains, reducing the time and labour required for these processes. Unfortunately, they do not have access to such machinery leading to them resorting to manual processing methods, which are slower, labour intensive.

Result in Table 2 presented other factors affecting acha farming. It showed that 245(64.47%) respondents experienced high infestation of insect/pest/rodents. The study indicated that insects, pests, and rodents are other factors farmers have been afraid of in committing much into acha farming especially due to lack of financial capacity to purchase pesticides and herbicides. The harvested acha stored without application of herbicides usually lead to the attraction of pests like weevils, moths, beetles, ants which consume or contaminate the crop resulting in reduction in quantity and quality.

The finding of Mapfeka et al., (2019) explored that, in a situation where there is high infestation of insect, pest and rodents, coupled with inadequate access to pesticide for the farmers, huge field loss of acha will be prevalent. This usually lead to a loss in weight, nutritional value, the viability of seeds, contaminating grains, odour change, growth of mold, and heat damage. All these reduce grain quality and make them unsuitable for human food or animal feed. Umar et al., (2020) mentioned stem borers, beetles and the leaf hoppers, fungi, weeds, birds, and rodents as the main storage insect pest and rodents found associated with acha in Nigeria.

The Table also presented data on the post-harvest factor of "field drying" in acha farming. According to the data, 211 (55.53%) respondents, acknowledged field drying as a factor affecting acha farming in the study area. Field drying refers to the process of allowing harvested crops to air-dry in the field before further processing or storage. This step is crucial for many crops, including acha, as it helps reduce moisture content and prevent mold or decay. The implication of this finding is that, the high percentage suggested that a significant portion of acha farmers in the study area recognized field drying as an important post-harvest factor.

One of the discussant opined thus:

> "Actually, God don bless us here for Plateau. Acha work is very hard o. Before you do it you think of rain that de fall anyhow here especially for raining season. So to start think of how to dry it, hmm, it is not easy. But you see maize no get that stress like acha. If you cut and put in the farm to dry, birds, rats, insect will chop it seriously, some people ma de steal the acha if you cut and put for farm to dry" (FGD, 2022).

The quantitative study highlighted that 55.53% of respondents recognized "field drying" as a significant post-harvest factor in acha farming. The qualitative discussion group further supported this, with participants emphasizing the challenges posed by the local weather conditions, especially in Plateau State, where rainy seasons and high humidity levels can hinder effective field drying. Participants also noted that acha farming demands significant effort and attention, particularly in managing the drying process to avoid losses from pests and theft.

The findings also revealed that 219 (55.63%) respondents acknowledged additional drying as a significant factor affecting acha farming in the study area. Additional drying refers to the supplementary drying process that takes place after the initial field drying. This step is essential for reducing moisture content to a level suitable for safe storage and to prevent the growth of molds and fungi. The high percentage suggested that a significant portion of acha farmers in the study area recognize additional drying as an important post-harvest factor. The information from the discussants strongly supported additional drying as a post-harvest factor affecting acha farming in the study area. One of the discussants stated that in her experience, additional drying is paramount because it ensures that the moisture content of the acha is at an optimal level for storage. This is because harvested acha can still contain amount of moisture, and without proper drying, it becomes susceptible to mold and spoilage during storage. In the same vein, a male participant said that, even after field drying, there might still be residual moisture. The extra drying step helps to guarantee that the acha is thoroughly dried, reducing the risk of post-harvest losses. Similarly, a participant from Du, Jos South added that, beyond preventing spoilage, additional drying also enhances the quality of the acha. According to her, properly dried acha tends to have bring out the white colour and taste. This not only satisfies consumer preferences but also improves marketability. At the same time, a participant from Mangu said that, additional drying of acha reduces the likelihood of pests and insect infestations during storage, which can be a significant issue if the acha isn't thoroughly dried.

The Table also indicated that 245 (64.47%) respondents agreed that they faced the challenge of long distance to market. Long distances often translate to higher transportation costs to the market consequently reducing their overall profitability. This financial burden stands to discourage farmers from engaging in acha farming or diminish their income potential. Participants in the study area indicated that the distance to the market is a major concern for them. After putting in all the hard work to harvest their acha, the last thing they face is a long, tiring journey to get it to market. A 47 year old female participant lamented thus:

> "In our place in Riyom, we have two markets, Ta-Hoss and Ganawuri. But we that farm acha, our main market is Ta-Hoss. If you go there, you will see many many things in the market like maize, acha, benny

seed, vegetables, potatoes, carrots, cabbage, beans. From my village you enter Going (machine) for ₦700 for person head to Ta-Hoss market. Our village is very very far to our market. If you have load, see the transport you will use. How much I will benefit. Sometimes we gather our things and give one person to sell for us and buy things for us. Ma, we are suffering here" (FGD, 2022).

Assumption of the study

There is no significant relationship between challenges faced by acha farmers and their income in Plateau State.

Table 3: Correlation between challenges and income of Acha farmers

Challenges	**Income**	
	Pearson Correlation	Sig. (2-tailed)
Challenges during threshing	- 0.724**	0.000
Challenges during packaging	- 0.149**	0.004
Challenges during transporting	- 0.086	0.093
Challenges during processing	- 0.086	0.093
Challenges during storage	- 0.086	0.093
Challenges during marketing	- 0.086	0.093

**Correlation is significant at 0.01 level

Result in Table 3 displayed that correlation between acha farmers' challenges and income in Plateau State. The result showed that challenges of farmers during threshing (r = -0.724), and packaging (r = -0.149) had significant correlation with income earned by Acha farmers at 0.01 level of significance, thus the stated assumption is rejected. On the other hand, challenges faced during transporting, processing, storage, and marketing showed no significant correlation with income earned by Acha farmers, thus the stated hypothesis is accepted for the non-significant challenges. The challenges of farmers during threshing, and packaging indicating negative coefficient correlation with income earned implies that the challenges have negatively impacted the income of the farmers while challenges faced during purchasing Acha for cultivation, transporting, processing, storage, and marketing showed possess no significant threat to income earned by Acha farmers.

CONCLUSION

This study examined post-harvest challenges faced by acha farmers and its association with income earned. The findings indicated that many farmers faced difficulties due to inadequate harvesting equipment and struggled in separating acha from related weeds. In addition, the findings showed that high labour costs particularly affects small-scale farmers in the study area and a majority of respondents lacked proper threshing tools, resorting to manual methods which caused physical strain. Time constraints during grain separation were a common issue, as acha farmers invested considerable effort in planting and growing stages. Additionally, traditional knowledge was valued, but access to modern processing equipment and packaging materials was limited, largely due to high costs and transportation challenges, including costs, taxes, and poor road conditions, were widespread. Issues such as insect infestation, cattle grazing, and attacks on crops further dampened farmers' motivation and storage pesticide knowledge and access to suitable facilities were areas of concern. Long distances to markets and limited market information were additional hurdles while some respondents reported poor market demand, others found success by targeting specific locations. In the same vein, consumer preference for grains like rice presented a notable obstacle to acha adoption in the study area. The study recommended that efforts should be put in place to address constraints related to inadequate equipment, storage facilities, and access to credit is paramount. Initiatives that provide affordable access to modern farming tools, storage facilities, and credit facilities that can significantly enhance the productivity and resilience of acha farmers should be provided be relevant government agencies.

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