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ORIGINAL RESEARCH ARTICLE

Assessing the Profitability of Cabbage Production among Farmers in North-Western Nigeria: A Case Study in Katsina Metropolis

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ABSTRACT
This study looked at the profitability of cabbage production among Cabbage farmers in North-western Nigeria. One hundred registered cabbage farmers were randomly chosen using a multi-stage sampling procedure. Descriptive statistics, such as frequency, percentage mean, and gross margin analysis, were used to analyse the study's objectives. Based on socioeconomic factors, the average age of cabbage farmers was 44 years old, with an average farm size of 1.5 hectares, 11 years of farming experience, and a family size of 9 persons. Additionally, 46% of the farmers had completed post-primary education. Farmers' profitability analysis showed a gross margin of N614,925.15 per hectare per year, with seed accounting for the largest variable cost of ₦37,384.82/ha of overall production costs. Furthermore, the ratio of the total variable cost to gross margin computed showed that for every ₦1 invested in cabbage production, ₦7.17k was realized. Pest and diseases, inadequate rainfall and inadequate capital were the major constraints faced by cabbage producers. Therefore, this study suggested that agricultural sector stakeholders provide agricultural credit, irrigation facilities, and resistant cabbage seed for increased productivity, resulting in high profitability.

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INTRODUCTION
Vegetables are of nutritional value to man as they offer much-needed vitamins, fibre, and minerals. They are vital foods that offer protection and are very helpful for preserving health and preventing illness. They have important food components that can strengthen and mend the body (Haruna, 2003). Vegetables are vital in preserving the body's alkaline reserve. Their high vitamin and mineral levels are the key reasons for their worth. Vegetables come in several varieties. Edible stems, roots, leaves, fruits, and seeds could be among them. Every group makes a unique contribution to the diet. Rich in energy and a rich source of vitamin B are fleshy roots. Proteins and carbohydrates are comparatively abundant in seeds. The sources of excellent minerals, vitamins, water, and roughage are leaves, steam, and fruits. In Nigeria, the amount of vegetables consumed is increasing annually, owing to a greater appreciation of their food value (Haruna, 2003).

According to Abdulrahman *et al.* (2018), among the Cole crops—which also include cauliflower, Brussels sprouts, broccoli, kohlrabi, collard greens, kale, broccoli, and many more—cabbage is the most significant vegetable in terms of commerce. It is widely grown as a garden and general farm crop and is considered one of the most significant vegetable crops. Because cabbage is always in demand, it becomes a staple vegetable much like potatoes. Retailers, restaurants, processors, and fresh produce markets sell fresh cabbages. Due to its versatility in diverse climates and soil types, nutritional content, ease of production, and storage, cabbage is a commonly consumed vegetable worldwide (Asia Farming, 2015). In Nigeria, this important vegetable is mostly produced in the North (Ogedegbe and Law-Ogbomo, 2013). It is largely said to originate from the wild, leafy vegetable grown in Europe (Grubben and Denton, 2004). It is still one of the most important vegetable crops in the world and is thought to be the most significant member of the Cruciferae, or mustard family.

Cabbage is claimed to be a crop high in vitamins and minerals, which benefits human health. It is highly regarded for its nutritional value and is a good source of vitamins A, B1, B2, and C, among other minerals (Kibar *et al.*, 2014). Being a vegetable, it is extremely nutritious and fulfills the dietary requirements of humans. The five

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countries that produce the most cabbage in Africa are Kenya, Ethiopia, Egypt, South Africa and Niger, according to Nicolas *et al.* (2012). These five nations have continued to dominate the industry, with Ethiopia generating 12% of all cabbage produced in Africa.

The rise in vegetable production has been stimulated by high demand by consumers as a result of their awareness of the health and dietary benefits inherent in fresh vegetables (Iheke, 2009). Therefore, there is a need to increase vegetable production to improve income, ensure food security, and offer employment opportunities to many rural farmers in Nigeria, who are smallholder farmers and depend on the income from their farm holdings to survive. Vegetables, especially cabbage, are a vital and widely cultivated food and income-generating crop in many parts of Africa (Adebisi-Adelani *et al.*, 2011). The market for cabbage is nonstop throughout the year and serves as an income source among groups most affected by poverty, including small farmers, youths, and, most especially, women who play an important role in agricultural production (Abdulrahman *et al.*, 2018).

The demand for cabbage is nationwide and the bulk of it is being consumed in the Southern part of Nigeria, while production is high in the Northern section of the Country. This situation has led to excessively high prices of cabbage due to transportation costs. Also, the demand for cabbage surpasses the supply, thereby causing a dearth of the commodity (Ogbodo *et al.*, 2009). However, this therefore informs the need to assess the profitability of cabbage production in the study area to provide an apparent yardstick for policy intervention.

Also, despite the involvement of farming households in cabbage production in the study area over the years, information on their income and profitability has remained scarce. Against the backdrop, this study looked at the profitability of cabbage production among cabbage farmers in Katsina metropolis, North-West Nigeria. Results from this study would enable policymakers to develop programs that would help the farmers increase their productivity and subsequently improve their income.

METHODOLOGY

Study Area

This study was carried out at Katsina Metropolis in Katsina State, which is situated near the Niger border. Katsina is roughly 160 miles east of Sokoto and 84 miles north-west of Kano State. The projected population of Katsina State in 2007 was 459,022. In addition to producing cabbage, groundnuts, cotton, hides and skins, millet, and guinea corn, the city is the hub of an agricultural region with mills for producing peanut oil. The majority ethnic groups in the city are the Hausa and Fulani, and the majority of the population is Muslim. It is located at 12° 59' 26.95" N latitude and 7° 36' 6.37" E longitude.

Sampling Procedure and Sample Size

For this investigation, a multi-stage sampling technique was employed. Purposive selection of the Katsina metro area was the initial step, as this region produces a lot of cabbage. Two (2) Katsina metropolis areas known for producing cabbage were purposefully sampled in the second stage. In the third step, one hundred (100) registered cabbage growers were chosen at random, proportionate to size, from the list of registered farmers. Primary data were obtained through interviews with the cabbage farmers and the use of a well-structured questionnaire.
The procedure for choosing the sample size proportionate to size involved the use of the following expression:

$$n = \left(\frac{x}{X}\right) * N,$$

Where:
n = Sample size
x = Number of cabbage farmers in a village
X = Total number of farmers in the selected villages
N = Total sample size

Table 1: Sampling frame and sample size in the study area.

S/N	Name of locations	No of registered cabbage farmers	Number of respondent selected
1	Kofar Sauri	500	70
2	Kofar Durbi	300	30

Data collection

The study used quantitative method of data collection. Primary data was collected using a well-structured questionnaire as the instrument used to collect data from smallholder cabbage farmers in the study area by trained enumerators. The questionnaire included precise questions regarding the socioeconomic characteristics of respondents, income of the farmers, cost of production, inputs used and output from their production, and the constraints faced by the farmers in cabbage production. The data collected were subsequently cleaned and coded in a worksheet to simplify access for analysis.

Analytical Technique

To accomplish the goals of this investigation, the following analytical instruments were employed: Basic descriptive statistics, such as frequency, percentage, and mean, were used to assess the respondents' socioeconomic characteristics, and the profitability of the cabbage producers was ascertained through the application of gross margin analysis. This assesses the costs and returns

of the farming operations. Using the following relationship, the gross margin per hectare was calculated:

$$GM = TR - TVC,$$
$$TR = Y_m * P_m,$$

Where:
GM = Gross margin (₦/ha)
TR =Total revenue (₦/ha)
TVC =Total Variable Cost (₦/ha)
Y_m = Output of cabbage (kg/ha)
P_m = Unit price of cabbage (₦)
and,

$$TVC = \sum P_i X_i,$$

Where:
P_i = unit price of the input (₦)
X_i = quantity of the input per hectare.
$\sum$ = summation sign

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Cabbage Farmers

Table 2, containing the socioeconomic characteristics of the farmers, revealed that, with a mean age of 44 years, the majority of the cabbage farmers (65%) were in the 40–59 years age group. This shows that the majority of cabbage farmers are younger, more lively, and full of energy. Similar results were also reported by Tefide and Melek (2024), who stated in their work that the average age of cabbage farmers in Niğde Province of Türkiye was 48.17 years. The results also showed that growing cabbage is a mostly male endeavour. In their investigation into the methods and barriers to cabbage production in Ghana's Brong Ahafo and Ashanti regions, Osei *et al.* (2013) found similar results. This could be explained by women's limited access to financial and land resources or by the fact that men are more likely to be active in farming in the study area and are historically seen as being able to provide for their families. This result is also consistent with Kibirige *et al.* (2016), who opined that men dominate farming in the province as women care for the family and household chores.

The majority of respondents (95%) were married, and 46% had completed their secondary education, according to the results. The research area's high literacy rate suggests that the respondents are open to accepting and implementing new ideas. The respondents' education level significantly impacts how quickly they pick up new ideas and concepts. This confirms the assertion of Mdoda *et al.* (2022) and Kiran *et al.* (2024), who reported that smallholder cabbage farmers in the Eastern Cape Province of South Africa and Khordha District of Odisha, India, respectively, were mostly literate, having spent approximately five years in school. Therefore, they are quick to adopt innovations.

Households with between one and nine members make up about 70% of the respondents. Given that the average household size is nine people, family labour is a readily available labour supply for the farmer. This is consistent with research by Jyanya *et al.* (2014), who found that household sizes ranged from six to more than ten persons among irrigated Irish potato growers in Plateau state. They contend that having a large family means free family labour is available, which lowers the cost of labour in manufacturing. In peasant or traditional agriculture, the respondents' family size is relevant since it affects how easy it is to obtain labour from the family for farming. There is a strong trend for the number of hectares farmed to increase with family size and to decrease with the number of hired labourers. Most farmers (96%) are members of an association where they talk about different issues and ways to increase the amount of cabbage they produce. Farmers who are members of farmers' associations can obtain knowledge that will help them and have access to limited resources. Results from the research work of Mdoda *et al.* (2022) revealed that the majority (70%) of cabbage farmers in the Eastern Cape Province of South Africa were members of farm organizations, who benefitted from training organized for them by their farmers' associations in line with their farming activities.

Enterprise characteristics of cabbage farmers

Farming experience is a vital criterion for efficiency, as improvement in farming methodology is being carried out from one farming season to another. Experience is an essential element that affects the management of an enterprise. The findings from this study revealed that about 88% of respondents have been involved in cabbage production for about 1 to 19 years, with an average farming experience of 11 years. This implies that cabbage production could be efficient in the study area as the years of experience could positively affect it. This result is congruent to the findings of Anselem and Ubokudom (2014), who worked on the Economics of water leaf production in Akwa Ibom State, Nigeria. The results also showed that 1.5 hectares was the typical farm size in the research area for producing cabbage. The outcome is comparable to that of Apata *et al.* (2011), who suggested that subsistence farmers—whose average farm size spans 0.7 and 2.2 hectares—play a significant role in food security.

Land ownership is a very important factor in agricultural production. Production depends on the availability of leveled and fertile land. The majority of respondents in the study area (74%) obtained their farm lands by inheritance, while 18% and 7% acquired lands through renting and purchasing, respectively. This agrees with the findings of Sithole *et al.* (2023), who reported that about 88.9% of vegetable farmers in Limpopo province of South Africa owned land. About 35% of those surveyed said that extension agents had recently paid them a visit.

Given that the extension agent did not contact a sizable portion of the farmers in the research area, it can be

inferred that the extension programs in the area are either understaffed or not equipped. The result of the farm income indicated that the cabbage farmers in the study area generate an average farm income of about ₦ 432,100, which could be a pointer that cabbage farming is profitable in the study area. This finding agrees with that of Barwal (2023), who reported that cabbage farmers generate income from cabbage production in Himachal Pradesh's high hills in India.

TABLE 2: Socioeconomic characteristics of cabbage farmers in Katsina metropolis

Variable	Frequency	Percentage (%)
Age		
20-39	26	26.0
40-59	65	65.0
60-79	09	09.0
Gender		
Male	100	100.0
Female	00	00.0
Marital Status		
Single	05	05.0
Married	95	95.0
Educational level		
No formal education	16	16.0
Quranic education	27	27.0
Primary education	09	09.0
Secondary education	46	46.0
Post-secondary education	02	02.0
Household size		
1-9	70	70.0
10-19	22	22.0
20-29	08	08.0
Membership of association		
Yes	96	96.0
No	4	4.0
TOTAL	**100**	**100**

Source: Field survey, 2018

Table 3: Enterprise characteristics of cabbage farmers in Katsina metropolis

Variable	Frequency	Percentage (%)	Mean
Farming experience (years)			11
1-9	62	62.0	
10-19	26	26.0	
20-29	3	3.0	
30 and above	9	9.0	
Farm income (₦)			432,100
100,000-299,000	41	41.0	
300,000-499,000	19	19.0	
500,000-699,000	25	25.0	
700,000 and above	15	15.0	
Farm size (ha)			1.5
<1ha	47	47.0	
1-3ha	42	42.0	
4 and above	11	11.0	
Land ownership			
Inherited	74	74.0	
Purchased	7	7.0	
Rented	18	18.0	
Lease	1	1.0	
Access to extension agent			
Yes	35	35.0	
No	65	65.0	
TOTAL	**100**	**100**	

Source: Field survey, 2018

Profitability of Cabbage Production

Table 4 below shows the profitability analysis of cabbage production. The results show that the inputs used for cabbage production include irrigation, fertilizer, labor, manure, pesticides, herbicides, and seed, while the outputs were the cabbage crop harvested. The land area cultivated by each farmer varies; hence, the data in this section are expressed a per hectare basis. The entire yields of each sampled farmer were multiplied by their average unit price at the time of data collection to calculate the gross return or total revenue. We took into account solely the variable cost components when evaluating the total variable cost of production. This consists of costs incurred on input such as seed, fertilizer, manure, irrigation, pesticide, herbicide, and labour. The total value of all production per hectare (gross return), less the total variable cost per hectare, is the gross margin.

According to the profitability analysis, the farmers realized a gross margin of N614,925.15 per hectare annually. Out of the overall cost of production, the biggest variable cost was seed, which stood at ₦37,384.82/ha. This agrees with Ebojei (2016), who opined that cabbage production in Plateau State was determined to be profitable, with a gross margin of N175,000 per hectare. The profit obtained from producing cabbage in the study region is not significantly different from that obtained from producing cabbage in the state.

It was also shown that ₦7.17 was obtained for every ₦1 spent in cabbage production in the research area by calculating the gross margin per hectare ratio to the total variable cost per hectare. This outcome demonstrated the profitability of cabbage cultivation in the research area. This is congruent with the research findings of Barwal (2023), who opined that cabbage production was profitable in Himachal Pradesh's high hills in India.

Table 4: Gross Margin Analysis per hectare

Variable	Total variable Cost (TVC) (₦)	Total Revenue (TR) (₦)	Gross Margin (GM) (₦)	TVC/ha (₦)	TR/ha (₦)	GM/ha (₦)
Cost of Irrigation	1,326,025			8,604.96		
Fertilizer	1,348,050			8,747.89		
Manure	428,250			2,779.04		
Pesticides	785,400			5,096.69		
Herbicides	763,310			4,953.34		
Labour	2,805,500			18,205.71		
Seed	5,761,000			37,384.82		
Output	----------	107,977,500	94,759,965	----------		614,925.15
TOTAL	**13,217,535**	**107,977,500**	**94,759,965**	**85,772.45**	**700,697.60**	**614,925.15**

Source: Authors' computation from Field survey, 2018

Returns for every naira invested = (GM/ha) ÷ (TVC/ha) = (614,925.15) ÷ (85,772.45) = ₦7.17

Constraints associated with cabbage production

Constraints associated with cabbage farming in the research area are presented in Table 5. The results revealed that pests and diseases (87%), inadequate rainfall (79%), and inadequate capital (79%) were the main constraints facing the cabbage producers. Other constraints, according to the farmers in other of descending ranking, were inadequate storage or processing facilities and poor quality planting materials, including high cost of seeds, storage problems, and insecurity. This finding is congruent with that of Mdoda *et al.* (2022), who reported that cabbage farmers face major challenges like lack of finance, lack of storage facilities and high input cost in cabbage production. These negatively affect their productivity and profitability.

Table 5: Constraints associated with cabbage production in the research area

Constraints	Frequency	Percentage (%)
Inadequate capital	79	79.00
Poor quality planting materials	10	10.00
Pest and diseases	87	87.00
Inadequate rainfall	79	79.00
Inadequate transport facilities	0	0.00
Inadequate storage or processing facilities	54	54.00
Others	2	2.00
Total	311*	

Source: Field survey, 2018 * Multiple responses were allowed

CONCLUSION

In line with the findings from this research, it can be concluded that growing cabbage was lucrative and profitable in the study area, as farmers earned as much as ₦7.17 for every ₦1 invested in cabbage production. Also, the farmers complained that cabbage production in their environment is faced with unreceptive constraints like inadequate capital, pests and diseases, and inadequate storage facilities, militating against its success. In order to boost production and, ultimately, revenue for cabbage farmers, this research recommends that agricultural sector players give inputs, including fertilizer, better seed varieties, and soft loans at subsidized rates to farmers. This would increase the availability of cabbage vegetables, which are very nutritious and rich in vitamins and minerals to meet human needs, as well as an improvement in the food security position of the cabbage growers.

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