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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Analysis of net farm income and constraints faced by okra farmers, North West, Nigeria

Kuzey Batı, Nijerya'daki bamya çiftçilerinin karşılaştığı net çiftlik geliri ve kısıtlamaların analizi

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ABSTRACT

This study analyzed the net farm income and constraints faced by okra farmers, in North West, Nigeria. A multi-stage sampling technique was utilized. In the fourth-stage, a proportional and random sampling technique was employed to select 200 okra producers. Primary data were used for this study. The data were evaluated using descriptive statistics, farm budgeting techniques, and Kendall's concordance of statistics . The mean age of respondents was 47 years. The total variable cost (TVC) in okra farming was calculated at 331878.61 Naira per hectare, accounting for 82.97% of the total cost. Similarly, the total fixed cost (TFC) was calculated at 68141.04 Naira per hectare, accounting for 17.03% of the total cost. The gross margin (GM) and net farm income(NFI) were estimated at 688141.39 and 620000.35 Naira per hectare, respectively. This means that okra farming is profitable. The RORI (rate of return on investment) or (return per Naira invested) in okra farming was estimated at 1.55. This implies that for every one Naira invested into okra farming, approximately 1.55 Naira is made as revenue. The high cost of fertilizer had the highest average rank score of 10.88 among the constraints faced by okra producers, while the high transportation cost had the lowest average rank score of 6.79. Credit should be provided to okra farmers at the single interest rate, devoid of cumbersome administrative procedures.

ÖZET

Bu çalışmada, Kuzey Batı, Nijerya'daki bamya çiftçilerinin karşılaştığı net çiftlik gelirini ve kısıtlamaları analiz edilmiştir. Çok aşamalı örnekleme tekniği kullanılmıştır. Dördüncü aşamada 200 bamya üreticisini seçmek için orantılı ve tesadüfi örnekleme tekniği uygulandı. Bu çalışma için birincil veriler kullanılmıştır. Veriler tanımlayıcı istatistikler, çiftlik bütçeleme tekniği ve Kendall'ın uyum istatistikleri kullanılarak değerlendirildi. Ankete katılanların yaş ortalaması 47 idi. Bamya yetiştiriciliğinde toplam değişken maliyet (TVC) hektar başına 331878.61 Naira olarak hesaplandı ve bu, toplam maliyetin %82.97'sini oluşturdu. Benzer şekilde toplam sabit maliyet (TFC) hektar başına 68141.04 Naira olarak hesaplandı ve bu toplam maliyetin %17.03'ünü oluşturuyordu. Brüt kar marjı (GM) ve net çiftlik gelirinin (NFI) sırasıyla hektar başına 688141.39 ve 620000.35 Naira olduğu tahmin edildi. Bu da bamya çiftçiliğinin karlı olduğu anlamına geliyor. Bamya çiftçiliğinde RORI (yatırım getirisi oranı) veya (yatırım yapılan Naira başına getiri) 1.55 olarak tahmin edildi. Bu, Naira'nın bamya çiftçiliğine yaptığı her yatırım için yaklaşık 1.55 Naira gelir elde edildiği anlamına geliyor. Bamya üreticilerinin karşılaştıkları kısıtlar arasında en yüksek ortalama sıralama puanı 10,88 ile gübre maliyetinin yüksek olduğu, en düşük sıralama puanının ise 6.79 ile yüksek nakliye maliyeti olduğu görüldü. Bamya çiftçilerine hantal idari prosedürlerinden arındırılmış, tek faiz oranıyla kredi sağlanmalıdır.

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INTRODUCTION

Okra (*Abelmoschus esculentus*) is the most significant vegetable crop commonly grown in the tropics for human consumption (Babatunde et al., 2007). The okra and other vegetables are among the stable food items whose farming has continued to increase in most countries across the globe (Udoh & Akpan, 2007). The okra fruit can be eaten in processed form, in a cooked form or may be eaten in raw form (Adiaha, 2017). Okra plays a meaningful role in the economy of a nation, in addition to its contribution to dietary and nutritional role. The fresh okra fruits are a good source of vitamins, plant protein, and minerals (Eke et al., 2008). Okra farming is a good source of income and employment for small and limited resource farmers (Ndaeyo et al., 2007). Okra farming serves as a source of earnings for marketers, labourers, and producers (Alimi, 2004). Okra farming as a small-scale activity can financially equip the producers especially those with limited access to land, with little capital and those working under labour constraints. The cash provided by okra farming contributes greatly to food security at the household status and it helps the producers to attain a degree of self-reliance within the budget of the family (Osalusi et al., 2019). According to Tegar et al. (2018) the economic return of vegetables such as okra is preferable to any other crops, the output per unit area is high, it leads to the generation of income, expands employment and it's a preferable choice of crop diversification because if properly managed can produce high productivity and much higher returns per a unit area.

The previous studies of Kshash and Oda (2022) evaluated economics of okra production in Al-Qasim District, Babylon Province, Iraq. A random sampling approach was used to select 120 okra farmers. The result shows that approximately 47% of okra farmers were within the age bracket of 30 – 45 years. The overall average returns and profit per hectare of okra farming varied with farm size, but okra farming was profitable. Medium farms (655 \$ ha^{-1}) had the highest profit followed by large farms (4837 \$ ha^{-1}) and small farms (3358 \$ ha^{-1}).

The study of Vikesh et al. (2018) analyzed economics of cost and return of okra in Middle Gujarat. A multi-stage sampling approach was adopted to select a total of 120 okra growers.The result shows that out of the total cost of cultivation, maximum share was of cost of seed (15.40%) followed by human labour (14.96%), manure (11.22%), plant protection chemicals (10.29%), fertilizer (9.54%), tractor charges (5.33%), irrigation cost (1.25%), depreciation (1.24%), looking to the cost, return and input-output ratio, it is concluded that okra cultivation was profitable vegetable crop in middle Gujarat condition.

The studies of Radhi and Barbaz (2021) investigated economics of okra production functions in Nineveh Governorate. A random sampling approach was used to select 100 okra farmers, Cobb-Douglas production function was used. The result shows that the productivity elasticity of capital was 0.88, which is positive value, and is higher than the productivity of elasticity of the labour resource which amounted to about 0.158, which signifies that the production of the crop depends greatly on the provision of capital. The farmers use extensively the technology represented by seeds, fertilizer, and pesticides. The return to capacity in the estimated production function, the total output elasticity, which is the sum of the production elasticities of the productive suppliers amounted to 1.046 which is greater than one, this indicates an increase in the return to capacity, this is an evidence that they are working within the first stage of the production process, this enhances the posiibility of expanding the cultivation of the crop.

Table 1 shows the okra producion and planting area in Nigeria and the world within the period of 2012 to 2023. Nigeria in 2021, 2022, and 2023 produced approximately 1803030 tons, 1844242.17 tons, and 1874730.35 tons of okra, which represents 17.06 % , 16.42%, and 16.26% of the world output, respectively (Figure 1). Similarly, in Nigeria, the okra area in 2021, 2022, and 2023 approximately 1567439 hectares, 1793831 hectares, and 2043104 hectares, respectively (Figure 2). The world output of okra in 2021 , 2022 and 2023 approximately 10713521.45 tons, 112326577.08 tons, and 11523291.49 tons, respectively (Figure 1). The world area of okra in 2021, 2022 and 2023 approximately 2492950 hectares, 2682813 hectares, and 2949566 hectares, respectively (Figure 2) (FAO,

2025). The major okra producing counries in the world is shown in Figure 3. India, Nigeria, and Mali produces approximately 7158000 tons, 1874730 tons, and 759511 tons of okra, and occupies the first, second, and third position, respectively in terms of world ranking. Okra productivity and profitability in Nigeria are low due to traditional farming methods, land fragmentation, poor irrigation facilities, non-availability of credit, mis-use of modern agricultural technology, and the impact of climate change (Chandio et al., 2017). According to Kshash and Oda (2022), vegetables such as okra farming are the most remunerative agricultural activity for marginal and small farmers, it is the main source of farm income for limited and small resource farmers. There is an increased demand for vegetable crops such as okra, with increased demand, there is low productivity due to the constraints faced by okra farmers, inefficient use of availability, and difficulty in obtaining economic resources. According to Nwaobiala and Ogbonna (2014) okra farming has been widely practiced because of its significance to economic development and can be seen in almost every market in Nigeria. Alimi (2005) reported that the highest ranked constraints to okra farming were high perishability during the rainy which is the peak season, low output prices, moisture stress, and lack of cultivable farmland in the dry season. According to Farinde et al. (2006) who documented that there are two different seasons for okra farming, the rainy and dry seasons. During the dry season, the okra fruits are low in quantities, expensive and scarce. In the peak season, the rainy season, it is produced in large quantities. Bamire and Oke (2003) noted that the output was higher during the peak rainy season, while the higher total revenue was obtained under the dry season conditions.

Table 1. Okra production and planting area in Nigeria and the world between 2012 and 2023
Çizelge 1. 2012-2023 yılları arasında Nijerya ve dünyada bamya üretim ve ekim alanı

Year	**Okra Production in Nigeria (tons)**	**Okra Production in the World (tons)**	**Okra Area in Nigeria (ha)**	**Okra Planting Area in the World (ha)**
2023	1874730.35	11523291.49	2043104	2949566
2022	1844242.17	11236577.08	1793831	2682813
2021	1803030	10713521.45	1567439	2492950
2020	1758180	10591363.31	1473150	2429741
2019	1718170	10010556.05	1430860	2385942
2018	1682120	9640340.53	1395130	2312258
2017	1561900	9267352	1301600	2161508
2016	1461600	8936340.52	1338600	2212108
2015	2067900	9331024.19	1859900	2729331
2014	2039500	9890209.51	1095400	1884605
2013	1886200	9741237.81	1089800	1870429
2012	1999200	9790560.93	1060200	1831366

Source: FAO (2025)

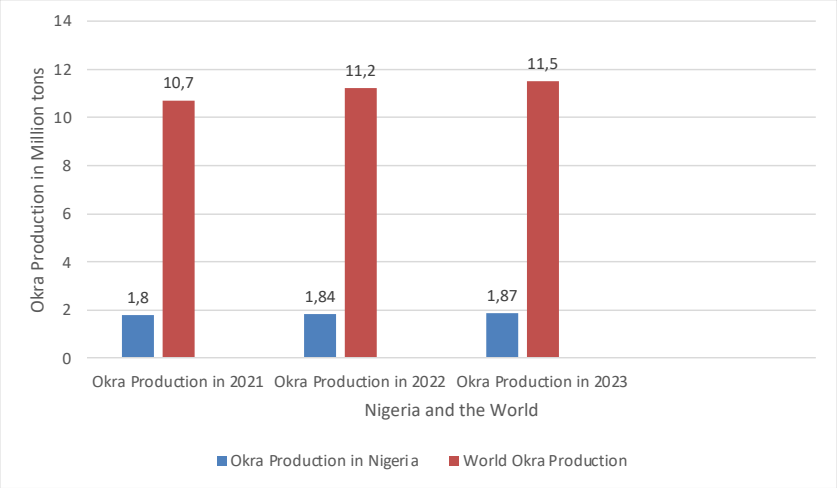

Figure 1. The okra production in Nigeria and the world

Şekil 1. Nijerya ve dünyada bamya üretimi

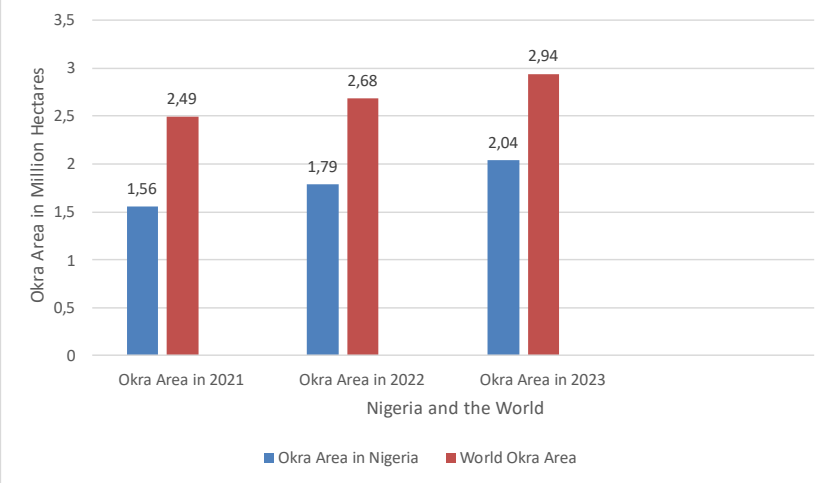

Figure 2. The okra area in Nigeria and the world (2023)

Şekil 2. Nijerya ve dünyada bamya alanı (2023)

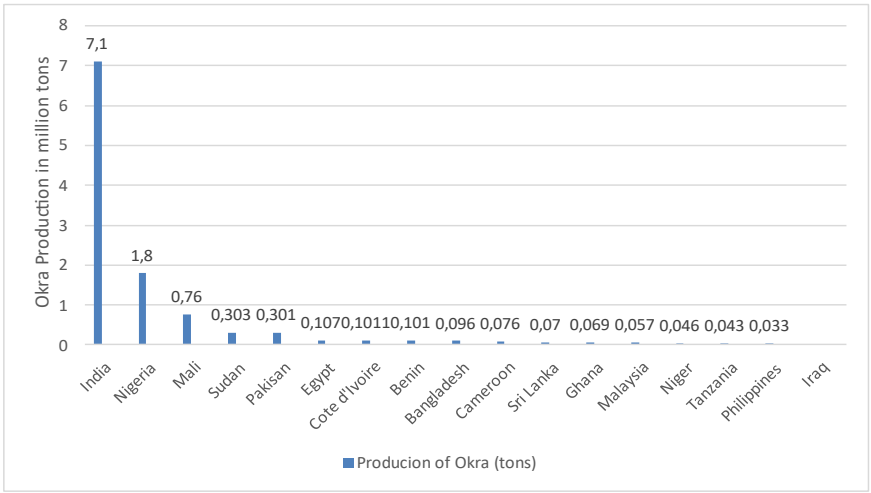

Figure 3. The major okra producing countries in the world

Şekil 3. Dünyada bamya üreten başlıca ülkeler

Objectives of the study

The major aim of the research is to analyzed the net farm income and constraints faced by okra farmers in North West, Nigeria. Specifically, the objectives include to:

(i) describe the socio-economic profiles of okra producers,

(ii) evaluate the net farm income and hence the profitability of okra farming, and

(iii) determine the constraints faced by okra producers.

MATERIALS and METHODS

This study was carried out in North West which consists of Kano and Kaduna States, Nigeria. The sample frame of okra producers approximates 400 respondents. This study employed a multi-stage sampling method. The fourth-stage of the multi-stage sampling technique employed the use of proportionate and random sampling techniques to select the total sample number of okra producers which approximates 200 respondents. This comprise 100 smallholder okra producers each from Kano and Kaduna States, respectively. Primary sources of data were used based on a well-designed questionnaire that was subjected to a reliability and validity test. This sample number was evaluated based on the established formula of Yamane (1967) as follows:

$$n = \frac{N}{1+N(e^2)} = \frac{400}{1+400(0.05^2)} = 200 \quad (1)$$

Where,

n = The Sample Number

N = The Total Number of Okra Producers (Number for the 2 States)

e = 5%

The data obtained were evaluated using descriptive statistics, farm budgeting techniques, and Kendall's coefficient of concordance.

Farm budgetary technique

Gross Margin Analysis is one of the farm budgetary methods and it can be explained as the difference between the gross farm income (GFI) and total variable cost (TVC):

$$GM = \sum_{i=1}^{n} P_i Q_i - \sum_{i=1}^{n} P_j X_j \quad (2)$$

$$GM = TR - TVC \quad (3)$$

Where,

GM means the Gross Margin (₦)

TR means the Total Revenue (₦)

TVC is the Total Variable Cost (₦)

NFI = Gross Margin (GM) – Total Fixed Cost (TFC)

$$NFI = \sum_{i=1}^{n} P_i Q_i - \sum_{i=1}^{n} P_j X_j - K \quad (4)$$

Where,

NFI = Net Farm Income measured in Naira

GM= Gross Margin measured in Naira

P_i = Price of Okra Output i^{th} ₦/Kg

Q_i = Quantity of Okra Output i^{th} (Kg)

P_j = Price of Input j^{th} (₦/Kg)

X_j = Quantity of Input j^{th} used (Kg)

K = Total Fixed Cost (TFC)

Depreciation of assets

The straight line depreciation method is specified as:

$$D = \frac{P-S}{N} \quad (5)$$

Where,

D= Depreciation of Farm Production Assets (Naira)

P= Purchase Cost of Farm Asset (Naira)

S means the Salvage Value of Farm Asset (Naira)

N means the Number of Years of the life span of the Farm Asset (Years)

Financial analysis

The formula of Gross Margin Ratio (GMR) is stated as:

$$GMR = \frac{Gross\ Margin}{Total\ Revenue} = \frac{GM}{TR} \quad (6)$$

The operating ratio (OR) is defined thus:

$$OR = \frac{TVC}{GI} \quad (7)$$

Where, OR is the Operating Ratio (Units); TVC means the Total Variable Cost (Naira); GI is the Gross Income in Naira. The rate of return invested per naira is stated thus;

$$RORI = \frac{NI}{TC} \quad (8)$$

Where, RORI means the Rate of Return per Naira Invested (Units); NI is the Net income from Okra Farming in Naira; TC is the Total Cost in Naira.

Kendalls' coefficient of concordance (W)

Kendalls' Coefficient or statistics of Concordance (W) is stated below:

$$W = \frac{12S}{M^3(n^3-n)-MT} \quad (9)$$

Where,

n = Number of Attributes or Objects that is Evaluated by Respondents

m = Number of Respondents

S = Sum Overall Subjects

T = Correction Factor estimated for Tied Ranks

$$T = \sum_{k=1}^{g}\left(t_k^3 - t_k\right) \quad (10)$$

Where,

t_k= Number for Tied Ranks for each (k) in 'g' Groups of Ties

Friedmans' Chi Square (χ^2)

$$\chi^2 = m(n-1)W \quad (11)$$

RESULTS and DISCUSSIONS

Socio-economic profiles of okra producers

The summary profile of okra producers is presented in Table 2. About 94% of okra producers were married. On average, the okra producers were 47 years of age. This shows that they are young, strong, energetic, and resourceful. This relates to the fact that they will be able to adopt innovations, research findings, and new farm technologies. This result is similar to the outcome of Ekunwe et al. (2018) who obtained an average age of 48 years among okra producers in Delta State in Nigeria.

Table 2. Summary profiles of okra producers

Çizelge 2. Summary profiles of okra producers

Variables	Unit of Measurement	$\bar{X}_i$	SD
Marital Status	Married, 1; Otherwise, 0	0.94	0.48
Age	Years	47	9.17
Sex	Male, 1; Otherwise, 0	0.81	0.36
Farm Size	Hectare	1.17	0.42
Household Size	Number	9	3.22
Formal Education	Years	12	3.17
Member of Cooperatives	Member, 1;Otherwise, 0	0.82	0.43
Farming Experience	Years	12	4.01

Source: Field Survey (2024)

The result agrees with the outcome of Alabi et al. (2023) who obtained an average of 46 years among okra farmers in Kaduna state, Nigeria. Approximately 81% of okra producers were male, while 19% of okra producers were female. The okra producers were small-scale farmers with a mean farm size of 1.17 hectares of farm land. This result is similar to the outcome of Nwaobiala and Ogbonna (2014) who obtained an average farm size of 1.07 hectares among okra producers in Enugu state, Nigeria. The household size was estimated at an average of 9 people (SD = 3.22) per household. This outcome agrees with the result of Ume at al. (2018) who obtained an average of 6 people per household among okra farmers south east, Nigeria. The okra producers are literate, and can read and write with an average of 12 years of attending school education. Approximately 82% (SD = 0.43) are members of cooperative organizations, this enables them to share ideas and information, access credit, and sell their okra produce in bulk. They had about 12 years' of experience in okra farming. This result is similar to the outcome of Ekunwe et al. (2018) who obtained an average farming experience of 20 years among okra producers in Delta State, Nigeria.

Analysis of net farm income and profitability of okra farming

The net farm income and profitability in okra cultivation calculated by cost and return analyses approximated by the farm budgeting technique in okra cultivation are shown in Table 3. The various costs spent and revenue obtained in okra farming were based on the current market survey. The total variable cost (TVC) was evaluated at 331878.61 Naira per hectare and this included 82.97% of the total cost. The total fixed cost (TFC) was evaluated at 68141.04 Naira per hectare, and this included for 17.03% of the total cost. The total cost is the addition of the TVC and the TFC, and this was estimated at 400019.65 Naira per hectare. The GM and NFI in okra production were estimated at 688141.39 Naira and 620000.35 Naira, respectively. This shows that the okra production in the area was profitable. The GMR and RORI were calculated at 0.674 and 1.55, respectively. The GMR of 0.674 shows that for every one Naira invested in okra farming, approximately 67 Kobo covered interest, profits, depreciation, and other expenses (marketing and administrative costs). This can be further explained to mean that the okra farmers retained 67.4% after accounting for the production cost. That implies that 67.4 % of each Naira earned in okra farming contributes to covering other expenses and generating net profit. The RORI or return per Naira invested in okra farming was estimated at 1.55. This means that for every Naira invested into okra farming, approximately 1.55 Naira is made as revenue, that is 0.55 Naira is realized as profit. This result is similar to the outcome of Alabi et al. (2023) who obtained a gross margin ratio (GMR) of 0.86 Naira among okra farmers in Kaduna State, Nigeria. This result is similar to outcome of Ekunwe et al. (2018) who obtained a return on investment of 2.03 among okra farmers in Delta State, Nigeria.

Table 3. The estimation of costs and returns in okra farming per hectare

Çizelge 3. Bamya yetiştiriciliğinde hektar başına maliyet ve getiri tahmini

Items	Kg	Value (Naira)	Percentage of TC
Quantity (1.0 tons)	1,000		
Price per Kg		1,020.02	
Total Revenue		1,020,020	
Total Variable Cost (TVC)		331,878.61	82.97
Depreciated Cost, Total Fixed Cost (TFC)		68,141.04	17.03
Total Cost (TFC + TVC)		400,019.65	100.00
Gross Margin (GM)		688,141.39	
Net Farm Income (NFI)		620,000.35	
Gross Margin Ratio (GMR)		0.674	
Operating Ratio		0.33	
Rate of Return on Investment (RORI)		1.55	

Source: Field Survey (2024), 100 Naira = 1 USA $

The constraints faced by okra producers

Kendall's statistics of concordance were utilized to explain the constraints faced by okra producers. The constraints were ranked from strongly agree to the least strongly disagree using numerals 1 to 13 as shown in Table 4. The average rank score for each constraint was computed and the constraints with the highest average rank score were considered the first, while the constraints with the lowest mean score were considered the least. The high cost of fertilizer was considered the highest rank, while the transportation cost was considered the lowest rank. The result further signifies that there were significant differences between the ranks of constraints which were tested at a 1% level of probability. Therefore, the null-hypothesis (there is no significant difference among the constraints faced by okra farmers) was rejected and the alternative hypothesis was accepted. Kendall's statistics of concordance (W) was estimated at 0.171, while the F-Critical was evaluated at 4.75 and F-Calculated was evaluated at 49.721. This result is similar to the outcomes of Sadiq et al. (2021) who evaluated the constraints faced by rice farmers in Niger State, Nigeria using Kendall's statistics of concordance (W) with an estimated value of 0.701 which was different significantly from zero at 1% probability level. The study agrees to the work of Godambe et al. (2016) who identified the production and marketing constraints facing farmers in Thane District of Maharashtra as high price of seed, non-availability of certified seed,lack of manure, high cost of fertilizer, pesticides, fungicides, non-avilaibility of market information, wide fluctutation in prices, and lack of transportation.

Table 4. The constraints faced by okra

Çizelge 4. Bamyanın karşılaştığı kısıtlamalar

Constraints	**Overall Rank**	**Mean Rank Score**
High Cost of Fertilizer	1	10.88
Lack of Credit	2	10.65
Bureaucracy in Accessing Credits	3	10.44
Pests and Diseases	4	9.49
Lack of Improved Seeds	5	8.31
Poor Access to Extension Services	6	8.26
Bad Road Network	7	8.25
High Cost of Labour	8	8.13
Lack of Farm Technologies	9	7.71
Problem of Insecurities	10	7.25
Price Instability	11	6.94
Long Distance to the Market	12	6.91
High Transportation Cost	13	6.79
Number of Observation	200	
Kendall's Coefficient (W)	0.171	
Chi Square	419.21	
df	12	
F-Critical	4.75	
F-Calculated	49.721	
Asymptotic Significance	0.000	

Source: Computed from Field Data (2024)

In conclusion, this study investigated the net farm income and constraints faced by okra producers in North West, Nigeria. A multi-stage sampling method was employed. In the fourth-stage, proportionate and random sampling was employed to select about 200 okra farmers. The total sample frame was 400 respondents. Primary data were used based on a well-designed set of questionnaires. The data were evaluated utilizing descriptive statistics, farm budgeting techniques, and Kendall's statistics of concordance. The result signifies that about 94% of okra producers were married. Approximately, 81% of respondents were male. The mean age was 47 years. The okra producers are small-scale with a mean farm size of 1.17 hectares. The household size was evaluated with an average of 9 people per household. They are literate and can read, and write and have 12 years of attending formal school education. About 82% of respondents belong to members of cooperative organizations, this group enables the okra producers to share ideas, and information and access the formal credit. They have 12 years' of experience in okra farming. The TVC was estimated at 331878.61 Naira per hectare, and this included 82.97% of the total cost. Similarly, the TFC was calculated at 68141.04 Naira per hectare and this included 17.03% of the total cost. The gross margin and net farm income were calculated at 688141.39 Naira and 620000.35 Naira. This means that okra production was profitable. The RORI or return per Naira invested in okra farming was estimated at 1.55. This means that for every one Naira invested into okra farming, approximately 1.55 Naira is made as revenue. Kendall's statistics of concordance (W) utilized to evaluate the constraints faced by okra producers show that the high cost of fertilizer had the highest average score of 10.88, while the high transportation cost had the lowest average score of 6.79. The Chi square value of 419.21 was significantly different from zero, this confirmed the model is of good fit. Based on the outcomes of this research, the following suggestions were made:

(i) Government and private companies should provide farm inputs such as fertilizer, improved seeds, and agrochemicals to farmers at affordable prices and at appropriate times.

(ii)Credit policy should be implemented by government and private organizations that will provide credit to okra farmers at the single interest rate, devoid of cumbersome administrative procedures.

(iii) Feeder roads should be constructed for easy transport of okra produce from producing areas to nearby market centers.
(iv) Farm equipment' and labour saving technologies should be made available to okra producers to increase output and income
(v) Extension agents should be employed to disseminate new research outcomes and innovations to okra producers.

STATEMENT OF CONFLICT OF INTEREST

The authors declare that there is no conflict of interest between them.

AUTHOR'S CONTRIBUTIONS

All author contributed equally for analyses, writing and interpretation of the article. The authors read and approved the final version of the manuscript.

STATEMENT OF ETHICS CONSENT

This article does not require ethical approval as there are no experiments with human or animal subjects.

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