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GENDER DIFFERENCES AND PROFITABILITY ANALYSIS OF PEPPER (*CAPSICUM SPECIES*) PRODUCTION, KADUNA STATE, NIGERIA

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Abstract: This study analysed gender differences and profitability of pepper (*Capsicum species*) production in Kaduna State, Nigeria. A multi-stage sampling technique was adopted. One hundred pepper farmers were selected. Primary data sources were employed with the help of a well-designed and well-structured questionnaire. The results show that 66% of pepper farmers were between 21 and 50 years old. Pepper production was profitable in the study area. Gender differences in average costs and returns in pepper production revealed that the gross margin was higher for male farmers at 137,556.51 Naira than for female pepper farmers at 109, 711.77 Naira per hectare. The gender differences in factors influencing pepper production show that age (X_1), and fertiliser input (X_4), were significant factors influencing pepper production among male farmers at the 1% probability level, while age (X_1), labour input (X_3), and fertiliser input (X_4), were significant factors influencing pepper production among female farmers at the 1% probability level. The return to scale (RTS) of pepper production was estimated at 2.798 for male farmers, which signifies an increase in the return to scale. The return to scale (RTS) was calculated for female pepper farmers at 0.033, which implies a decrease in the return to scale. The major constraints faced by pepper farmers were: lack of fertilisers, pest and disease infestations, and inadequate capital. The study recommends that female pepper farmers should have more access to farm inputs and low interest loans to increase productivity.

Key words: gender differences, profitability analysis, pepper production, Kaduna State, Nigeria.

Introduction

Pepper (*Capsicum species*) is a highly valued, varied and widely grown spice crop for food and cash by farmers all over the world (Aliyu et al., 2012). Pepper ranks second (2nd) after tomatoes in the world as the most important fruit vegetable

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(Alabi et al., 2022). Pepper constitutes about 40% of human vegetable consumption and it is the world's most commonly used spice (Adeoye et al., 2014). Pepper is the most widely produced type of colouring food and spices and is an excellent source of natural colourants and anti-oxidants (Alabi et al., 2022). Nigeria has good soil and weather conditions that can support the growth and productivity of pepper. Nigeria is one of the largest pepper producers in the world, accounting for 50% of Africa's production (Mohammed et al., 2013). Nigeria produced 762,174 tonnes of green chillies and peppers in 2020, which is 0.27% more than in 2019, when its production amounted to 760,114 tonnes (FAO, 2020). The average yield of green chillies and peppers in 2020 was 2 to 2.5 tonnes per hectare (FAO, 2020) The area under green chillies and peppers was 101,350 hectares in 2020, the yield of green chillies and peppers was 75,202 hg/ha (FAO, 2020). The production of dry chillies and peppers in 2020, was 62,556 tonnes which implies a 0.32% increase in the production compared to 2019 when it amounted to 62,356 tonnes (FAO, 2020). The area and yield of dry chillies and peppers in 2020, were 36,605 ha and 17,089 hg/ha respectively (FAO, 2020). Pepper is a medicinal and nutritional plant which has potentials to generate foreign exchange, reduce unemployment, and its use in pharmaceuticals, culinary and confectionary purposes has increased. According to Dipeolu and Akinbode (2008), peppers contain vitamins A, B, C, B_1, B_2 and B_3. All varieties of peppers are good and excellent sources of vitamins A, and C, potassium, folic acid and fibre (Alabi et al., 2022). Most Nigerian pepper is produced by small-scale, resource-poor, smallholder farmers who sell their produce to middlemen or traders who re-sell the products to processors (Adeoye et al., 2014). Pepper is widely cultivated throughout Nigeria, especially in northern Nigeria. However, the yields obtained by resource-poor farmers are still low (Ogunbo, 2015). Production constraints include: lack of farm inputs, lack of credit facilities, pests and diseases, weeds, low soil fertility, and poor management practices (Dennis and Kentus, 2018; Ogunbo, 2015). High potential pepper producing areas of Nigeria include: Kano, Kaduna, Jigawa, Plateau, Sokoto, and Bauchi States. Pepper grown in Nigeria is in high demand because of it pungency and good flavour (Dennis and Kentus, 2018).

Gender refers to the social opportunities and attributes associated with being a woman or a man and to the relationships between men and women (UNDP, 2009). Gender plays a significant role in the agricultural sector where both women and men participate and complement each other in the agricultural value chain activities (Adam et al., 2018). Women make up 60 to 80 % of the agricultural labour force in Nigeria (World Bank, 2003). In sub-Saharan Africa including Nigeria, women are known to be more involved in agricultural activities than men. About 73% of African women were involved in cash crops, arable and vegetable gardening, 16% in post-harvest activities, and 15% of African women were involved in agro-forestry activities (Ajibade et al., 2021). Women have practically

taken over the processing and production of arable crops in Nigeria and are responsible for as much as 80% of staple foods (Afolabi, 2008; Ogunlela and Mukhtar, 2009). Despite the high percentage of women in agriculture in Nigeria, the productivity of female farmers is lower compared to productivity of their male counterparts (Olakojo, 2017). Women tend to have less access to agricultural productive resources than men due to gender specific constraints (FAO, 2011). Productive resources include: access to extension services, access to credit facilities, ownership of land, crop and livestock, access to farm inputs; access to education, skills and knowledge related to agriculture, and agricultural resource management (Moore et al., 2015). Women also had a problem with access to agricultural information. When adequate information is available to female farmers, they can share experiences, receive financial supports, learn about best practices, and access new markets. In order to improve agricultural production and achieve agricultural sustainable development, information on agriculture is crucial for any nation (Lawal et al., 2017). The productive capacity of women in the agricultural sector remains lower than that of their male counterparts, which negatively affects overall productivity (Olakojo, 2017). Male and female farmers have equal productive efficiency especially when inputs, credit and market access as well as physical and human capital are adequately controlled (Olakojo, 2017)

Objectives of the study

This study analysed gender differences and performed profitability analysis in the production of pepper (*Capsicum species*) in Kaduna State, Nigeria. Specifically, the objectives were to:

(i) determine the socio-economic characteristics of pepper farmers;
(ii) analyse the gender differences in the costs and returns of pepper production;
(iii) evaluate the gender differences in the factors influencing output of pepper production;
(iv) evaluate the gender differences in elasticities of production, and return to scale of pepper production and
(v) determine the constraints faced by pepper farmers in the study area.

Material and Methods

This research study was conducted in Kaduna State, Nigeria. Kaduna State lies between Longitudes 06^0 $15^|$ and 08^0 $50^|$ East of the prime meridian and Latitudes 09^0 $02^|$ and 09^0 $02^|$North of the equator. The State has total land area of 4.5 million hectares. The vegetation of Kaduna State is divided into the Northern Guinea Savanna and the Southern Guinea Savanna. There are two (2) seasons in Kaduna State: the dry season and the wet season. The dry season lasts from October to March, and the wet season lasts from April to October with the short

harmattan period from November to February in between. The average rainfall is about 1,482mm. The temperature of Kaduna State ranges from 35^0C to 36^0C during the humid period and from 10^0C to 23^0C during the harmattan period. The population of Kaduna in 2021 was 8.9 million. They are involved in agricultural activities. The crops grown include: pepper, maize, ginger, sorghum, rice, yam, cassava, millet, and tomatoes. Animals reared include: cattle, goats, sheep, rabbit, and poultry. A multi-stage sampling technique was used. One hundred (100) pepper farmers were selected. The data collected from the pepper farmers were from primary sources using a well-designed and well-structured questionnaire. The questionnaire was administered to the pepper farmers by well-trained enumerators. The data were analysed using the following analytical tools:

Descriptive statistics: This involves the use of mean, range, percentages and frequency distributions to summarise the socio-economic characteristics of pepper farmers as stated in specific objective one (i).

Farm budgetary technique: The farm budgetary technique used was gross margin analysis (GM) and it is defined as the difference between gross farm income (GFI) and total variable cost (TVC). This tool of analysis was used to determine the gender differences in the costs and returns of pepper production as specified in specific objective two (ii). The gross margin model is described as follows:

$$GM = TR - TVC \quad (1)$$

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

$$NFI = TR - TC \quad (3)$$

$$NFI = \sum_{i=1}^{n} P_i Q_i - \left[\sum_{j=1}^{m} P_j X_j + \sum_{k=1}^{k} GK\right] \quad (4)$$

where,

P_i = Price of pepper ($\frac{₦}{Kg}$),

Q_i = Quantity of pepper (kg),

P_j = Price of variable inputs ($\frac{₦}{unit}$),

X_j = Quantity of variable inputs (units),

TR = Total revenue obtained from the sales of pepper (₦),

TVC = Total variable cost (₦),

GK = Cost of all fixed inputs (Naira),

NFI = Net farm income (Naira).

Financial analysis: This is an analytical tool used to determine the gender differences in profitability of pepper production. The financial analysis was used to achieve part of specific objective two (ii). Gross margin ratio is defined according to Alabi et al. (2020) and Ben-Chendo et al. (2015) as follows:

$$Gross\ margin\ ratio = \frac{Gross\ margin}{Total\ revenue} \quad (5)$$

The operating ratio (OR) is defined according to Olukosi and Erhabor (2015) as follows:

$$Operating\ Ratio = \frac{TVC}{GI} \tag{6}$$

where,
TVC = Total variable cost (Naira),
GI = Gross income (Naira).

According to Alabi et al. (2020) and Olukosi and Erhabor (2015), an operating ratio of less than one (1) implies that the gross income from the pepper enterprise was able to pay for the cost of the variable inputs used in the enterprise.

The rate of return per Naira invested (RORI) in pepper production is defined according to Alabi et al. (2020) as follows:

$$RORI = \frac{NI}{TC} \tag{7}$$

where,
$RORI =$ Rate of return per Naira invested (unit),
$NI =$ Net income (Naira),
$TC =$ Total cost (Naira).

The Cobb-Douglas production function model: The model is defined as follows:

$$Log\ Y = \beta_0 + \beta_1 Log\ X_1 + \beta_2 Log\ X_2 + \beta_3 Log\ X_3 + \beta_4 Log\ X_4 + \beta_5 Log\ X_5 + \beta_6 Log\ X_6 + U_i \tag{8}$$

$Y =$ Output of pepper (kg),
$X_1 =$ Age of farmers (years),
$X_2 =$ Farm size (hectares),
$X_3 =$ Labour input (mandays),
$X_4 =$ Fertiliser input (kg),
$X_5 =$ Seed input (kg),
$X_6 =$ Chemical input (litres),
$U_i =$ Error term,
$\beta_1 - \beta_6 =$ Regression coefficients,
$\beta_0 =$ Constant term.

This was used to evaluate gender differences in factors influencing pepper production as stated in specific objective three (iii).

Elasticity of production and return to scale: According to Alabi et al. (2020), the elasticity of production and return to scale of pepper production can be defined as follows:

$$RTS = \sum_i^n EP \tag{9}$$

$$RTS = \sum_1^6 \beta_i \tag{10}$$

$\text{RTS} = 1,$ Constant return to scale,
$\text{RTS} > 1,$ Increasing return to scale,
$\text{RTS} < 1,$ Decreasing return to scale,
where,
$RTS =$ Return to scale (units) and
$EP =$ Elasticity of production inputs (units).

This was used to evaluate the gender differences in the elasticity of production and return to scale of pepper production as stated in specific objective four (iv).

Principal component analysis: The gender differences in the constraints faced by pepper farmers were subjected to a principal component analysis. This was used to achieve specific objective five (v).

Results and Discussion

Socio-economic characteristics of the pepper farmers in the study area

The socio-economic characteristics of the sampled pepper farmers were age, gender, marital status, educational status, household size, access to credit facilities, contact with extension agents, years of farm experience, and farm size (Table 1). The results show that 66% of the sampled pepper farmers were between 21and 50 years old. The mean age was 43 years. This implies that the pepper farmers in the study area were active, energetic, and resourceful in their youthful age. This is in line with the findings of Alabi et al. (2022), who reported that the average age of the pepper farmers was 38 years implying that they are relatively young, energetic, within the active age in pepper production, thus high productivity is expected. Mohammed et al. (2016) reported that younger pepper farmers were more flexible to risks and new ideas, and therefore, more likely to adopt innovations than older farmers. Gender analysis in this research study classified pepper farmers into males and females. About 78% of the pepper farmers were male, while 22% were female. This means that pepper farming was dominated by males. This finding is in line with that of Alabi et al. (2022) who reported a 4:1 ratio of males to females in pepper farming in their study. About 43% of pepper farmers had formal education, while 57% had non-formal education. Dennis and Kentus (2018) reported that illiteracy among pepper farmers could affect negatively their ability to participate in extension training as well as adopt high levels of innovations and improved practises in pepper production. Alabi et al. (2010) reported that education acquired by pepper farmers was an important socio-economic factor influencing management decisions and adoption of new technologies. Furthermore, 74% of the pepper farmers had between 1 and 10 persons as household members. Averagely, there were 8 persons per household. Mohammed et al. (2015) reported an average household size of 11 persons for pepper farming households implying that a

considerable number of family members are available to carry out the various farming activities. Similarly, Sani et al. *(*2010) have reported that larger households among pepper farmers provide enough persons for family labour which signifies that little or less money will be needed to pay for hired labour. In addition, 83% of pepper farmers had access to credit facilities, while 35% did not have access to credit facilities.

Table 1. Socio-economic characteristics of pepper farmers in the study area.

Variables	Frequency	Percentage	Mean
Age (years)			
21 – 30	28	28.00	
31 – 40	19	19.00	
41 – 50	19	19.00	43.61
> 51	34	34.000	
Gender			
Male	78	78.00	
Female	22	22.00	
Marital status			
Single	07	07.00	
Married	84	84.00	
Divorced	09	09.00	
Educational status			
Primary	21	21.00	
Secondary	15	15.00	
Tertiary	07	07.00	
Non-Formal	57	57.00	
Household size (units)			
1 – 5	36	36.00	
6 – 10	38	38.00	8.0
11 – 15	21	21.00	
16 – 20	05	05.00	
Access to credit facilities			
Yes	65	65.00	
No	35	35.00	
Contact with extension agents			
Yes	83	83.00	
No	17	17.00	
Years of farm experience			
1 – 5	75	75.00	
6 – 10	23	23.00	4.35
11 – 15	02	02.00	
Farm size (hectares)			
0 – 0.99	40	40.00	
1 – 1.99	50	50.00	1.01
2 – 2.99	10	10.00	
Total	100.00	100.00	

Source: Field survey (2021).

The low access to credit could be due to the fact that the government rarely provides financial credit to farmers (Ekong, 2003). Access to credit is a very important factor in the development of any business. The availability of credit could determine the extent of production capacity (Mohammed et al., 2016). Access to micro-credit could improve the productivity of pepper farmers and contribute to uplifting the livelihood of peasant resource-poor rural farming communities (Nasiru, 2010). Farm experience of pepper farmers is another important socio-economic factor that can bring about an increase in pepper productivity. About 98% of pepper farmers had between 1 and 10 years of experience in pepper farming. Experienced pepper farmers can correct past errors and can forecast future market situations of their products at higher prices to make better profits (Alabi et al., 2022). Averagely, pepper farmers had 1.01 hectares of planted pepper area. They are small-scale, smallholder, resource-poor pepper farmers. According to Alabi et al. (2022) Nigerian farms are classified into small-scale (less than 5 hectares), medium scale (5 – 10 hectares), and large scale (more than 10 hectares). According to Ogunbo (2015), farm size may influence the adoption of technologies, scale of production, output level, and revenue accruable to pepper farmers.

Gender differences in profitability analysis of pepper production in the study area

The gender differences in the costs and returns of pepper production are presented in Table 2. All costs incurred and revenues obtained were based on the market price as at the time of the field survey. The variable costs incurred in pepper production for male and female farmers include: fertiliser input, seed input, herbicides, insecticides, bags, and labour input. The depreciated fixed costs involved in pepper production for both male and female farmers include: sprayer, land rent, hoe, water pump, and cutlass. There was a significant difference in the total variable costs involved in pepper production between male and female farmers. The average total variable costs of pepper production were 155,409.01 Naira and 122,800.73 Naira for males and females which accounted for 81.87% and 81.81% of the total cost of production per hectare, respectively. There was also a significant difference in the average total costs incurred in pepper production between male and female farmers. The male farmers incurred an average total cost of 189,824.06 Naira, while the female farmers incurred 82,418.15 Naira. Pooling the data for both male and female farmers together, the average total cost incurred for both male and female farmers in pepper production was 134,430.66 Naira. The gross margin analysis per hectare revealed that pepper production was profitable for both male and female farmers. The enterprise was worthwhile for both male and female pepper farmers. The gross margin per hectare was higher for male pepper farmers at 137,556.51 Naira than for female pepper farmers at 109,711.77

Naira. The net farm income analysis also revealed that both male and female pepper farmers were profitable. There was a significant difference in the net farm income for both male and female pepper farmers. The net farm income of male pepper farmers was higher at 103, 141.46 Naira than that of female pepper farmers at 82,418.15 Naira per hectare. Pooling the data together for both male and female pepper farmers, the net farm income was estimated at 98,582.33 Naira. This implies that pepper production in the study area was profitable. The financial analysis revealed that the gross margin ratios of pepper production for male and female farmers and for the pooled data were 0.47 each.

Table 2. Gender differences in average costs and returns of pepper production per hectare.

Items	Male		Female		Pooled	
	Amount (Naira)	Percentage	Amount (Naira)	Percentage	Amount (Naira)	Percentage
Total revenue	292,965.52		232,512.50		279,665.85	
			Variable cost			
Seed input	1,480.10	0.779	1,280.01	0.852	1,436.08	0.793
Fertiliser input	44,919.14	23.66	39,231.20	26.13	43,667.79	24.11
Herbicides	6,063.84	3.194	4,547.88	3.030	5,730.33	5.164
Insecticides	1,450.46	0.764	1,160.37	0.775	1,386.64	0.965
Bags	1,989.06	1.047	1,591.24	1.060	1,901.54	1.050
Labour input						
(a) Land clearing	12,044.33	6.344	9,033.25	6.018	11,381.89	6.285
(b) Soil tillage	13,385.22	7.051	10,038.91	6.688	12,649.03	6.905
(c) Planting	11,240.39	5.921	8,430.29	5.616	10,622.16	5.865
(d) Manure application	8,275.86	4.339	6,620.68	4.411	7,911.72	4.369
(e) Chemical application	8,122.17	4.248	6,497.74	4.329	7,764.79	4.289
(f) Weeding	18,622.66	9.810	14,898.13	9.923	17,803.26	9.831
(g) Fertiliser application	8,029.56	4.230	5,620.69	3.744	7,499.61	4.141
(h) Harvesting	15,822.66	8.335	11,075.86	7.379	14,778.364	8.161
(i) Bagging	3,963.55	2.088	2,774.48	1.848	3,701.96	2.044
Fixed cost (depreciation)						
(a) Land rent	26, 256.16	13.83	21,004.92	15.999	25,100.89	13.86
(b) Sprayer	2,384.03	1.255	1,668.82	1.111	1,859.68	1.026
(c) Hoe	2,123.30	1.185	1,698.64	1.131	2,029.87	1.120
(d) Cutlass	238.73	0.125	190.98	0.127	228,23	0.126
(e) Water pump	3,412.83	1.797	2,730.26	1.819	3,254.86	1.797
Total variable cost	155,409.01	81.87	122,800.73	81.81	148,235.19	81.86
Total fixed cost	34,415.05	18.13	27,293.62	18.19	32,848.33	18.14
Total cost	189,824.06	100.00	150,094.35	100.00	181,083.58	100.00
Gross margin	137, 556.51		109,711. 77		134,430.66	
Net farm income	103,141.46		82,418.15		82,418.15	98,582.33
Quantity (50 Kg)	14.64	11.62			13.98	
Price	20,000		20,000		20,000	
Operating ratio	0.53		0.52		0.53	
Rate of return on investment	0.55		0.54		0.544	
Gross margin ratio	0.47		0.47		0.47	

Source: Field survey (2021).

This implies that for one Naira invested in pepper production, 46 kobos covered profits, taxes, expenses, and depreciation. The rate of return on investment was higher for male pepper farmers at 0.55 than for female pepper farmers at 0.54, implying that for one Naira invested by male pepper farmers, additional 55 kobos were earned. This is in line with the findings of Alabi et al. (2022), who obtained a gross margin of 167,642.49 Naira and gross margin ratio of 0.481 for pepper production per hectare in Abuja, Nigeria. Ajibade et al. (2021) reported similar results for the same group of vegetable producers: the gross margin of tomato production was at 67,083.64 Naira per hectare for male farmers, higher than the gross margin of tomato production at 34,325.38 Naira per hectare for female farmers in Abuja, Nigeria.

Gender differences in factors influencing the output of pepper (*Capsicum species*) production in the study area

Gender differences in factors influencing the output of pepper production are presented in Table 3. The explanatory variables considered in the Cobb-Douglas production model were age (X_1), farm size (X_2), labour input (X_3), fertiliser input (X_4), seed input (X_5), and chemical input (X_6). All the regression coefficients for male and female pepper farmers and pool data were positive. Age (X_1) , and fertiliser input (X_4) were statistically significant at ($P < 0.01$) for male pepper farmers, while age (X_1), labour input (X_3), and fertiliser input (X_4) were statistically significant at ($P < 0.01$) for female pepper farmers. The pooled data revealed that age (X_1), and labour input (X_3) were statistically significant at ($P < 0.01$). The coefficient of multiple determinations (R^2) was 0.81 for male pepper farmers and 0.56 for female pepper farmers. The coefficient of multiple determinations (R^2) for pooled data was 0.755. The coefficient of determinations (R^2) of 0.81 implies that 81% of variations in production of pepper by male pepper farmers were explained by the explanatory variables included in the model. The coefficient of determinations (R^2) of 0.56 implies that 56% of variations in the production of pepper by female pepper farmers were explained by the explanatory variables included in the model. The F-values were statistically significant at ($P < 0.01$) for male (225.71), female (196.21) pepper farmers and pooled data (219.22) respectively. This confirmed the explanatory variables included in the model as jointly responsible for variations in production of pepper by male, and female pepper farmers and pooled data, respectively. The regression coefficients of farm size and fertiliser input were 0.521 and 0.491 for male pepper farmers, while the regression coefficients for female pepper farmers were 0.020 and 0.001 respectively. This implies that a 1% increase in farm size will lead to a 52.1% increase and a 2.0% increase in pepper production for male and female farmers, respectively. This finding is in line with Alabi et al. (2022), who have reported that a 1% increase in farm size will lead to a 69.85% increase in pepper production among smallholder farmers in Abuja, Nigeria. Similarly, Adeoye

et al. (2014) have reported that a 1% increase in farm size will lead to a 05.15% increase in pepper production among farmers under tropical conditions.

Table 3. The result of multiple regression analysis of the Cobb-Douglas production function model.

Variable	Male			Female		
	Regression coefficient	Standard error	t-statistics	Regression coefficient	Standard error	t-statistics
Age (X_1)	0.412	0.1141	3.61***	0.035	0.011	3.21***
Farm size (X_2)	0.521	0.2059	2.53**	0.020	0.008	2.57**
Labour input (X_3)	0.361	0.1332	2.71**	0.006	0.002	3.64***
Fertiliser input (X_4)	0.491	0.1323	3.71***	0.039	0.001	3.45***
Seed input (X_5)	0.530	0.2070	2.56**	0.014	0.006	2.41**
Chemical input (X_6)	0.483	0.2185	2.21**	0.012	0.005	2.56**
Constant	4.012	1.6786	2.39**	2.844	1.252	2.27**
RTS	2.798			0.033		
R^2	0.81			0.56		
Adjusted R^2	0.78			0.51		
F-Value	225.71***			196.21***		

Source: Data analysis (2021). *Significant at the 10% probability level; **Significant at the 5% probability level, ***Significant at the 1% probability level.

Table 3. Continued. The result of multiple regression analysis of the Cobb-Douglas production function model.

Variable	Pooled data		
	Regression coefficient	Standard error	t-statistics
Age (X_1)	0.3291	0.0093	3.52***
Farm size (X_2)	0.4108	0.1624	2.53**
Labour input (X_3)	0.2829	0.0972	2.91***
Fertiliser input (X_4)	0.3916	0.1072	3.65***
Seed input (X_5)	0.4165	0.1646	2.53**
Chemical input (X_6)	0.3793	0.1663	2.28**
Constant	3.7550	1.3372	2.808**
RTS	2.2064		
R^2	0.755		
Adjusted R^2	0.720		
F-value	219.22***		

Source: Data analysis (2021). *Significant at the 10% probability level; **Significant at the 5% probability level, ***Significant at the 1% probability level.

Gender differences in elasticity of production and return to scale of pepper production in the study area

The gender differences in elasticity of production and return to scale of pepper production are presented in Table 3. The regression coefficients of the male and

female pepper farmers and the pooled data were the elasticities of production. The sum of the elasticities of production gave the return to scale for male and female pepper farmers and for the pooled data respectively. The elasticities of production of fertiliser input were 0.491 for male, and 0.039 for female pepper farmers. The elasticity of production of fertiliser input for pooled data was 0. 3916. All the elasticities of production for variable inputs included in the Cobb-Douglas production model were positive for male and, female pepper farmers and for pooled data respectively. The return to scale (RTS) of pepper production for male farmers was 2.798, which signifies increasing return to scale. This implies that a unit increase in any production input in pepper production will lead to more than a proportionate increase in the output of pepper produced. The return to scale (RTS) of pepper production for female farmers was 0.033, which signifies a decrease in return to scale. This implies that a unit increase in any production inputs will lead to disproportionately small decrease in the output of pepper produced. The return to scale for the pooled data was 2.206, which signifies an increase in the return to scale of pepper production. This result is similar to the findings of Dossah and Mohammed (2016), who obtained the return to scale (RTS) of 1.314 for male vegetable farmers (increasing return to scale), and 0.97 for female vegetable farmers (decreasing return to scale) in Plateau State, Nigeria.

Constraints faced by pepper farmers in the study area

Table 4 shows the constraints faced by pepper farmers in the study area using the principal component model. Principal component analysis (PCA) is an analytical technique that can transform many interrelated constraints of pepper farmers into few uncorrelated constraints.

Constraints with Eigen-values greater than one (1) were retained by the principal component model. Constraints with Eigen-values less than one (1) were discarded by the model. Lack of fertilisers with an Eigen-value of 3.2091 ranked 1st among the constraints based on the perception of pepper farmers, explaining 21.71% of all the constraints retained by the principal component model. Pest and disease infestations ranked 2nd based on the perceptions of pepper farmers, and this explained 21.60% of all the constraints retained by the model. The other constraints faced by pepper farmers include: inadequate capital (3rd), high perishability of commodities (4th), poor soil fertility (5th), lack of improved seeds (6th), and lack of storage facilities (7th). The retained constraints faced by pepper farmers explained 83.76% of all the constraints faced by pepper farmers in the study area. This is in line with the findings of Alabi et al. (2022), who reported that, using the principal component model and based on the perceptions of smallholder pepper farmers, lack of fertilisers and lack of improved seeds ranked 2nd and 3rd among the constraints faced by smallholder pepper farmers in Abuja, Nigeria.

Table 4. Principal component analysis of constraints faced by pepper farmers.

Constraints	Eigen-value	Difference	Proportion	Cumulative
Lack of fertilisers	3.2091	0.4120	0.2171	0.2171
Pest and disease infestation	3.1020	0.3971	0.2160	0.4331
Inadequate capital	2.9801	0.3651	0.1131	0.5462
High perishability of commodity	2.9107	0.3402	0.1001	0.6463
Poor soil fertility	2.8709	0.3101	0.0971	0.7434
Lack of improved seeds	1.8701	0.2907	0.0621	0.8055
Lack of storage facilities	1.6701	0.2770	0.0321	0.8376
Bartlett test of sphericity				
KMO	0.6701			
Chi square	490.67			
Rho	1.000000			

Source: Data analysis (2021). ***Significant at the 1% probability level.

Conclusion

This research study has shown that pepper production was a profitable enterprise for both male and female farmers in the study area. The pepper farmers were active, energetic, resourceful, and in their youthful age. Pepper production was mainly dominated by male farmers and households were large with an average of 8 persons per household. They were small-scale, smallholder, peasant and resource-poor pepper farmers with an average farm size of 1.01 hectares of farm land. Gender differences in average costs and returns of pepper production show that the gross margin of male pepper farmers was higher at 137,141.46 Naira per hectare than that of female pepper farmers with a gross margin of 109,711.77 Naira per hectare. The net farm income of male pepper farmers was higher at 103,141.46 Naira per hectare than that of female pepper farmers with a net farm income of 82,418.15 Naira per hectare. The financial analysis revealed that the gross margin ratios were for male and female pepper farmers 0.47 each. This signifies that for every Naira invested in pepper production, 47 kobos covered taxes, profits, expenses, interest, and depreciation. The rate of return on investment was higher for male pepper farmers at 0.55 than for female pepper farmers who had a rate of return on investment of 0.54. The gender differences in factors influencing pepper production show that age and fertiliser input were the statistically significant factors influencing the production of pepper by male farmers at the 1% probability level, while age, labour input, and fertiliser input were the statistically significant factors influencing production of pepper by female farmers at the 1% probability level. The coefficient of multiple determinations (R^2) was 0.81 for male pepper farmers and 0.56 for female pepper farmers. The return to scale was estimated at 2.798 for male pepper farmers which signifies increasing return to scale, while that of female pepper farmers was calculated at 0.033 which implies decreasing return

to scale. The constraints faced by pepper farmers include: lack of fertilisers, pest and disease infestations, inadequate capital, high perishability of commodities, poor soil fertility, lack of improved seeds, and lack of storage facilities. This research study recommends the following:

To increase productivity, male and female pepper farmers should be provided with farm inputs such as improved seeds, fertiliser, and chemicals.

Female pepper farmers should be given more access to low interest loan rate to increase productivity.

The government should hire female extension agents to disseminate research findings and new technologies to pepper farmers.

The government should promote mechanised farming by providing equipment such as tractors, motorised sprayers, irrigation facilities etc. to increase productivity.

Storage facilities should be provided to the pepper farmers to solve the problem of high perishability of commodities.

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RODNE RAZLIKE I ANALIZA PROFITABILNOSTI PROIZVODNJE PAPRIKE (RODA *CAPSICUM*), DRŽAVA KADUNA, NIGERIJA

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R e z i m e

U okviru ove studije analizirane su rodne razlike i profitabilnost proizvodnje paprike (roda *Capsicum*) u državi Kaduna, Nigerija. Usvojena je tehnika višestepenog uzorkovanja. Izabrano je sto proizvođača paprike. Primarni izvori podataka korišćeni su uz pomoć dobro osmišljenog i dobro strukturiranog upitnika. Rezultati pokazuju da je 66% proizvođača paprike imalo između 21 i 50 godina. Proizvodnja paprike je bila profitabilna u ispitivanom području. Rodne razlike su uticale na visinu troškova i prihoda u proizvodnji paprike, pa su proizvođači muškog pola ostvarili veću bruto maržu – 137.556,51 naira od proizvođača paprike ženskog pola – 109.711,77 naira po hektaru. Rodne razlike među faktorima koji utiču na proizvodnju paprike pokazuju da su starost (X_1) i đubrivo (X_4) značajni faktori koji utiču na proizvodnju paprike među proizvođačima na nivou verovatnoće od 1%, dok su starost (X_1), radna snaga (X_3), i đubrivo (X_4) značajni faktori koji utiču na proizvodnju paprika među proizvođačima ženskog pola na nivou verovatnoće od 1%. Prihod u proizvodnji paprike u odnosu na rast inputa (RTS) procenjen je na 2,798 za proizvođače muškog pola, što označava povećanje prihoda u odnosu na obim inputa. Prihod u proizvodnji paprike u odnosu na rast inputa (RTS) je izračunat za proizvođače paprike ženskog pola na 0,033, što implicira smanjenje prihoda u odnosu na obim inputa. Glavna ograničenja sa kojima se suočavaju proizvođači paprike su: nedostatak đubriva, napadi štetočina i bolesti i neadekvatan kapital. U okviru studije se preporučuje da proizvođači paprike ženskog pola treba da imaju veći pristup poljoprivrednim inputima i kreditima sa niskim kamatama kako bi se povećala produktivnost.

Ključne reči: rodne razlike, analiza profitabilnosti, proizvodnja paprike, država Kaduna, Nigerija.

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