



RESOURCE USE EFFICIENCY OF PEPPER PRODUCTION IN TAKUM AND DONGA LGAs OF TARABA STATE, NIGERIA

¹Reuben, J., ²Merga, S. S. and ³Dauda, A. F.

¹Department of Agricultural Economics and Extension, Taraba State University, Jalingo

²Post Primary School Management Board Jalingo, Taraba State, Nigeria

³Department of Agricultural Economics and Extension, Taraba State University, Jalingo

ABSTRACT

The study analyzed Resource use efficiency of pepper production in Takum and Donga LGAs of Taraba State. The specific objectives of the study were to describe the socio-economic characteristics of pepper farmers, estimate the costs and returns associated with pepper production, determine resource use efficiency of pepper farming, and identify the major constraints associated with pepper production in the study area. Data were collected from 134 pepper farmers in the 2021/2022 cropping season using structured questionnaires. The data were analyzed using descriptive statistics, farm budgeting techniques, inferential statistics and the Likert scale. The findings showed that most of the pepper farmers (78.3%) were within the age range of 15 to 45 years, with majority (82.1% being) male, and most (85.07%) having a household size of between 1-10 persons. The venture gave a gross margin of ₦451,250 per hectare and the return on every naira invested was 1.22 which showed that pepper production in the area was profitable. The results on factors influencing pepper production indicated that labour and fertilizer were statistically significant at 1% level while agrochemical at 10%. The results also indicated that labour was underutilized while fertilizer and agrochemical were over utilized. Major constraints identified were lack of extension services and credit facilities. It was recommended that emphases be made in improving the educational and cultural characteristics of farmers in the area because it influences efficiency greatly. It was further recommended that, trainings on how to utilize farm inputs and formation of viable cooperative societies that will link up farmers to sources of credits and inputs are equally imperative.

Keywords: Resource use, Profitability, Efficiency, Constraints, Taraba State

Corresponding Author: Phone 08080490860, Email jonnyato4@yahoo.com,

INTRODUCTION

Pepper (*Capsicum frutescens*) is a high-value crop that is grown for cash by farmers all over the world (Choumbou *et al.*, 2020). Nigeria is known to be one of the major producers of pepper in the world accounting for about 50% of the African production (Idowu-agida *et al.*, 2010). There are various names of pepper referred to as: Chillies, Chile hot Peppers, Bell Peppers, Red Peppers, Pod Peppers, Cayenne Peppers, Paprica, Pimento, and Capsicum in different parts of the world. These crops are prominent cash crops for many developing countries such as

Mexico, Ethiopia, Nigeria, Ghana, China, India, Pakistan, Bhutan, Indonesia, Cambodia and Thailand (Kate and Merker, 2019). It has substantial contribution to human health by inhibiting pain messenger, arthritis, headaches, burns and neuralgia. It has the power to boost immune system, lower cholesterol and getting rid of parasites of gut (Senai, 2010). Pepper consumption in Nigeria accounted for 40% of the total vegetable consumed per day, with a total of 100-200ha being cultivated annually in Nigeria (Adetula and Olakojo, 2016).

A study conducted by Mussema and Haramaya, (2006) revealed that pepper is the world second important vegetable ranking after tomatoes. It is the most produced type of spice flavoring and color to food while providing essential vitamins and minerals. The nutritional value of hot pepper merits special attention; it is a rich source of vitamin A, C and E. It is used extensively in food flavoring in the daily diet of over 120 million Nigerians, irrespective of their socio-economic status. It is used in the preparation of soups and stew, which are among the major essential compliments of staple based on cereals and root crops, and form remedies for toothache and sore throat (Leung and Foster, 1996). This has necessitated even small-scale farmers to produce surplus for commercialization. Thus, there is a need to identify and improve the production of commodities that have international market potentials. In Nigeria, such produce include chili pepper (Suleiman and Isah, 2010). For a country to attain growth and development, the economy must be diversifying simultaneously by developing various sectors of the economy instead of over-reliance on a particular sector. In Nigeria, almost all other sectors of the economy seem to have gone into oblivion, thereby, making the country to depend on revenue from crude oil export (Ocheni, 2015).

The decline in export crop production, low levels of agricultural technology, investments, inefficient utilization of farm inputs, drought and post-harvest losses largely contributed to the poor performance of the agricultural sector (Ufiobor, 2017). Mohammed (2015) stated that investment in Pepper production is a viable enterprise for income generation, poverty alleviation, job creation and improvement of food security to every household. Similarly, research conducted in Nigeria revealed that vegetable farming is a profitable enterprise and farmers realize profit by engaging in its production (Shehu *et al.*, 2017). According to Rahji *et al.* (2006), the efficiency with which producers use resources and technologies are important because low productivity is a major problem. Household size, level of education, credit accessibility, and extension visits can positively contribute to efficiency; while age, farming experience, and off-farm income reduce efficiency.

Efficiency was first introduced by Farrell, (1957) as the ability to produce a given level of output at lowest cost. It is therefore concerned with the relative performance of the process used in the production. It also measures the success with which a farm best utilizes its available resources to produce maximum levels of potential output. A farm is efficient if and only if it is not possible to increase output (decrease inputs) without more inputs use (without decreasing output). Failure to obtain this potential maximum output results in inefficiency (Upton *et al.*, 2013). According to Bamidele *et al.* (2010), resource use efficiency include technical and allocative efficiency. He isolated allocative efficiency into absolute and relative efficiency and affirmed that these can be analysed in the production function framework.

Coelli and Battesse (1998) in analyzing efficiency found that it is better to use frontier function than the ordinary least square OLS because the former provides clear understanding of the technology used in any production process and how it influenced the output. Secondly, the frontier function represents a best practice technology against which the efficiency of firms within the industry can be measured. It is this second use of frontiers, which leads to widely application of estimating frontier functions. Measurement of efficiency according to Okike,

(2006) is important for the following reasons; firstly it is a success indicator, performance measure by which productive units are evaluated. Secondly, only by measuring efficiency and separating its effects from that of the production environment can one explore hypotheses concerning the sources of inefficiency differentials. Identifying of sources of inefficiency is important to institutions of private and public agencies designed to improve performance. Thirdly, the ability to quantify efficiency provides decision makers with mechanism with which to monitor the performance of the production system or units under their control in some cases, theory provides no guidance or conflicting signal concerning the impact of some phenomenon on performance. In such situations, empirical measurement provides qualitative as well as quantitative evidence (Coelli *et al.*, 2005).

Technical efficiency (TE) is defined as the ability to achieve a maximum level of output, given similar production resources (inputs) with fixed technology. It is the attainment of producing goods without wastage (Amaza and Olayemi, 2002 as cited by Girei *et al.*, 2018). This is regarded as estimating average production function (Olayide and Heady, 1982). This definition assumes that technical inefficiency is absent from the production frontier. Farrell, (1957) suggested a method of measuring technical efficiency of a firm in an industry by estimating the production function of firms which are fully efficient (i.e. frontier production function). This aspect of the result gives an indication whether the farmers are technically efficient or not. A focus is placed on how the farmers combine the resources to achieve efficiency. Allocative efficiency (AE) deals with the extent to which farmers make efficient decisions by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost, (Goni *et al.*, 2007). Sani *et al.*, (2013) looked at allocative efficiency as a condition that exists when resources are within the firm according to market price. In a materialistic society they argued, this will represent a desirable characteristic when markets measure relative scarcity. This will be the case when price are determined in perfectly competitive markets, but when prices are distorted by monopolistic influence or where some goods remain outside the market system the role of price in resource allocation is greatly impaired. Girei and Saingbe, (2018) stated that a farm is said to be allocatively efficient if it maximizes profit. That is when it equates its marginal product of every variable input to its corresponding opportunity cost; any firm that does not meet the stated condition is technically inefficient.

In Farrell's framework, Economic Efficiency (EE) is an overall performance measure and is equal to the product of Technical Efficiency (TE) and Allocative Efficiency (AE). Mathematically stated as $EE=TE*AE$. The simultaneous achievement of both efficient conditions according to Iyabo *et al.* (2014), occurs when price relationship are employed to denote the maximum profits for the firm or when the choice indicator are employed to denote the maximization of other economics objectives. According to Adesina and Ajato, (1996) economic efficiency occurs when a firm chose resource and enterprise in such a way as to attain economic optimum. The optimum implies that a given resources is considered to be most efficiently used when its marginal value productivity is just sufficient to offsets its marginal cost. Thus, economic efficiency refers to the best combination for a particular level of output which is determined by both the input and output prices. This would lead to increase in the farmers output as well as its income which will lead to poverty reduction, improved living condition and wellbeing. A resource is said to be optimally allocated if there is no significant difference between the marginal value product and marginal factor cost (i.e. ratio of MVP to $MFC =1$). Technical and allocative efficiencies are components of economic efficiency (Adeyemo, 2009).

Statement of the Problem

Due to the declining food production, rural households continue to face low standard of living. The returns from land in terms of output have been on the decrease especially where increased population and non-agricultural uses compete for land and resource use. Nigeria still imports pepper, an indication that there is high demand for the commodity despite the good weather, soil and numerous potentials of pepper production and even to export. Food production in Nigeria can no longer keep pace with population growth, while pepper yields have been very low compared to Western Europe (Vibeke *et al.*, 2020). Comparatively, yield in the developing countries is about 10 – 30% of that in developed countries (Grubben *et al.*, 2010). The low yield in pepper production in Nigeria could be attributed to some production challenges which include disease, pest and poor management practices in terms of resource use. Pepper production in Nigeria has once been reported to be a lucrative enterprise (Idowu-agida *et al.*, 2010). Scarcity of resources have made researchers to evolve methods of re-allocation of existing resources to improve output with given level of input combinations, or to produce a prescribed level of output with minimum cost without changing the production technology.

Despite the economic importance of pepper, there are no programs design to encourage farmers venture into massive production in the study area to meet the prevailing demand or increasing its level of contribution to the farmer's income. The aim of production is to maximize profit from sales of output; thus, the farmer must be careful in selecting inputs combination that will give the highest output. The knowledge of what percentage each resource is contributing to overall profit will encourage farmers to specialize and improve efficiency in production to maximize profit (Mohammed, 2015). Poor agricultural practice as well as weak marketing system, disease and unstable price of pepper could discourage farmers from producing more. There is a wide information gap on resource usage, profitability, problems, and potentials of pepper production in Nigeria and particularly the study area that can be taken up for research. It is in view of the above facts that this study was carried out to examine resource use efficiency of pepper production in Takum and Donga LGAs of Taraba State, Nigeria. The specific objectives were to:

- (i) describe the socio-economic characteristics of pepper farmers;
- (ii) estimate the profitability associated with pepper production;
- (iii) determine the factors influencing pepper production;
- (iv) determine resource use efficiency in pepper production; and,
- (v) identify the major constraints associated with pepper production in the study area.

MATERIALS AND METHODS

The Study Area

The study was conducted in Takum and Donga LGAs, of Taraba state, Nigeria. Taraba state has a land area of 59,400 km² with a population of 2,300,736 (NPC, 2006). According to Taraba State Agricultural Development Programme (TADP, 2020) there are four (4) agricultural zones in the state, namely: Zone I, II, III, and IV. The study area is located in Zone III which comprises of Takum, Donga, Ussa, Kurmi, parts of Bali (Bali/Suntai) LGAs, and Yangtu Special Development Area (SDA) with headquarters at Takum (see figure 1). The study area falls within the Tropical and Sudan savannah vegetation belt of Nigeria with annual rainfall rate between the ranges of 600mm-1000mm, (Adakola *et al.*, 2015). The zone has a tropical climate that is marked by dry session between November -March, and rainy session between

April-October. The agrarian nature of rich alluvial track of soil found in most part of the study area makes it conducive for growing different types of crops which include: groundnuts, pepper, maize, rice, sorghum, millet, cassava, yam, and so on. In addition, cattle, sheep and goats are reared in large numbers. The study area comprises of many ethnic groups such as, Kuteb, Chamba, kpanzo, Wurkums, Fulanis, Ichen, Tiv, Wawa, Hausa and Ndola.

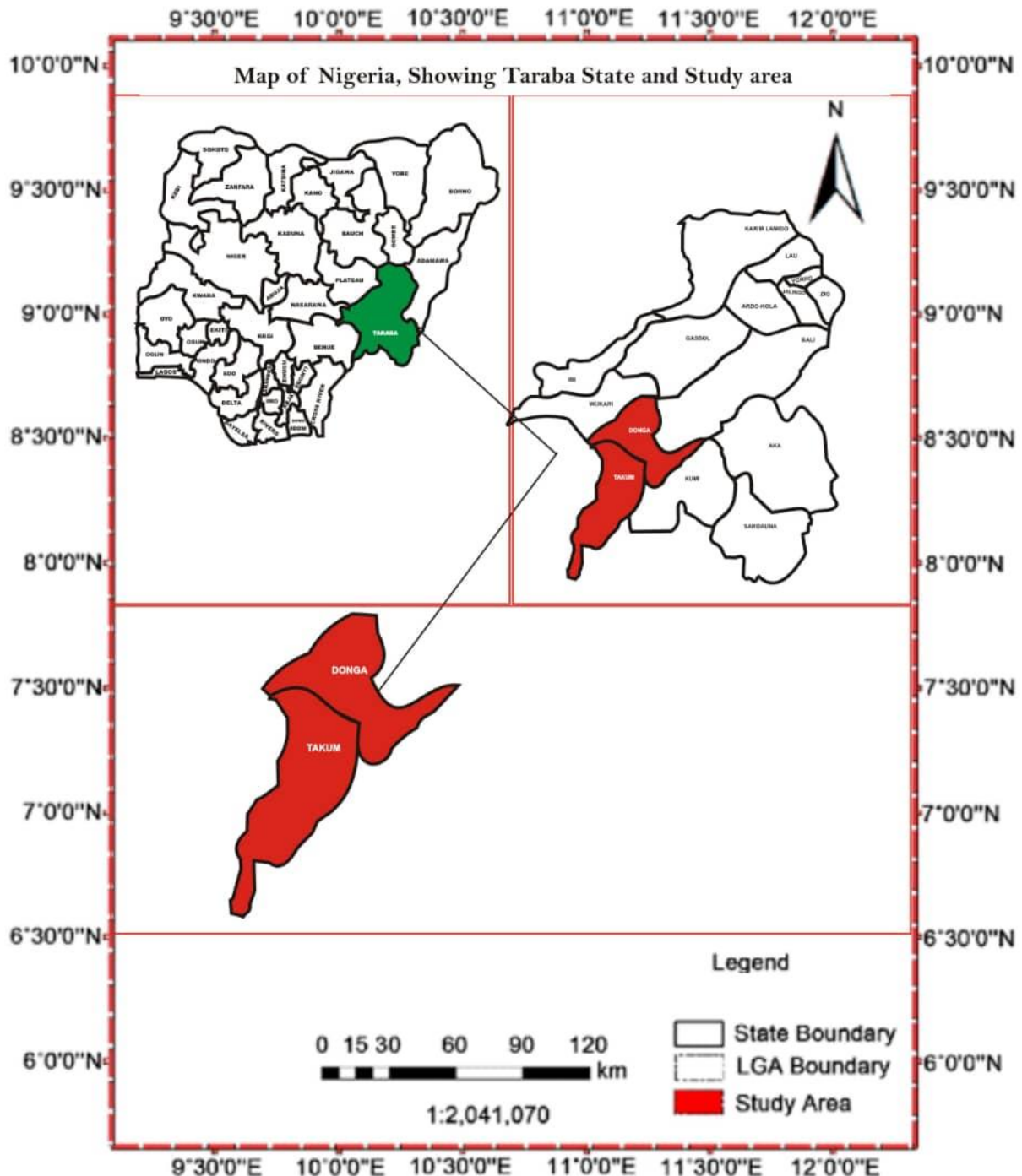


Figure 1: Map of Taraba State Showing the Study Area
 Source: Geographic Information System Analyst, 2022.

Sources and Methods of Data Collection

For this study, primary data were used which were collected with the aid of a structured questionnaire administered manually by the researcher and a trained enumerator. The population for this study comprised of pepper farmers in Takum and Donga local Government Areas of Taraba State, Nigeria. The data collected were from 134 pepper farmers in the 2021/2022 cropping season.

Sampling Technique and Sampling Size

Multistage sampling procedure was employed in selection of the respondents. In the first stage, two blocks (that is the LGAs) were purposively selected from zone III based on their prominence in pepper production. In the second stage six (6) cells were selected from each of the two blocks due to their intensity in pepper production to give a total of twelve (12) cells. In the third stage, Snowball sampling was used to identify 15 pepper farmers in Tor-Damisa, while 17 pepper farmers were identified each from the remaining cells as seen in Table 1. The sample frame of 202 pepper farmers were identified while Taro Yamane formula was used to determine sample size of 134 pepper farmers at 5% Margin errors which were administered questionnaires. All the questionnaires were retrieved and used in the analysis.

Table 1: Distribution of Respondents in the Study Area

Blocks	Cells	Sample frame	Sample size
Takum	Peva	17	11.28
	Demevaa	17	11.28
	Iornumbe	17	11.28
	Shanu Barack	17	11.28
	Tati Kumbo	17	11.28
	Gangum	17	11.28
Donga	Tordamsa	17	9.95
	Mbakombor	17	11.28
	Ananum	17	11.28
	Kpu –Kpur	17	11.28
	Kadarko	17	11.28
	Isha- gogo	17	11.28
Total	12	202	134.03

Source: Field survey, 2022

Method of Data Analysis

The analytical tools used for this study include; descriptive statistics which was used to address objectives (i) and (v), while farm budgeting techniques and inferential statistics (multiple regression) were used to achieved objective (ii) and (iii & iv) respectively.

Farm budgeting technique

Net farm income is the difference between the total revenue and total cost. The total cost of production includes both total variable cost and total fixed cost. Total variable cost includes; cost of seed, cost of fertilizer, cost of labour, and cost of agrochemicals while total fixed cost include costs of land, equipment, implements and vehicles (Olukosi and Erhabor, 1987) . The formula for Net Farm Income is stated as follows:

$$NFI=GM-TFC..... (1)$$

Where:

NFI= Net Farm Income (Naira/ha), GM= Gross Margin (Naira/ha) and

TC= Total Cost of production (Naira/ha)

TC= TVC+TFC

Total Cost (TC) = Total Variable Cost (TVC) + Total Fixed Cost (TFC)

TVC = (seed, fertilizer, labour and agrochemicals)

TFC = (cost of renting land and depreciation of tools)

They were depreciated using Straight line method at 5 years expected life span of assets used,

$D = (P-S)/N$

Where:

D = depreciation (Naira), P = Purchase value (Naira), S = Salvage value (Naira) and

N = life span of asset (years)

The Return per naira invested was obtained by dividing the gross income (GI) over the total variable cost (TVC).

Therefore, $RNI = GI/TVC \dots \dots \dots (2)$

Where:

RNI = Return per Naira Invested, GM = Gross Income, TVC = Total variable Cost

Decision Rule: when

- a. $RNI > 1$ implies that the enterprise is profitable.
- b. $RNI = 1$ The farmer is operating at breakeven point and
- c. $RNI < 1$ Implies the farmer is operating at loss.

The Operating Ratio (OR) is the business's operating expenses as a percentage of revenue. The smaller the ratio the more efficient the business in generating revenue or sales

$OR = TOC/GI \dots \dots \dots (3)$

Where:

OR= Operation ratio, TOC= Total operating cost and GI= Gross income

Multiple regression model

In order to determine resource use efficiency, an ordinary least squares (OLS) regression model was employed to address objective (iii). The model is specified below;

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \quad (4)$$

Where:

Y = pepper output (kg), a = intercept, $b_1 - b_4$ = Regression coefficient and e= Error term

X_1 = Labour cost (₦), X_2 = Fertilizer (kg), X_3 = Seeds (Kg) and X_4 = Agro-chemical (litre)

Four functional forms that were tried are; linear, Cobb-Douglas, Semi-log and Exponential functions.

- i. Linear Production Function

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \quad (5)$$

- ii. Exponential production function

$$\log Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e \quad (6)$$

- iii. Semi-log function

$$Y = a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + e \quad (7)$$

- iv Cobb-Douglas production function

$$\log Y = a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + e \quad (8)$$

In summary, the criteria adopted in the selection of lead equation was relative to its conformity to *a priori* economic criteria of the magnitudes of the coefficients, and significance of parameter estimate, coefficient of determinations, R^2 , F-ratio and t-ratios.

In order to determine the resource use efficiency of pepper farmers, the study adopted the method used by Omoyiwola (2017), where the marginal value product (MVP_1) which is the additional income received from using an additional unit of financial input for each resource,

was computed and compared with the respective acquisition cost (MFC_1) as expressed in equation 9.

$$r = \frac{MVP}{MFC} \dots\dots\dots (9)$$

Where: r = efficiency ratio, MVP = Marginal value product of a variable input, MFC = Marginal factor cost (price per unit). On the basis of the economic theory, a firm maximizes profit with respect to resources use when the ratio of the marginal value product to marginal factor cost of input is one or unitary. The values are interpreted as follows:

- i. If $r < 1$, it means there is over utilization of resource and decreasing the quantity used of the resource in question, hence increases profit.
- ii. If $r > 1$, it means there is underutilization of the resource and increasing the quantity used of the resource hence decreases profit.
- iii. If $r = 1$, it means the resource use is efficient, that is optimum utilization of resources and hence, the point of profit maximization.

MVP = Marginal value product of a variable input, MFC = Marginal factor cost (price per unit). The value of MVP was estimated using the regression coefficient of each input and the unit price of farm output, P_y , as expressed in equation 10 as follows:

$$MVP_{x1} = MPP_{x1} x P_y \dots\dots\dots (10)$$

Where:

P_y = Price of unit input, MVP_{x1} = Marginal value product of resource X_i ($i = 1,2,3,4$)

MPP_{x1} = Marginal physical product of input X_i

$$\text{But, } MPP_{x1} = \frac{dy}{dx} = b_i \frac{\bar{y}}{x}$$

Where,

$\frac{dy}{dx_i} = MPP_{x1}$ = the first derivative of pepper output with respect to a given input variable

b_i = Estimated regression coefficient of an input variable (X_i), \bar{y} = Arithmetic mean value of pepper output and X_i = Arithmetic mean value of the input variable.

The Percentage adjustment in MVP for attainment of optimal resource allocation is expressed in equation (11). Sometimes, farmers either over utilize or underutilize farm resources and hence, not to the best economic advantage. To determine this, the relative percentage change in MPV of each resource required to obtain optimal resource allocation that is, $r = 1$ or $MVP = MFC$ will be estimated using the formula that follows:

$$D = \left(\frac{1-MFC}{MVP} \right) \times 100 = (1-r^{-1} \times 100) = \left(\frac{1}{1} - \frac{1}{r} \right) \times 100 \dots\dots\dots (11)$$

Where:

D = Absolute value or modulus of percentage change in MVP of each resource (Rutgers, 2018).

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Pepper Farmers

The Result in Table 2 showed that 52.9 % of the pepper farmers were within the age range of 31 to 45 years, with the mean age of 37 years. This age range falls within the active economic age group which implies that majority of them were young. This result agrees with Ogunbo (2015) on her studies on resource-use efficiency and optimal farm plan in pepper (*capsicum spp.*) production in Ogun State. The findings also showed that majority (61.2%) of the farmers were married and mostly (82.1%) male. This implied that pepper production was dominated by male and needed more able hands in the family to accomplish the task within a given possible time. The result is in consonance with the findings of Adaigho (2018) on assessment

of pepper production and socio economics of pepper farmers in Delta state Nigeria who revealed that, pepper farming was dominated by males, because the area was a typical society in which the male gender is expected to head and care for the family while the women and children are subordinates.

Table 2: Socio-Economic Characteristics of Pepper Farmers

Variable	Frequency (n = 134)	Percentage (%)	Mean
Age			37
15-30	34	25.4	
31-45	71	52.9	
46 and above	29	21.6	
Gender			
Female	24	17.9	
Male	220	82.1	
Marital status			
Married	82	61.2	
Single	22	16.4	
Widowed	18	13.4	
Divorced	12	8.9	
Farming experience			5
1-5	73	54.5	
6-10	42	31.3	
11 and above	19	14.2	
Level of education			
Adult education	90	67.2	
Primary education	20	14.9	
Secondary education	15	11.2	
Tertiary	09	6.7	
Farm size			5
1-5	85	63.4	
6-10	34	25.4	
11 and above	15	11.2	
Farm input			
Access to farm input	30	22.4	
No access to farm input	104	77.6	
Household size			6
1-5	54	40.3	
6-10	72	53.7	
11 and above	08	5.97	

Source: Field Survey, 2022

The Results further showed that the mean experience in pepper farming was 5 years. This means that the farmers have reasonable farming experience. The finding agreed with Mohammed (2015) that 24% of pepper farmers had farming experience of 6-10 years, 18.5% of the respondents were within 11-15 years of farming experience while 17.5% of the respondents were within 1-5 years of farming experience. Experience influences individual's perception and understanding of the management requirements and consequently improved farm output. Farming experience is another important socio-economic factor that can bring

about increase in productivity. A mean farm size of 0.6 hectares was estimated indicating that pepper was produced more in small scale than in large scale. This could be because of tedious work involved in pepper production and lack of farm inputs which was a challenge with about 77.6% without access to farm inputs.

Education is an important socio-economic factor that influences farmer's decision making, farmers' awareness, perception and adoption of innovations that can bring about increase in productivity. The study revealed that 67.2 % of the farmers have adult education. This implies that the farmers were learned at higher levels which can affect the level of adoption of innovations. The finding is at conformity with Tahir *et al.* (2021) that education has a positive and significant impact on farmers' efficiency in production. Thus, literacy level will greatly influence the decision making and adoption of innovation by farmers. Large proportion of the farmers had mean of six persons per household (6-10), this is very good because it can support families in their farm labour. This agreed with Ogunbo, (2015) on findings in resource use efficiency and optimal farm plan in pepper (*capsicum spp.*) production in Ogun State, that majority of the farmers (53.5%) had household size that ranged from 6-10 persons. The average household size was 11 persons. There was a positive and significant relationship between household size and farmers' efficiency in production because both will put heads together to brainstorm on the best way to apply resources. In addition, the larger the family size, the more the available labour force and consequently the more productivity.

Cost and Returns per Hectare of Pepper Production

The results in Table 3 showed that the average variable cost per hectare of pepper production was ₦348,750 Constituting 96.7% of the total cost of production. The average yield per hectare was estimated to be 1600kg and sold at an average market price of ₦500/kg. The result further revealed that, the Gross Income, Gross Margin, Net Farm Income and Returns on Naira Invested were: ₦800,000, ₦451,250, ₦439,675.34 and 22K respectively. The implication of this result is that pepper farmer realized a return of 22kobo for every one naira Invested. This indicates that pepper production is a profitable venture in the study area. This result agreed with the findings of Ogunbo (2015) who examined the economics of pepper production in Ogun State Nigeria, and found a return on investment ratio of 2.62kobo. The result indicated that most (66.6%) of the variable cost was incurred on labour despite the household size which is an indication that a lot of labour was demanded in pepper production activities especially during harvesting where the fruits were picked manually and individually on the stands.

Table 3: Average Cost and Return of Pepper Production per Hectare

Variable	₦/ha	Percentage (%)
(a) Variable costs		
Labour	240,000	66.6
Fertilizer	37,500	10.4
Seeds	1,250	0.3
Agrochemical	70,000	19.4
Total variable cost (TVC)	348,750	96.7
(b) Fixed costs		
Rent on land	11,250.23	3.1
Depreciation on fixed assets	324.43	0.09
Total fixed costs	11,574.66	3.2
Total cost (a+b)	360,324.66	100
(c) Returns		
Quantity of pepper in kg	1600	
Price/kg	500	

Gross income (GI)	800,000
Gross margin (GM)	451,250
Net farm income (NFI)	439,675.34
Return on naira invested (RNI)	1.22

Source: Field Survey, 2022

Factors Influencing Pepper Production

The results in Table 4, examined the extent to which the independent variables, labour, fertilizer, seeds and agrochemical contributed to the variation in output of pepper, which was the dependent variable. The results of the regression analysis showed that the Cobb- Douglas (equation 8) fitted best based on how significant the independent variables were and the level of coefficient of multiple determinations (R^2). The R^2 value of 0.89 in the result was an indication that the independent variable X_1 , X_2 and X_4 explained the variation in the output of pepper production in the study area. The adjusted coefficient of multiple determinations R^2 indicates the percentage of variations in the observed dependent value that is explained by the fitted regression equation. The unexplained variation (0.11) in the output may obviously be due to other inputs not specified in the model. It was deduced from the result that out of the four independent variables used namely; labour (X_1), and fertilizer (X_2) were significant at 1% level while agrochemical (X_4) was significant at 10% level. This means a unit increase in labour, fertilizer and agrochemical brought about increase in the output of pepper production.

Pepper production in the study area had an increasing return to scale from the sum of elasticity of production. The estimated coefficient of labour (0.383) was positive and significant at 1% level, implies that 1% increase in labour will increase output by 38.3% if all things being equal. This agreed with the findings of Oladele (2011), in a study on the contribution of indigenous vegetable and fruit production to poverty alleviation in Oyo state, Nigeria that the coefficient of labour was positive and significant at 1% level of significance. This showed that labour was an important variable in pepper production as human manual power played a vital role in farming activities. The estimate coefficient of fertilizer (0.57) was positive and significant at 1% level of significance. This means that 1% level increase in fertilizer used increased the level of pepper output by 57%. This was in consonance with the findings of Saito *et al* (1994) on raising productivity of women farmers in sub Saharan Africa which found that fertilizer increased output by 67% and was statistically significant at 1% level. It therefore, means that fertilizer is also a major determinant in pepper production the study area.

The coefficient of agro chemicals used was positive (0.11) and significant at 10%. This showed there was a positive relationship between agrochemical and output in the study area, though with less influence on the output. Increase in a unit of agrochemical led to an increase of 11% changed in output of pepper. This agreed with the findings of Ayorinde (2011) on the growth and yield of pepper in Ogun state Nigeria, where the coefficient of 0.6, positive and statistically significant at 10% level of significance were obtained. The estimated coefficient of seed (-0.053), was negative and not significant. This means that there is an inverse relationship between seed and the output of pepper production in the study area. It meant by implication that due to small size and microscopic nature of pepper seeds, if not carefully used an increase in a unit of it may result in decrease of output of pepper by 5%. This was because the more clusters the plants were the less yield the plant produced.

Table 4: Factors Influencing Output of Pepper Production

Variable	Coefficient	Std error	T-Statistic	Prob.
C	0.3342	0.0642	5.2031	0.0000
Labour (X ₁)	0.3827	0.0926	4.1312	0.0001***
Fertilizer (X ₂)	0.5701	0.0759	7.5078	0.0000***
Seeds (X ₃)	-0.0531	0.0717	-0.7400	0.4606NS
Agrochemical (X ₄)	0.1132	0.0659	1.7179	0.0882*
R-Squared	0.89			
Adjusted R-squared	0.89			
F-statistic	284.5951			
Prob. (F-statistic)	0.0000			

Source: Field & Survey, 2022,

Note: *= 10%, **= 5%, ***= 1%, NS= Not Significant

Resource Use Efficiency of the Pepper Farmers

The result in Table 5 showed the resource use efficiency of pepper farmers in the study area. The ratio of the Marginal Value Product (MVP) and Marginal Factor Cost (MFC) revealed that fertilizer, agrochemical had the efficiency ratio values of 0.9866, and 0.6 less than unity (over-utilization) while labour had the efficiency ratio value of 1.4 greater than unity (under-utilization). This result implied that, fertilizer and agro chemical were not efficiently allocated by the farmers. To attain absolute efficiency, there should be decrease in the use of fertilizer and agrochemical by 99.01% and 99.4% respectively while the use of labour should be increased by 98.6%. This result agreed with the findings of Taphee *et al.* (2015) on resource productivity and efficiency of small scale farmers in Taraba State, Nigeria who reported that the ratio of marginal value product (MVP) to marginal factor cost (MFC) showed that; labour, land, planting material, fertilizer and capital inputs had values of 0.0035, 1.1600, 0.3207, 0.5103, and 0.2589 respectively.

Table 5: Resource-Use Efficiency of Pepper Farmers

Resource	MPP	MVP (₦)	MFC (₦)	Efficiency ratio (r)
Labour (X ₁)	712	366,000	240,000	1.4
Fertilizer (X ₂)	740	370,000	37,500	0.9866
Agrochemical (X ₄)	84	42,000	70,000	0.6

Source: Field survey, 2022

Constraints of Pepper Production in the Study Area

The distribution of the respondents according to the constraints in pepper production was presented in Table 6. Constraints therefore mean hindrances experienced by the farmers in the study areas. The respondents considered limited agricultural extension staff services as the most severe challenge, ranked first as shown in Table 6. This is closely followed by lack of credit facility (Ranked second) and the high cost of agrochemical such as fertilizer, herbicides and pesticides which was ranked third in the result. This agreed with the findings of Ekunwe *et al.* (2013) who reported that extension services in Nigeria are poorly organized and in some cases, unavailable. Idowu-agida (2010), identified lack of credit facility as a constraint that

mitigates the active participation in agricultural production activities. Furthermore, other severe problems that were encountered by the pepper farmers included high cost and inadequate labour (ranked 4th and 6th). This was in consonance with Kadiri, (2014), who asserted that the major factor that limits agricultural activities as perceived by farmers was unavailability of labour.

Table 6: Constraints of Pepper Farmers

Problems	Very severe	Severe	Not severe	Mean	Std	Rank
Limited extension services	101	27	6	2.71	6.10	1
Lack of credit facility	96	30	8	2.66	5.60	2
High cost of agrochemicals	89	40	5	2.62	5.15	3
High cost of labour	95	29	8	2.61	5.54	4
Lack of functional cooperatives	96	23	15	2.60	5.45	5
Inadequate labour supply	82	37	15	2.50	4.24	6
Inadequate storage facilities	78	34	22	2.42	3.60	7
Pest and disease	65	45	24	2.31	2.51	8
Weed control	36	73	25	2.08	3.07	9
Lack of improved seed	15	23	96	1.39	5.56	10

Source: Field Survey Data, 2021

CONCLUSION AND RECOMMENDATIONS

This study analyzed the resource use efficiency of pepper production in Takum and Donga Local Government areas of Taraba state, Nigeria. The Socio-economic characteristics of the farmers had a great influence on the production of the product and the business was found to be profitable. However, the farmers were inefficient in allocating most of the inputs available to them and variably reducing the margin of the income acquired. Lack of extension services and credit facilities were ranked as the most severe challenges in production of pepper in the areas.

The following recommendations were made based on the findings of the study:

1. Government and philanthropists should engage extension agent services who will help in dissemination of innovations to the farmers and will as well be a linkage between the farmers, research institute and government.
2. Financial institutions/government should make available soft loans to cushion farmers' hardship in procurement of farm inputs and payments of labour to be able to increase their production.
3. Farmers are advised to form or join existing cooperative societies to enable them pull more resources together in order to improve their financial base as a group and then credit be granted to individuals. This will also enable members access interventions provided by government, cooperate bodies, and stakeholders.

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