



Profitability in Chilli Pepper Production in Kaduna State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author BM designed the study, performed the statistical analysis and wrote the first draft of the manuscript. Authors ZA and BA wrote the protocol, managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The aims of the study were to determine relationship between farmer's socio-economic variables and profitability in chilli pepper production, and to determine the profitability in chilli pepper producers in Kaduna state, Nigeria. Primary data were collected from chilli pepper producers through the use of structured questionnaires. This study was carried out in three local government areas in Kaduna state, Nigeria, between August and November 2014 cropping season. Purposive and random sampling techniques were employed for data collection. The study revealed that 37.5% of the respondents fall within the age of 30-39 years. The 53% had no formal education. The household size ranged from 6-10 persons, about (72%) of chilli pepper farmers do not participate in any chilli pepper related cooperative association, The result shows that 98.5% of chilli pepper farmers financed their production from personal savings. The data revealed that (58.5%) of chilli pepper farmers have extension visit. The result revealed that chilli pepper production is profitable in

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the study area. Based on the findings of the study, it can be concluded that investment in chilli pepper production is a viable enterprises for income generation, poverty alleviation, job creation and improvement of food security to every household since it is a profitable venture and it was also found that education was an important factor in increasing the profitability in chilli pepper production.

Keywords: Profitability; chilli pepper; net farm income; multiple regression and Kaduna state.

1. INTRODUCTION

Chilli pepper (*Capsicum frutescens*) is a high value crop that is grown for cash by farmers all over the world [1]. Nigeria is known to be one of the major producers of pepper in the world accounting for about 50% of the African production [2].

In recent years, interest and demand for peppers has increased dramatically worldwide and peppers have achieved major economic significance in the global market [3]. Apart of potentials of this commodity to generate foreign exchange for Nigeria, their common use in confectionary, medicinal and culinary purpose is on the increase. Specifically, chillies are used both as pungent or condiment for culinary purposes for domestic catering and food processing industry. The moderate pungency of the Nigerian chilli allows its use for the production of spice blends and red pepper. Industrial users also require the moderately pungent chillies (Nigerian type) for use in the pharmaceutical industries [4].

In Nigeria, *Capsicum frutescens* is third among the cultivated vegetables being utilized in the dry state as spice, capsicum content and an alkaloid that is a digestive stimulant is used in ointment for leaf of arthritic and neuropathic pains [5]. *Capsicum* species are rich in Vitamin A which is responsible for red colour in mature fruit. *Capsicum frutescens* are further used as pungent spices for domestic culinary purposes and by food manufacturing industries for seasoning of processed foods in the preparation of curry powder, hot sauce and in pickling [5].

According to [6], the economics of pepper is characterized by wide and frequent changes in price. The prices are generally low at both domestic and export market. Others economic uses include the following activities: Both green and red Chillies are used to impart pungency to the food, red chilli powder is used as condiment in every household, green chillies of some varieties are used as vegetable, it is also used

for preparation of chutnees, masala, sauces and pickles, it is rich source of vitamin C, extract of green chillies can be used as bio-insecticide.

Agriculture in Nigeria is dominated by the small scale farmers who are engaged in the production of the bulk of food requirements of the country [7]. In spite of the fact that these small scale farmers occupy a unique and pivotal position, they belong to the poorest group of the population and as such, they cannot invest much in their farms [7]. According to [8], the vicious circle of poverty among these farmers has led to the unimpressive performance of the agricultural sector. Thus, resources must be used much more efficiently, which entails eliminating waste, thereby leading to an increase in productivity and incomes [9].

Nigeria has good soils and weather that can readily support the growth and production of pepper. Pepper grown in Nigeria is in high demand because of its pungency and good flavour. It can readily be dried, ground and packaged for export. Investing in pepper production is one of the ways of sourcing for foreign exchange [10]. Exportation of pepper in Nigeria has once been reported to be a lucrative business [9]. The major area for its production is the Northern region between latitudes 10°N and 12°30'N. Pepper is utilized mostly for culinary purposes and seasonings. It also has medicinal uses, internally as a stimulant and carminative and externally as a counter-irritant [11].

Scarcity of resources has led to production economists think about the reallocation of existing resources to have more output with a given level of input combinations or to produce a prescribed level of output with the minimum cost without changing the production technology. Similarly, the measurement of the productive efficiency in agricultural production is an important issue because it gives pertinent information for making sound management decision in resource allocation. Except for a few descriptive studies, econometric analysis has yet to be conducted to examine the production

function for chilli cultivation and its potential for future improvement.

Considering the above facts, the study was undertaken to determine the level of profitability in the chilli pepper producing farmers.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in three local government areas of Kaduna state namely, Ikara, Kubau and Soba. These local government areas are located in the Northern Guinea savannah ecological zone of Nigeria and the choice of these local government areas were made because of the reasonable numbers of chilli pepper farmers in the areas [12].

Kaduna state lies between latitudes 09° 02' and 12° 32' North of the equator and between longitudes 06° 15' and 08° 50' east of the prime meridian. The state shares boundaries with Katsina and Kano state to the north, Plateau to the north east, Nasarawa and Abuja to the south and Niger and Zamfara state to the west [12]. The state has a total land area of about 4.5 million hectares, with an estimated total arable land of about 2.02 million ha comprising 1.94 million ha upland and 0.08 million ha lowland. There are two distinct seasons in the state, namely wet and dry seasons. Wet season generally spans from April to October, while dry season falls between Octobers to March. The average rainfall is about 1,482 mm, while temperature ranges from 35°C-36°C during the humid period to as low as 10°C-23°C during the hamattan periods of November – February [12].

Kaduna state vegetation is divided into Northern Guinea Savanna and Southern Guinea Savanna. The soil is developed from undifferentiated complex igneous and metamorphic rocks. The fine top soil couple with reasonable organic matter in it enhances the fertility status, especially the southern part of the state. The physical properties of the soil are moderately good and allow continuous cropping for variety of crops. About 84,471 households grow pepper in the state in 2011 [12].

2.2 Sampling Procedure

A multi stage sampling technique was employed to select the respondents for the study. In the first stage, Ikara, Kubau and Soba local

government areas were purposively selected out of local government areas in the state on the basis of being the most prominent producing areas of chilli pepper in the state [12]. In the second stage, two villages were purposively selected from each of the three local government areas because of the large number of chilli pepper farmers in the areas. In the third stage, simple random sampling non replacement method was employed to select 10% out of the population of chilli pepper farmers in each of the villages. This represents a sample of 200 respondents used for the study.

2.3 Data Collection and Analysis

Primary data was used for this study. The interview method of data collection with the aid of structured questionnaire was used to obtain information from the selected farmers in the study area. Data collection was centered on socio-economic characteristic of the farmers such as age, gender, household size, educational status, farming experience, amount of credit, access to extension service, cooperative membership, farm size, quantities and prices of various production inputs used by the farmers.

2.4 Model Specification

Net farm income was used to determine the return to investment in chilli pepper production which the differences between the two parameters are a measure of the net farm income. The farm income is the total output multiplied by the price per unit cost. Therefore, farm income is the total revenue generated from the production while 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 cost of land. The formula for net farm income is stated as follows.

$$NFI = TR - TC \quad (1)$$

Where:

NFI= net farm income (Naira/ha)
TR= total revenue (Naira/ha)
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)

The fixed inputs are not normally used up in a production cycle. They were depreciated using the straight line method given by.

$$D = \frac{(P-S)}{N} \quad (2)$$

Where:

D = depreciation (Naira)
 P = Purchase value (Naira)
 S = salvage value (Naira)
 N = life span of asset (years)
 Return per naira invested (RNI) is obtained by dividing the gross income (GI) over the total cost (TC).

Therefore,

$$RNI = \frac{(GI)}{TC} \quad (3)$$

Where:

RNI = return per naira invested
 GI = gross income
 TC = total cost

Decision Rule:

RNI > 1, it implies the enterprise is profitable;
 RNI = 1, it implies that the farmer is operating at breakeven point and
 RNI < 1, the farmer is operating at loss.

2.5 Multiple Regression Analysis

Multiple regression analysis was used to determine the relationship between farmer's socio-economic variables and profitability in chilli pepper production. The probability of a farmer being profitable is determined by an underlying response variable that captures the true economic status of a farmer.

$$\pi = f(X_1 X_2 X_3 X_4 X_5 X_6 X_7 + u) \quad (4)$$

$$\pi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e_i \quad (5)$$

Where:

π = Profit (naira/kg)
 $\beta_1 - \beta_7$ = the coefficients for the respective variables in the model
 μ_i = error term
 X_1 = age of farmer (years)
 X_2 = formal education (years of formal schooling)
 X_3 = household size (number of people)
 X_4 = farmers experience (number of years in chilli pepper production)
 X_5 = pepper related cooperative membership (years of participation)
 X_6 = amount of credit (amount of credit obtained)
 X_7 = extension visit (number of visit)

The specification of the model for the socio-economic characteristic in equation 5 implies that, if the independent variables in the model have a positive sign on an estimated parameter, then the associated variable has a direct relationship with profit while a negative sign indicates an inverse relationship to profit.

Thus, the *a priori* expectation was that the coefficients of the whole independent variables of the socio-economic characteristic in the model (i.e $X_1, X_2, X_3, X_4, X_5, X_6$ and X_7) should be positive, respectively. Therefore, each variable was expected to have positive effect on profit.

3. RESULTS AND DISCUSSION

The socio-economic characteristics of the respondents are presented in Table 1. The study revealed that 37.5% of the chilli pepper farmers were within the age range of 30-39 years with mean of 46 years. This implies that the farmers are still strong and active and they can participate actively in farming activities is also in line with the findings of [13] younger farmers are more flexible to new ideas and risk; hence they are expected to adopt innovations more readily than older farmers. Education the result shows that 47% of chilli pepper farmers had no formal education, while 30% of the respondents are within 1-6 years of education which means they had only primary education, and 15.5% had secondary education while 7.5% had tertiary education. This indicates that the farmers' educational level is low. This finding is at variance with [14].

The majority of the farmers (33.5%) had household size that ranged from 6-10 persons. The average household size was 11 persons

implying that there is appreciable number of family labour supply to accomplish various farm operations. Farming experience is another important socio-economic factor that can bring about increase in productivity. The result shows that 24% of chilli pepper farmers had experience of 6-10 years, 18.5% of the respondents are within 11-15 years of farming experience while 17.5% of the respondents are within 1-5 years of farming experience which means that chilli pepper farmers in the study area had experience in their production.

The result in cooperative membership shows the numbers of years spent in cooperative. About (72%) of chilli pepper farmers do not participate in any chilli pepper related cooperative association and the reasons for this include: being small scale and unawareness of any association while 28% participated with average of 1.7 years. The effect of this result is that most of the chilli pepper farmers in the study area do not enjoy the assumed benefits accrued to cooperative societies through pooling of resources together for a better expansion, efficiency and effective management of resources and for profit maximization. Ekong [15] and Ajayi [16] Stated that membership of cooperative societies has advantages of accessibility to micro-credit, input subsidy and also as avenue in cross breeding ideas and information.

The result in table shows that 98.5% of chilli pepper farmers financed their production from personal savings while 1.5% sourced credit, through Bank of agriculture. The low access to credit could be attributed to the fact that government seldom grants financial credit to a farmer. Ekong [15] asserts that credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. It also agrees with findings of [17] who noted that access to micro-credit could have prospect in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities. The result revealed that 41.5% of chilli pepper farmers in the study area have no extension visit while (58.5%) have extension visit with average of 1 visit, this could be attributed to increased extension of agent-farmers' ratio by the KADP in the study area.

3.1 Summary of the Level of Inputs and Output in Chilli Pepper Production

The summary statistics of level of inputs and output production in the study area are reported

in Table 2 which shows that agricultural production in the study area is labour intensive. The average yield per hectare was 1118.57 kg/ha. This was obtained from 1.05 hectare of farm size, average seed was 1.71 kg/ha, average fertilizer was 292.17 kg/ha, 26 man-day for maximum labour applied while the minimum labour used was 5 man-days and average agrochemical was 4.31 litres. This, however, contradicts the recommended rates per hectare for seed (1.08 kg), fertilizer NPK 15:15:15 (200 kg) [18], and the average pepper potential yield of (3956 kg/ha) [9]. This implies that chilli pepper farmers in the study area are over-utilizing their resources to produce less than the potential yield per hectare.

3.2 Return to Investment in Chilli Pepper Production

The analysis of average cost, return and profitability per unit of chilli pepper production in Table 3 shows that cost of fertilizer constitutes a large proportion with 59.% of the total cost. According to [19], pepper has also been shown to respond very well to the application of fertilizer. The total revenue (TR) was ₦111,857 while the total cost (TVC + TFC) was ₦49,006 The net farm income was therefore ₦62,851 the rate of return on investment (return per naira invested) was 2.28, indicating that for every ₦1 invested in chilli pepper production in Kaduna state, a return of ₦2.28 kobo was made. T d on the findings of [9], the maximum gross return of ₦1, 037,500, net returns (₦768, 801) and hus, it could be concluded that chilli pepper production is profitable in the study area. Base benefit to cost ratio of (3.9:1) were obtained. The highest profit (₦3.90) per naira invested was recorded and the result on the average indicated that pepper production was profitable.

3.3 Relationship between Famer's Socio-economic Variables and Profitability in Chilli Pepper Production

The result of the multiple regressions presented in Table 4 which shows that some of the coefficients of the variables (education, household size and farming experience) included in the model had positive signs while others (age, cooperative membership, credit obtained and extension contact) had negative signs. The implication is that any increased in respect of variables with positive signs or decrease with respect to variables with negative signs could lead to an increase in farmer's profit.

Table 1. Socio-economic characteristics of chilli pepper farmers

Variable	Frequency (N=200)	Percentage
Age (Years)		
20-29	5	2.5
30-39	75	37.5
40-49	37	18.5
50-59	58	29.0
60 above	25	12.5
Mean	46	
Educational status		
No formal education	94	47.0
1-6	60	30.0
7-12	31	15.5
13 Above	15	7.5
Household size		
1-5	42	21.0
6-10	67	33.5
11-15	50	25.0
16-20	21	10.5
21-25	12	6.0
26-30	4	2.0
>31	4	2.0
Mean	11	
Farming experience		
1-5	34	17.0
6-10	48	24.0
11-15	37	18.5
16-20	19	9.5
21-25	22	11.0
26-30	14	7.0
>31	26	13.0
Mean	17	
Membership of cooperative society		
Non members	144	72.0
1-5	24	12.0
6-10	30	15.0
>11	2	1.0
Mean	1.7	
Source of capital		
Informal	197	98.5
Formal	3	1.5
Mean	1750	
Extension visit		
No visit	83	41.5
1-2	91	45.5
3-4	25	12.5
>5	1	0.5
Mean	1	

N=Number of respondents

Table 2. Summary of the inputs and yield of chilli pepper production

Variables	Unit	Mean	Standard deviation	Min	Max
Seed	Kg/ha	1.71	1.67	0.22	12.25
Fertilizer	Kg/ha	292.17	240.79	25	1250
Labour	Man-day/ha	12.65	3.56	5	26
Agrochemical	Litre/ha	4.31	2.95	1	20
Yield	Kg/ha	1118.57	919.25	210	6180

Table 3. Average cost, return and profitability per unit hectare of chilli pepper production

Variable	Value/ha (naira)	% Contribution
Total revenue (TR)	111,857	
Total cost (TVC+TFC)		
1. seed (kg)	1710	3.5
2. fertilizer (kg)	29,217	59.6
3. labour (man-day)	5,692.5	11.6
4. agrochemical	2,801.5	5.7
Total variable cost (1 + 2 + 3 + 4)	39,421	
5. cost of renting land	5,020	10.3
6. depreciation of tools	1,440	2.9
7. interest rate	3,125	6.4
Total fixed cost (5 + 6+ 7)	9,585	
Total cost (39,421 + 9,585)	49,006	
Net farm income (TR – TC)	62,851	
Return per naira invested (TR/TC)	2.28	100

Table 4. Relationship between famer’s socio-economic variables and profitability in chilli pepper production

Variables	Parameters	Coefficients	Std. error	T-value
Constant	β_0	34451.86**	16970.63	2.030
Age	X_1	-430.04	412.511	-1.042
Education	X_2	1254.82*	668.49	1.877
Household size	X_3	38.37	492.56	0.078
Farming experience	X_4	1522.22***	328.41	4.635
Cooperative	X_5	-560.03	1020.69	-0.549
Credit borrowed	X_6	-1.15*	0.61	-1.885
Extension visit	X_7	-3934.88	2876.56	-1.368

Note: *** significant at 1% level of probability, ** significant at 5% level of probability and * significant at 10% level of probability. Fit R-squared = 0.52; Adjusted R-squared = 0.45

The result also shows that the R^2 value of 0.52 implies that 52% of variation in profitability in chilli pepper has been explained by the socio-economic factors of the farmer and that 48% was as a result of the random error term. This implied that the model gave relative fit of the data and that the socio-economic characteristics of chilli pepper farmers had a relative influence in profitability in chilli pepper production.

The result revealed that the coefficient of education (1254.82) was found to be positively related to profitability and significantly had a direct relationship to profitability in chilli pepper

production at 10% level of probability. This implied that the higher the level of education of the respondents the higher the level of profitability in chilli pepper production. This finding is in line with the finding of [14] which stated 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, which may bring about an increase in productivity and profit.

Farming experience had a positive coefficient (1522.22) and significant at 1% level of

probability. This implies that farmers with high experience realize more profit more than inexperienced farmers.

Amount of credit obtained had a negative coefficient (-1.15) and significant at 10% level of probability and negatively related with profitability in chilli pepper production. This implied that as the farmer continues to obtain more credit the profitability of chilli pepper production would tend to decline. This is contrary to apriori expectation of the amount of credit obtained. This could be attributed to the fact that government seldom grants financial credit to large numbers of farmer and when done with high interest rate.

4. CONCLUSION

Based on the findings from the study, it can be concluded that investment in chilli pepper production is a viable enterprises for income generation, poverty alleviation, job creation and improvement of food security to every household since it is a profitable venture. Similarly education is an important variable in profitability of chilli pepper.

5. RECOMMENDATIONS

Since chilli pepper production in the study area has been shown to be very profitable and has huge potential for income generation, it is recommended that farmers should go into chilli pepper production to make more income and enhance their livelihoods.

It was found that education was an important factor in increasing the profitability in chilli pepper production. It is therefore recommended that adult education should be organized to farmers by State Agricultural Development Projects (ADP^s) to enhance efficiency, productivity and income.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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