International Journal of Irrigation and Agricultural Development
Agricultural Science and Development.
IJIRAD 3(1) [2019] [192 - 200]
IJIRAD
ISSN: 2616-1508
https://www.ijirad.org

Economic Analysis of Groundnut Production in Tolon District, Ghana

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ARTICLE INFO

Article history:
Received: **February 24, 2019**
Received in revised form:
March 19, 2019 June
Accepted**: June 30, 2019**

Keywords:
Benefit-Cost Analysis,
Gross Margin,
Groundnut,
Profitability

ABSTRACT

The purpose of this study was to undertake an economic analysis of groundnut production in the Tolon district of Ghana using cross-sectional data for the 2017/2018 cropping season. A total of 160 small-scale groundnut producers were randomly selected from 8 communities and interviewed using semi-structured questionnaire. The determination of profitability involved gross margin and cost-benefit analyses as well as estimation of a profit function. Also, regression analysis was used to assess the factors affecting farm profit. The results of the study indicated a cost-benefit ratio of 0.30 and gross margin of GHS 22,143.4 indicating that groundnut production in the study area is profitable. Profit was estimated at GHS 42,584.3. Meanwhile, farmers' age and cost of inputs had a negative effect on profitability while cost of harvesting positively influenced farm profit. Based on the findings, the authors conclude that groundnut production in the study area is profitable; however, measures are required to increase profitability since groundnut is an important cash/food security crop for smallholders.

INTRODUCTION

This study focused on the economics of groundnut *(Arachis hypogaea)* production in the Tolon district of Northern Region. Groundnut is the most important legume crop cultivated in Ghana (Tanzubil and Yahaya, 2017). Groundnut is the 13th most prominent eatable crop in the world, and contains vegetable protein, fat and oil, and carbohydrates amounting to 20-50 %, 40-50 % and 10-20 % respectively (FAO, 2006). According to Mukhtar (2009), groundnut is the 6th most important oil seed crop in the world and contains 48-50 % oil. Most Ghanaian societies use groundnut in preparing stews, soups, and cereal mixtures (Asibuo *et al*., 2008). Groundnut is sometimes processed into groundnut cake by most industrial oil processing centres for human and livestock consumption (Awuah *et al*., 2009). Groundnut is a readily saleable crop that provides income and livelihood support to farmers. From the agrological point of view, groundnut is cultivated largely in the northern savannah zone in Ghana.

Groundnut production in Ghana is largely subsistence-based and usually cultivated by peasant farmers. The production of groundnut provides income to households (Abu, 2015) as well as multiple nutrients to consumers. Groundnut rotated with cereals such as sorghum reduces the density of *striga* infestation (Onwuema and Sinha, 1991). Groundnut as a legume, also has the ability to utilize residual fertilizers (Milla, 2003). Planting is done as soon as there is consistent/adequate moisture usually from late May to end of June (Dokurugu, 2015). Groundnut cultivation is a peasant and commercial venture for many farm families in Ghana.

According to FAOSTAT (2016), Ghana produced an average of 500,000 tonnes of groundnut per annum over the last decade. Statistics from MoFA (2017) indicated that area planted to groundnut in Ghana in 2016 was 327,000 hectares with an annual production of 426,000 tonnes. This gives an average groundnut yield of 1.3 tonnes per

hectare, which falls below the achievable yield of 2.5 tonnes per hectare. Groundnut is harvested by hand using hoes to dig the pods in order to remove the nuts which are carried home together with the vines either by head, tractor, motor-tricycle, bicycle or motorcycle. Harvesting of groundnut can sometimes be very tedious in instances where there are no rains or the rains cease early, which also leads to pod loss. The harvested pods are dried in the sun or open soil to reduce moisture and aflatoxin content before storage (usually in bags) (Tsigbey *et al.* 2003).

Tanzubil (2016) identified pests and diseases as serious constraints affecting groundnut cultivation in northern Ghana resulting in substantial yield losses. Biotic stresses are major inhibitors of groundnut production with groundnut rosette virus disease (GRD) accounting for yearly losses of US$156 million in Africa (Nigam *et al*., 2012). Yield loss due to the rosette is determined by the vegetative phase at which infection occurs; a 100 % yield loss may happen if seedlings become infected while there may be insignificant effect when the infection occurs at the pod filling phase (Waliyar *et al*., 2007). The major pre- and post-harvest insect pests that cause considerable amount of economic losses in groundnut production comprise of Spodoptera, thrips and aphids.

Groundnut is an important cash crop grown by most households in the Tolon district of Ghana, where agriculture is a dominant agricultural activity. Groundnut contributes to household income and food security in the district and is therefore important to poverty alleviation. Notwithstanding its significance, there is inadequate production of the crop to meet market demand as well as inadequate information on profitability of the crop in the current farming systems of smallholders. This situation is attributed to high cost of production, lack of understanding of cost structure, low per capital income, poor storage, poor transportation and marketing services (Girei *et al*., 2013).

A clear understanding of cost structure in groundnut production will help to find ways to reduce the cost of production and thereby increase profitability of the crop in the district. This will enhance household income and food security. Cultivation of groundnut will also improve the farming system because of the legume-fixing ability of groundnuts, especially in crop rotations and mixed cropping systems.

The objectives of the study were thus to estimate costs and returns of groundnut production in order to determine profitability as well as identify problems faced by groundnut farmers in the study area.

MATERIALS AND METHODS

Study Area

The study was conducted in Tolon District in the Northern Region of Ghana. The District lies between latitudes 9° 15′ and 10° 02′ North and Longitudes 0° 53′and 1° 25′ West. The study area is characterized by a single rainy season, which starts in May and ends in October-November, with mean annual rainfall ranging between 950 mm – 1,200 mm. The study area covers a total land mass of 1,354km^2 and a population of 72,990 (Ghana Statistical Service, 2010). The predominant vegetation in the district is grassland. The savannah woodlands comprise of drought-resistant trees such as neem (*Azadirachta indica*), baobab (*Adansonia digitata* Linn), Shea nut (*Vitellaria paradoxa*), and mango (*Mangifera indica*). Crops such as maize, millet, groundnut, yam, cassava, soybean, bambara beans, guinea corn, rice and vegetables are cultivated by farmers in the study area.

Sampling and Data Collection

Farmers from eight (8) communities namely Dingoni, Kpendua, Chirifoyili, Lingbun, Nyobilbalgu, Woribogu-Kamonayili, Tibogunayili and Jagdoyili were sampled for the study. Twenty (20) respondents were randomly selected from each of the communities to give a total sample of 160 respondents. Semi-structured questionnaire was used in collecting information from each respondent in the study area. Verbal consent of farmers was sought before interviewing them. Interview was done in the local dialect and recorded in English. Primary data were collected on household and farm characteristics, production activities, output level and price, input costs, as well as production constraints. Data from secondary sources included vegetation type, land

area, location, population, and economic activities in the study area.

Method of Data Analysis

Stata version 15 and Microsoft Excel statistical software were employed to analyse the data. The data collected were coded and entered into Microsoft Excel spreadsheet and imported into Stata. The data was analysed using descriptive and inferential statistics. The descriptive analysis involved the calculation of means and standard deviations of the variables, as well as calculation of costs and returns. Stata version 14 was used to carry out regression analysis of the factors affecting profitability of groundnut production in the study area.

Gross Margin Analysis

Gross margin analysis was used to estimate cost and returns from groundnut production. The model is expressed as follows:

Gross margin (GM) = GI – TVC (1)

Where; GI is gross income and TVC is total variable cost.

Profit Analysis

Profit analysis was used to estimate the profitability of groundnut production. The profit estimation equation is expressed as follows:

profit (π) = TR – TC (2)

where; TR is total revenue and TC is total cost of production. Total revenue was computed as the gross output multiplied by price while total cost comprised the total cost incurred in production.

Benefit-Cost Analysis

Benefit-cost ratio of groundnut production was expressed as:

$$BCR = \frac{total\ benefit\ or\ profit}{total\ cost\ \left(TC\right)} = \frac{TR - TC}{TC} \quad (3)$$

Where; BCR is benefit-cost ratio of groundnut production, TR is total revenue from groundnut production (Ghana Cedi), TC is total cost of groundnut production (Ghana Cedi). BCR of less than zero (0) represents loss whiles a ratio equal to zero (0) implies farmers break-even and a ratio greater than zero (0) indicates realization of profit.

Regression Analysis

The regression analysis for the study is represented as follows:

$$\pi = \beta_0 + \beta_1 A + \beta_2 S + \beta_3 GA + \beta_4 TRC + \beta_5 SC + \beta_6 PC + \beta_7 TNC + \beta_8 LC + \beta_9 HC + \beta_{10} SIFC + \beta_{11} EDU + \beta_{12} CA + \beta_{13} EXT + \beta_{14} MARS + \varepsilon \quad (4)$$

Where; π is profit from groundnut production; β_0 is the intercept, $\beta_1 - \beta_{14}$ are parameters to be estimated, and ε is the random error term. The independent variables in the model are defined as: A = age of respondent; S = sex of respondent, GA = groundnut land size of respondents, TRC = tractor cost, SC = seed cost, PC = pesticide cost, TNC = transportation cost, LC = labour cost, HC = harvesting cost, SFIC = cost of simple farm inputs, EDU = years of formal education of respondent, CA = access to credit, and EXT = extension visit.

RESULTS AND DISCUSSIONS

Respondents Characteristics

Table 1 presents the characteristics of groundnut farmers in the study area, which reveals a mean age of 37 years. This result is in line with the findings of Audu *et al*. (2017), which reveals that groundnut producers in Nigeria were relatively young and fell within the age range of 30-40 years.

Majority of the respondents (85 %) were male. It was observed that educational level of the respondents was very low with an average of 1 year of formal education. This result is in line with Madaki *et al.,* (2016) who observed that about 1% of groundnut farmers in Nigeria had formal education. The low level of education is expected to have a negative effect on respondents' ability to keep farm records, form vibrant farmers' associations, adopt new varieties and practices of farming. The low level of education also poses a threat to farmers bargaining power and ability to escape exploitation by traders and middlemen. Low educational level also accounts for farmers' poor understanding of their cost structure and prevalence of subsistence farming instead of commercial/large-scale production.

The average farm size of groundnut farmers in the study area was approximately 1.74 hectares. This indicates that the respondents are small-scale producers. The result agrees with the findings of MoFA (2017) which indicated that 90 % of farm holdings in Ghana are less than 2 hectares.

Table 1: Respondents Characteristics

Variable	Mean	Std. Dev.	Minimum	Maximum
Age	36.74	11.31	18	70
Sex (1 = male)	0.850	0.358	0	1
Education in years	1.056	2.851	0	12
Farm size (acres)	4.306	2.380	1	18
Extension visit (1 = access)	0.438	0.498	0	1
Credit accessibility (1 = access)	0.213	0.410	0	1

The study also revealed that majority of the respondents (56.2%) had no access to extension services which is consistent with the findings of Madaki *et al.,* (2016) which showed that 43% of groundnut farmers in Borno State, Nigeria had access to extention services whiles 57 % did not have any extension visit. Furthermore, 21% of the respondents had access to credit to carry out their farm operations. The size of credit was very low, with a mean of GHS 40 and a maximum amount of GHS 600.

Cost Structure of Groundnut Production

Table 2 gives a detailed description of activities and inputs that constituted the cost of groundnut production.

Table 2: Cost Structure of Groundnut Production in the Study Area

Variable	Total Costs (GHS)	Average cost per acre (GHS)	Percentage (%)
Cost of Farm Inputs			
Seeds	15667	22.74	10.88
Pesticides	8930	12.96	6.20
Simple farm tools	8710	12.64	6.05
Cost of Farm Operations			
Planting	4247	6.16	2.95
Weeding	12974	18.83	9.01
Spraying	1862	2.70	1.29
Land preparation	1614	2.34	1.12
Harvesting	41200	59.80	28.60
Transportation	6961	10.10	4.83
Plough	41875	60.78	29.07
Total	**144,040**	**209.06**	**100**

Source: Field Survey, 2018

The study revealed that cost of ploughing was the highest of all the cost components in groundnut production representing 29.07 % of the total cost of production. The high share of ploughing cost in total production cost is expected to have a negative effect on groundnut profitability. A study by Girei *et al*. (2013) showed that the cost of ploughing was the second most important cost item of groundnut production in Nasarawa State, Nigeria. It is therefore important that the Ministry of Food and Agriculture, non-governmental organizations as well as private businessmen endeavour to provide tractor services to help Ghanaian farmers reduce cost of ploughing. Cost of groundnut harvesting represented 28.6 % of the cost items. This is attributed to high demand for labour at the time of harvesting. In the study area, farmers incur high cost during harvesting because each harvester is paid a proportion of the crops harvested in kind (instead of cash payments) as labour cost. These payments in kind were estimated and included in the calculation of harvesting cost.

Gross Margin Analysis

Gross margin analysis was used to estimate cost and returns from groundnut production. The result indicated that groundnut farmers had a gross margin of GH₵ 22,143.40. The implication is that groundnut production is profitable in the study area. Groundnut production is therefore expected to contribute to household income of farm households engaged in the cultivation of the crop. The result agrees with Abu (2015) who indicated that production of groundnut provides income to households.

Profit Analysis

Table 3 shows the estimated total cost of production and total revenue from which profit was derived. The result indicates that groundnut farmers made a profit of GHS 42,584.3. This translates into an average profit of GHS 266.2 from groundnut production.

Table 3: Cost, Revenue and Profit Estimates of Groundnut Production

Variable	Total	Percent (%)
Cost of harvesting	41,200	28.6
Total cost of simple inputs	8,710	6.05
Total cost of man-days	20,697	14.37
Transportation cost	6,961	4.83
Cost of pesticides	8,930	6.2
Cost of seeds	15,667	10.88
Tractor cost	41,875	29.07
Total cost of production (TC)	**144,040**	**100**
Returns from unshelled groundnut	105,740	56.66
Returns from shelled groundnut	80,884.3	43.34
Total revenue (TR)	**186,624.3**	**100**
Profit (π)	**42,584.3**	**-**

Where: Profit (π) = Total Revenue (TR) – Total Cost (TC)

Benefit-Cost Analysis

From Table 3, benefit-cost ratio (BCR) was computed as 0.30. BCR of less than zero (0) represents loss whiles a ratio equal to zero (0) implies farmers break-even and a ratio greater than zero (0) indicates realization of profit. The implication is that groundnut production in the study area is therefore profitable.

Regression Analysis

Table 4 presents multiple regression analysis of the determinants of profitability in groundnut production in the study area. The overall significance of the regression equation was tested using the *F*-test. The *F* statistic,

F (13, 146) = 49.42 was significant at 1 % level, indicating that the explanatory variables in the model jointly explained profitability of groundnut production. The R-square also indicates that 81.5 % of the variation in profit is explained by the independent variables in the regression model.

Table 4: Regression Analysis of Factors Affecting Groundnut Profitability

Variable	Coefficient	Std. Error	P > |t|
Constant	98.05	85.36	0.253
Age of respondents	-5.142**	2.047	0.013
Sex of respondents	104.8	67.75	0.124
Education in years	3.427	7.425	0.645
Groundnut acreage	216.1	131.6	0.103
Cost of tractor services	-4.160*	2.154	0.055
Cost of seeds	-1.101***	0.143	0.000
Cost of pesticides	-1.811***	0.449	0.000
Transport cost	-2.128**	0.826	0.011
Cost of labour	-0.702***	0.139	0.000
Cost of harvesting	3.218***	0.180	0.000
Cost of farm tools	-0.629	0.746	0.400
Credit accessibility	-2.074	58.51	0.972
Extension visit	50.73	44.32	0.254
Number of observations =160			
F (13, 146) = 49.42			
Prob > F = 0.000			
R-squared = 0.815			
Adjusted R-squared = 0.798			

Dependent variable is profit. ***, ** and * indicate statistical significance at $p<0.01$, $p<0.05$ and $p<0.10$ respectively.

The results of the study indicated that age of farmers, cost of seeds, pesticides, transportation, labour, tractor services and harvesting are statistically significant. According to the regression analysis, age of farmer, cost of seed, pesticide, labour, tractor services, and transportation had negative correlation with profit which indicates that an increase in any of them will cause a decrease in profit.

From the regression analysis, it was observed that age of respondents is statistically related to profitability of groundnut production. The variable was significant at 5 % with a negative correlation of - 5.142 indicating that a unit increase in age decreases the profit margin of groundnut farmers by GHS 5.1. This is attributed to the fact that older farmers are less energetic to carry out some farm operations such as weeding, harvesting etc. In a study by Madaki *et al.,* (2016), farmers' age was positively correlated with gross margin but did not have an effect on profit.

Cost of tractor services was found to influence profit. The variable was significant at 10 % and had a negative correlation of - 4.160 with profit showing a unit increase in the cost of tractor service (i.e. cost of ploughing 1 acre) reduces profit by GHS 4.16. Also, cost of seeds was estimated to have a negative correlation of - 1.101 and was significant at 1 % level implying that a unit increase in the cost of seeds decreases the profit margin by GHS 1.10. This result disagrees with that of Taphee and Jongur (2014) where cost of seeds had a positive relationship with profit.

From the analysis, cost of harvesting had a positive and significant association with profit signifying that a unit increase in harvesting cost is associated with an increase in profitability of groundnut production by GHS 3.20. The result is contrary to *a priori* expectation. Furthermore, the analysis showed that, sex of the farmer, years of formal education, access to credit, cost of simple farm inputs, extension visit and marital status had no significant relationship with profit. This

implies that these variables had little or no influence on profit.

3.7 Constraints of Groundnut Farmers

Table 5 presents problems encountered by groundnut farmers in the study area. The study revealed that groundnut producers in the study area rank financial constraint as the most important constraint. As indicated by the study, only 21 % of the respondents had access to credit, and the size of credit was quite low. This constraint accounted for 25 % of the problems faced by farmers in the study area.

Table 5: Groundnut Farmers Constraints

Problems	Frequency	Percentage (%)	Rank
Financial constraint	40	25.00	1st
Scarcity of tractor service	28	17.50	2nd
Pests and diseases	28	17.50	2nd
High weed density	28	17.50	2nd
Rainfall	21	13.13	3rd
Infertile land	7	4.38	4th
Poverty/Lack of resources	5	3.13	5th
Poor road network	3	1.88	6th
Total	160	100.00	

Three (3) problems were ranked as the next important problems, namely; scarcity of tractor services, pests and diseases, and high weed infestation. Each of these problems accounted for 17.5 % of the constraints faced by farmers. Scarcity of tractor services leads to late planting which reduces farm output and profit level. Farmers also disclosed that pests and diseases infestation led to reduction in yield. Furthermore, high weed densities increased the cost of production and reduced crop yield, resulting in lower profits.

According to the findings, erratic rainfall during the cropping season accounted for 13.1 % of the constraints identified. Excessive rainfall leads to flooding of farms and excessive vegetative growth and poor pod formation. Also, during periods of inadequate rainfall, there is poor pod formation, loss of pods resulting from dry soils and sometimes wilting of groundnut plants. Other problems include infertile soil, poverty or lack of resources and poor road network which accounted for 4.4%, 3.1% and 1.9% respectively.

CONCLUSION

The study concludes that groundnut production in the study area is profitable as the cost-benefit and gross margin analyses gave positive outcomes. However, despite the high potential of groundnut production as an income source for farm households, farmers encounter several challenges in production. These challenges include financial constraints, scarcity of tractor services, pests and diseases infestation, as well as high weed density. These challenges have implications for farm yields and returns from production. The specific factors affecting groundnut profitability in the study area include farm size, sex of respondents, cost of harvesting, educational level and access to extension services.

Based on the findings, the study recommends that commercial banks and other financial institutions should be encouraged to make credit facilities available and affordable to farmers. This will ease the liquidity constraints of farmer which will enable them to finance acquisition of production inputs to enhance yield and profitability. This recommendation is very important considering that the respondents ranked lack of finance as the most serious constraint in groundnut production.

The study further recommends that government and other non-governmental organizations should increase the provision of extension services to farmers in the study area. As indicated by the regression analysis, access to extension services had a positive and significant effect on groundnut

profitability. This recommendation is also supported by the fact that 56% of the respondents did not have access to extension services.

Finally, it was observed that the cost of tractor services (especially ploughing cost) was high in the cost structure of farmers in the study area. This calls for the establishment of mechanization centres in the districts and farming communities to provide tractor and ploughing services to farmers in order to enhance access to these services as well as reduce ploughing cost to farmers. This will go a long way to enhance profitability of groundnut production.

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