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Economic analysis of soybean production in Ibarapa Zone of Oyo State, Nigeria.

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Abstract

There is growing believe that Soybean is not only supplying protein to the diet of Nigeria people but also contributes immensely to the economic development of rural farmers. Therefore, this study instigated the economics of Soybean in Ibarapa zone of Oyo State, Nigeria. Ibarapa zone of Oyo State is mainly agrarian area with over 90% of its population engaged directly or indirectly in crop productions. Multi-stage sampling method was adopted to select 160 Soybean farmers. Data collected were analysed using descriptive statistics (frequency table, percentages, mean) and inferential statistics (t-test, Gross margin, multiple regression). The result revealed that majority (91.88%) of the farmers were males and their average age was 49years. Majority of the farmers (73.12%) had no formal education and engaged primarily (71.25%) on crop production. They were mostly married (88.13%) with average of 6 persons per household. It was observed that the challenges faced by the farmers were; pest infestations, high cost of pesticides, herdsmen destructive activities, low yield, high labour cost, insufficient capital among others. The t-test showed significances different between male and female farmers in terms of farm size, years of experience and revenue generated. The gross margin (GM) was ₦377,106.41 with the average profit of ₦230,530.11 and Benefit Cost Ratio (BCR) of 1.63. Regression analysis showed that level of education (P= 0.063), years of experience (P= 0.080), farm size (P= 0.000), labour used (P= 0.095), and chemical used (P= 0.000) have positive significant effect on the revenue while pest infestation (P=0.001) has negative effect. In conclusion, this study provided strong evidence that soybean cultivation is a profitable venture with profit margin of about 60%. It is recommended that farmers should engage in commercial production of soybean and seed breeders should develop pest and disease resistance varieties.

Keywords: Soybean, Oyo State, underutilized legume, crop management

Introduction

Soybean (*Glycine max*) is a legume that grows in the tropical, subtropical and even the temperate climate and was brought to Africa in the 19th century by Chinese traders along the East Coast of Africa (IITA, 2015). Soybean is the richest source of plant protein known to man (FAO, 2011). It is also an important source of income. The crop is an essential source of high quality, inexpensive protein and oil, the protein and oil levels are about 40% 20% respectively (Ahmed, 2009). The oil produced from soybean is highly digestible and contains no cholesterol. A by-product from the oil production-soybean cake is used as a high protein animal feed. The crop also improves soil fertility by adding nitrogen from the atmosphere and used as cover crop to prevent erosion (IITA, 2015).

The origin and early history of soybeans are not known. It is common to read in agronomic publications that the earliest recorded origins of soybeans date back to 2800 B.C. in China (Thoenes, 2014). It can grow on all types of soil, but deep fertile loam with good drainage is most suitable for growth (Whigham, 1974). It is a useful food plant that, used in its several forms, is proficient of providing most nutrients. It can substitute for meat and to some extent for milk. It is a crop capable of plummeting protein malnutrition. In addition, soybean is a good source of high value animal feed (Martin, 1998). Soybean is a substitute protein source to the rural families and can be consumed at home in numerous forms and the excess can be sold to other consumers and manufacturers for income (Ambitsi, Onyango & Oucho, 2007). Soybean is among the main industrial and food crops grown in every continent (Dugje, *et al.,*2009). Soybean has an average **protein content of 40%** (Collombet, 2013) and is more protein-rich than any of the common vegetable or animal food sources. Soybean seeds also contain about 20% oil on a dry matter basis, and this is 85% (Dugje, *et al.,*2009) unsaturated and cholesterol-free (Ambitsi, Onyango and Oucho, 2007).

Soybean is recognized globally due to its multi-purpose use as human food, livestock feed, industrial purposes, and more recently, as a source of bio-energy (Myaka *et al*., 2005). It also contains 20% non-cholesterol oil and its fortified products are substantially inexpensive than other sources of high quality protein. It is the prime source of edible oil globally with the uppermost gross output of vegetable oil among the cultivated crops with total cultivated area of 117.7 million hectares and total production of 308.4 million tons (FAOSTAT, 2015).

It is one of the significant crops produced in Nigeria. However, it was reported that the crop is grown in rather small holder farms in most African countries including Nigeria (Olorunsanya *et al*., 2009). Available statistics on world soya bean production shows that although production tends to increase between the year 2000 and 2006, there is a noticeable waning in the production of soybean in the year 2007. Also, the contribution of Nigeria to world soya bean production which stood at an average of 0.28% in 2006, declined to about 0.26% in 2007 (FAOSTATS, 2009). Study has shown that the problems of small scale agriculture in Nigeria include the lack of high yielding cultivars, poor information about new production technology, insufficient basic farm inputs and the use of traditional technology of low productivity.

The crop can be processed into several forms such as soymilk, soyflour, soymeat, soyspice, yoghurt, biscuit, baby food, condiments, breakfast cereals, etc. these products are highly utilized because they are inexpensive, have satisfactory taste and high nutritional values as well as major source of the daily protein intake of children and adults (Kokoiwen, 2002).

In recent time there has been an upsurge in soybeans production round the globe. With the rapid expansion of soybean production around the world, competition in global soybean trade imposes new challenges to conventional commodity cropping systems. Lower production costs and comparable technologies are just a few results of worldwide production competitiveness (Paz, Batchelor, and Jones, 2003; Lambert and Lowenberg-DeBoer, 2003). Additionally, utilizing new ways to add value to commodity soybean (e.g., planting of food-grade specialty soybeans) could improve profitability and competitiveness in the world market (Fernandez-Cornejo, Wechsler, Livingston, and Mitchell, 2014).

In the main Soybean producing countries and particularly in Brazil, Argentina, Paraguay and the USA, soybean contributes significantly to the total value added by the agricultural sector. In these countries, soybeans and its sub-products also occupy an important position in total export earnings. Among smaller producers only India and Bolivia earn significant income from the exportation of soybean and derived products (Thoenes, 2014). The aforementioned countries are making fortunes from exportation of soybeans but Nigeria is yet to tap into this opportunity. Worst still, the level production in Ibarapa zone is far below the other in Oyo State. This problem of under-utilization of soybean in Ibarapa may be due to lack of information about economic importance of

soybean. This lack of information constitutes a gap in research that formed the basis for this study. Hence, to fill the knowledge gap and gain better insight on the economics of soybean production in Ibarapa Zone of Oyo State, the study therefore sought to identify socio-economic characteristics of soybeans farmers as well as the challenges that soybean farmers face in acieving their outcomes. The study also hoped to examine the factors that determined soybean outputs.

Materials and Methods

Study area

This research was carried out in Ibarapa zone of Oyo State. The name Ibarapa is derived from local cultivar of the melon plant, known locally as "Egusi Ibara", which was historically acknowledged by neighboring people. Ibarapa has seven towns namely: Eruwa, Lanlate, Igboora, Idere, Aiyete, Tapa and Igangan. The Ibarapa area falls within latitude 70.5'N and 70.55'N and longitudes 30E and 30.30'E. It is located approximately 100km north of the coast of Lagos. The population of the area is approximately 380,150. The area is approximately 2,496km^2 in geographical size, and consists mostly of rolling savannah with forests situated along the Southern border and in isolated patches along river courses such as the Ogun. The natural vegetation was originally rainforest but that has been mostly transformed into derived type savanna as a result of several centuries of slashes and burn farming system.

Sample Size and Sampling Technique

Respondents were selected through a multi-stage sampling method. In the stage 1, four towns (Igboora, Idere, Aiyete and Iganagan) were purposively selected. In the second stage, 40 Soybean farmers were randomly selected from each of the four designated towns, totaling 160 respondents.

Data Collection and Analysis

Data used for the study were gotten from primary sources through the use of pre tested structured and validated questionnaires. Questionnaires were administered to the farmers to elicit information from them about their production process. Data collected were analysed by descriptive statistics (frequency table, mean and percentage) and inferential statistics (Gross Margin, T-test and Regression).

Model Specification

Gross Margin

$$GM = \sum piqi - \sum rjxj$$

Where;

GM= Gross-margin

P*i* = Unit Price of Output *i*,

q*i* = quantity of output *i*,

r_j = unit cost of variable input*j*,

x_j = quantity of the variable input*j,*

piqi = Total Revenue (TR)

rjxj = Total Variable cost (TVC)

GM = TR-TVC

π = GM-TFC

Where;

π = Profit

TFC = Total Fixed Cost

Multiple Regression Model

$$\ln Yi = ln\beta 0 + \sum_{i}^{8} = 1\beta j\ lnXij + \mu$$

$lnYi = ln\beta_0 + \beta_1 lnX_1 + \beta_2 lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_4 + \beta_5 lnX_5 + \beta_6 lnX_6 + \beta_7 lnX_7 + \beta_8 lnX_8 + \mu$

Where:

Ln = natural logarithm
Yi = Soybeans output(kg)
Xij = Vector of inputs ($X_1 – X_8$) used
X_1 = Farmers' age (Year)
X_2 = Education level
X_3 = Household size
X_4 = Farming experience (year)
X_5 = Farm size (Ha)
X_6 = Pest/disease infestation
X_7 = Labour used (Number/quantity)
X_8 = Chemical used (Litre)

Results and Discussion

Socio-Economic characteristics of respondents

Table1 revealed large number (46.88%) of the respondents have age between 41-50years and this is closely followed by those that were between 51-60years (223.12%). Only 1.88% of the respondents were 30 years or less while 11.24% were above 60years of age. The mean age was approximately 49years. This suggests that the respondents in the study area were in their productive ages. This is in tandem with findings of Birhanu, Adam and Mazengia (2018) in their study "Analysis of Cost and Return of Soybean Production Under Small Holder Farmers in Pawe District, North Western Ethiopia" where average age was 41.98years.

According to gender, 91.88% of the respondents were males while only 8.12% were females. This echoed the findings of Birhanu, Adam and Mazengia (2018) in their study, where majority (95.45%) of the soybean farmers were males.

It was revealed that 73.12% of the respondents have non-formal education while only 26.88% have formal education. This indicates that most of the farmers were illiterate. This result is contrary to the finding Birhanu, Adam and Mazengia (2018) in their study, where only 38.64% of the farmers were illiterates.

The Major occupation as shown on Table 1 was farming (71.25%); while only 6.25% were civil servants primarily. Those who chosen trading and artisan as their main occupations were 10.62% and 11.88% respectively. This implies that respondents engaged more in farming as main occupation than other occupations.

For farming years of experience, Table 1 revealed large number (57.50%) of the respondents have between 11-15years of farming experience while 9.38% have between 1-5 years of experience. The mean years of experience were approximately 12years.

In terms of Farm Size, the mean farm size was 7.86 hectares. This is contrary to findings of SHALMA, H.J. (2014) in his study, where average farm size was 0.89 hectares.

Challenges faced by Soybean Farmers

According to table 2, 93.75% of the respondents affirmed strongly that high cost of pesticides was a very serious problem facing soybean farmers with the mean response of 4.93 which makes it the most prevalent problem in the study area. This is closely followed by pest/disease infestation with the mean response of 4.88.

Large number ((88.12%) of the farmers strongly claimed that herdsmen destructive activities was one of serious challenges facing soybean farmers with the mean response of 4.73 which make it third most prevailing problem. Low yield, high cost of labour, insufficient capital and transportation cost were ranked as fourth, fifth, sixth and seventh prevalent challenges respectively.

About 41% agreed that high cost machinery was a serious problem while only 8.2% strongly disagreed with this assertion. Unavailability of High Yield Variety (HYV) was ranked ninth problem with the mean response of 3.06. Majority (75.00%) of the respondents strongly disagreed that market unavailability is a serious challenge with the mean response of 1.42 which make it the least problem.

Gross margin and Profitability Analysis of soybean production

Table 3 presents the result of Gross margin and Profitability Analysis of soybean production in the study area. It was revealed that average total variable cost (TVC) was ₦218,691.89 while the average total fixed cost (TFC) was ₦146,576.30. The average total cost (TC) was ₦365,268.19. The average total revenue (TR) received by the farmers was ₦595,798.30. The gross margin (GM) was ₦377,106.41. This indicated that soybean is highly profitable in the study with profit (π) of ₦230,530.11. The benefit cost ratio (BCR) was 1.63, this indicate 160% return on investment. It simply means that every ₦1 invested in soybean production, will bring ₦1.63k. This implies 63% profit margin on invest.

Regression Analysis

Table 4 reveals the result of multiple-regression which was used to show the factors that influence the output of soybean. It was revealed that education level was positively correlated with about with coefficient of 0.0623 and was significant at 10% level of significant. This infers that if level of education is increased by one unit, soybean output will be increased by 0.0623. Also, year of farming experience (significant at 10%), farm size (significant at 1%), labour used (significant at 10%) and chemicals used (significant at 1%) were all positively correlated with output and were statistically significant at different level. this implies that an increase in any of these factors brings about certain increase in soybeans output. Pest/disease infestation was also significant at 1% level but negatively correlated with output which means that an increase in pest/disease infestation brings about decrease in output. Age and Household size were not significant. Adjusted R^2 was 0.8906 which means 89.06% of factors that determine the output of soybean have been explained by independent variables while the rest has been captured by stochastic error term.

Hypotheses

Table 5 revealed that male and female soybean farmers were statistically (p=0.0001) different in term of farm size. The average farm size for male was 8.29ha while that of female was 3ha. The mean difference was 5.29ha and this was statistically significant at 1%, therefore, null hypothesis was rejected.

Also males have average years of farming experience of 11.93years while females have 8.15years of farming experience with the difference of 3.78years and this was statistically (p=0.0002) significant at 1%. Therefore, null

hypothesis was rejected. Likewise, the revenue generated. Average revenue generated by male farmers was ₦612,444 while that of female was ₦204,880 with the average difference of ₦75,578 and was statistically (p=0.0037) significant at 1%. Hence, null hypothesis was rejected.

Male and female soybeans farmers were not statistical different in term of their education level (p=0.127) and age (p=0.1990). Therefore, null hypotheses were accepted.

Conclusion

In conclusion, majority (91.88%) of the soybean farmers were male and their average age was 49years. Majority (73.12%) had no formal education and they were married with average household size of 6 persons. It was discovered that the challenges that facing soybean farmers in Ibarapa among others are High cost of pesticides, Pest/Disease infestation, Herdsmen activities, Low yield, High labour cost and Insufficient capital. The gross margin (GM) was ₦377,106.41 with profit (π) of ₦230,530.11 and benefit cost ratio (BCR) was 1.63. The factors that influence soybean output are; education level, year of farming experience, farm size, labour used, chemical used and pest/disease infestation. Adjusted R^2 was 89.06%. Male and female soybean farmers were statistically difference in terms of farm size, years of farming experience and revenue generated. It is recommended that seed breeders should endeavour to develop disease resistance cultivars or varieties. Government should provide credit facility for farmers. Farmers should engage in commercial production of soybean to tap into economic benefits of soybeans.

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Conflict of Interests

The authors declare no conflict of interests

Tables, Figures and Charts

Table1: Frequency distribution of respondents by socio-economic-characteristics (N=160)

Socio-economic-characteristics	Freq.	Percentage	Mean
Age (year)			
≤ 30	3	1.88	
31-40	27	16.88	
41-50	75	46.88	48.72
51-60	35	23.12	
Above 60	18	11.24	
Sex			
Male	147	91.88	
Female	13	8.12	
Marital-Status			
Single	1	0.63	
Married	141	88.13	
Divorced	8	5.00	
Widowed	10	6.24	
Religion			
Christianity	43	26.88	
Islam	106	66.24	
Traditional	11	6.88	
Formal Education Status			
Non-formal	117	73.12	
Formal	43	26.88	
Major Occupation			
Farming	114	71.25	
Artisan	19	11.88	
Civil Service	10	6.25	
Trading/Business	17	10.62	
Farming years of experience			
1-5years	15	9.38	
6-10years	53	33.12	11.63
11-15years	93	57.50	
Farm Size (Ha)			
1-5	66	41.24	
6-10	44	27.50	7.86
11-15	29	18.13	
16-20	21	13.13	
Household Size			
1-5persons	101	63.12	5.38
6-10persons	59	36.88	

Table 2: Distribution of the respondents by challenges faced by soybeans farmers (N=160)

Challenges	Strongly Agreed	Agreed	Undecided	Disagreed	Strongly Disagreed	Mean/Rank
High cost of pesticides	150(93.75)	8(5.00)	2(1.25)	0(0.00)	0(0.00)	4.93
Pest/Disease infestation	141(88.12)	19(11.88)	0(0.00)	0(0.00)	0(0.00)	4.88
Herdsmen activities	134(83.75)	8(5.00)	18(11.25)	0(0.00)	0(0.00)	4.73
Low yield	111(69.38)	18(11.25)	21(13.12)	10(6.25)	0(0.00)	4.54
High labour cost	104(65.41)	45(28.30)	2(1.25)	4(2.52)	4(2.52)	4.52
Insufficient capital	10(6.25)	148(92.50)	2(1.25)	0(0.00)	0(0.00)	4.07
Transportation problem	0(0.00)	134(83.75)	16(10.00)	8(5.00)	2(1.25)	3.76
High cost of machinery	14(8.75)	66(41.25)	47(29.39)	20(12.50)	13(8.12)	3.30
Unavailability of HYV	10(6.25)	73(45.62)	26(16.25)	19(11.88)	32(20.00)	3.06
Market unavailability	0(0.00)	4(2.50)	19(11.88)	17(10.62)	120(75.00)	1.42

Note: Values in parentheses are percentages

Table 3: Gross margin and Profitability Analysis of soybean production

Variables	Mean Value (₦)	
A. **Variable costs**		
Labour Cost	78,044.38	
Cost of Seed	12,975.00	
Chemical Cost	94,585.00	
Processing Cost	15,000.00	
Transportation	14,189.38	
Marketing Cost	3,898.13	
Total Variable cost (TVC)	**218,691.89**	
B. Fixed Costs		
Depreciated Land Cost	57,282.50	
Depreciated cost of Equipment	89,293.80	
Total Fixed Cost (TFC)	**146,576.30**	
C. Total Cost (TC)= TVC + TFC (218,691.89 + 146,576.30)	**365,268.19**	
D. Total Revenue (TR)	**595,798.30**	
Gross Margin (GM) = TR-TVC = (595,798.30 - 218,691.89)	**377,106.41**	
Profitability (π) = TR-TC = (595,798.30 – 365,268.19)	**230,530.11**	
Benefit Cost Ratio (BCR)= (TR ÷TC) = (595,798.30/365,268.19) = 1.63		

Table 4: Regression Result

Variable	Coefficient	Standard-Error	T - Value	Probability
Age	-0.0503	0.0533	-0.94	0.348
Education Level	0.0623	0.0333	1.87	0.063*
Household Size	0.0013	0.0242	0.06	0.955
Farming years of Experience	0.2692	0.1521	1.77	0.080*
Farm Size	0.6536	0.0834	7.84	0.000***
Pest/Disease Infestation	-0.2119	0.0631	-3.36	0.001***
Labour used	0.1470	0.0874	1.68	0.095*
Chemical Used	0.3721	0.1013	3.67	0.000***
Constants	9.0257	1.0591	8.52	0.000
R^2 = 0.8983				
Adjusted R^2 = 0.8906				
F-Value = 0.0000				
Number of observation = 160				

Note: *, ** and *** represent 10%, 5% & 1% level of significance

Table 5: T-test estimates of the variables (difference between means)

Variables	Mean		Diff	Std. Error	T-Value	P-Value	Decision
	Male	Female					
Farm Size	8.29	3.00	5.29	1.4205	3.72	0.0001***	Reject H_O
Farming years of exp.	11.93	8.15	3.78	1.0295	3.68	0.0002***	Reject H_O
Revenue	612444	4075645	204880	75578	2.71	0.0037***	Reject H_O
Education Level	0.55	0.38	0.17	0.1446	1.15	0.1257	Accept H_O
Age	48.91	46.54	2.37	2.7996	0.85	0.1990	Accept H_O

Note: *, ** and *** represent 10%, 5% & 1% level of significance

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