Economic Analysis of Cotton Production among Cotton Farmers in Northern Nigeria: A Case Study of Zamfara State, Nigeria.

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Abstract: *The thrust of this study is on economic analysis of cotton production.The specific objectives were to describe socio-economic characteristics, resource utilization and production technologies and to determine profit in cotton production. Primary data were used for the study through administration of structured questionnaireto collect information from 220 farmers using the list from reconnaissance survey of Zamfara State Agricultural Development Project to randomly select 15% of farmers from selected villages of the four local government areas in the study area. The analytical tools used to achieve the stated objectives in this study were descriptive statistics and net farm income model. The study found that 68% of the farmers were within the average age of 50 years and 30% of the farmers had no formal education while majority of about 74% were married. Also, about 90% were males and 30% having about 15 years of experience in farming. In resource utilization and production technologies, about 35% used seed retained from previous planting while 36% procured fertilizers used from Agricultural Development Projects. Analysis of net farm income showed a profit of ₦ 51, 414.51/ha if all labour were valued and the returns per man-day of ₦966.80 while the returns to investment showed that a farmer gains ₦1.11 per Naira invested in cotton production. . It was recommended that appropriate inputs delivery network need to be put in place by government and agro-service agencies, adequate and intensive research and extension service delivery programme should pursue a consistent and systematic campaign for cotton production while an enabling marketing policy should be instituted by government throughproduct marketing corporation which will serve as a clearing house for cotton marketing in Nigeria.*
Key Words: *Economic analysis, cotton production, cotton farmers, Zamfara state, Nigeria*

I. Introduction

In Nigeria, the agricultural sector has been invaluable in supporting economic growth and development since independence in 1960. Indeed, before the discovery and exploration of petroleum, the Nigerian economy depended on funds generated from agricultural export expansion for the development of other sectors of the economy. Due to its important role in nation building, the agricultural sector has continued to be a target of government policies overtime (Eyo, 2008).

According to the National Bureau of Statistics (NBS) (2011), the percent share in the GDP of the crop sub-sector between 1981 to 1990 had been fluctuating between28.37% and 22.99% and did not register any significant increase.The Central Bank of Nigeria (CBN) (2011), in its annual report indicated the per cent share in total of the contribution of the agricultural sector to the GDP at 1990 constant basic prices. From 2007 through 2012, the share has been declining from 42% of the total GDP to 40.2%. The place of the crop production sub-sector in the total GDP have shown similar trend with a decline from 37.5% to 35.8% between the same period. Despite these marginal decline in recent years, the demand for many agricultural products outweighs the supply.

It is with respect to this that cotton was chosen to form the basis of this study. With regards to fibre crop, cotton is an important crop in the world, it ranks first followed by jute, kenaf and sisal in the world production of fibres. It is noticeable from the performance of the cotton production industry that since 2003/2004 cropping season, there has been a fall and fluctuating pattern in the production trends in cotton. According to United State Department of Agriculture(USDA)(2011), the production trend in cotton had not witnessed remarkable improvement between 2007/2008 cropping year while the 2010 – 2012 cropping seasons experienced a decline.

This phenomenon revealed a glaring disparity between demand and supply thereby creating a gap in the cotton production industry. Batterham (2000) asserted that supply is yet to satisfy the level of demand for cotton. This has caused great concern in the textile cotton fibre supply situation in the local market and export profile in the country thereby having a declining effect in its contribution to the agricultural economy of the country.

The phenomenon of downward trend in the Nigerian agricultural sector since 1970's has been a matter of concern in the country. The decline in cotton production among cotton farmers has been an endemic problem associated with the characteristics of most traditional farmers. It is presumed that some of the factors attributed to farmers' productivity is associated with the scope and pattern of resource allocation and utilization and socio-economic conditions prevailing among cotton farmers.

1.2Research Objectives
It is based on this credence that the following research questions were raised and the subsequent objectives were addressed by this study:
  i.   What are the socio-economic characteristics of cotton farmers?
 ii.   What are the patterns of resource utilisation in cotton production?
iii.   Is there profit or otherwise in cotton production in the state?
The specific objectives of the study were to;
i.   describe the socio-economic characteristics of farmers in the study area;
ii. examine the pattern of resource utilization and production technologies in cotton production;
iii. determine the level of costs, returns and profit in cotton production;

1.3 Test of hypothesis
Cotton production is not profitable in the study area.

II.   Methodology
Zamfara state was used for this study. The state lies between latitude 10^0 50`N and $13^0$ 38`N and longitudes 4^o16`E and $7^o18$`E. The state is located in the Sudan Savanna ecological zone of Nigeria. It has a land area of 39,762km^2. Zamfara state shares common borders with Sokoto and the Republic of Niger to the north, Katsina and Kaduna states to the east, Niger and Kebbi states in the South (Yakubu,2005., www.zamfarastate.net, 2010). The state has a population of about 3,259,846 people in 2006 according to the National Population Commission (NPC)(2006). This is projected in 2011 to be 3,667,326 People representing 3.2% annual growth rate in population.

The climate is essentially that of tropical climate. The climate is generally characterized by alternating dry and wet seasons. The rains usually commence in May/June and end in September/October. The effective rainy season in the study area is restricted to July to mid-September (Yakubu, 2005).

Specifically, four local government areas namely Kaura, Gusau, Tsafe and Bungudu were chosen as the study area. They are in the northwestern part of the state. These areas were chosen because they are well known for cotton production. A significant proportion of cotton produced in Zamfara state comes from these areas (www.zamfarastate.net. 2010). The main ethnic groups in these areas are Hausas, Beriberis, Buzzaye and Fulanis. Indeed, agriculture forms the main occupation of the entire population. This constitutes the bulk of those involved in traditional farming, fishing, hunting and nomadic pastoralism.

2.1Sampling Procedures and Sample Size
The field survey employed the list from reconnaissance survey of farmers conducted by Zamfara State Agricultural Development Project (ZADP, 2010). A multistage sampling technique was employed in selecting the study farmers. The first stage was purposive sampling of four local government areas (LGA's) as earlier indicated. These are Kaura, Gusau, Tsafe and Bungudu.

The second stage involved a selection of two villages known to be cotton outgrowers from each of the local government areas based on the prevalence of cotton farmers and their involvement in cotton production and accessibility. Hence, a total of eight villages were selected for the study.

The third stage involved using the list of cotton growers obtained from the reconnaissance survey to randomly select 15% of farmers from each of the eight villages in the ratio of 26, 33, 23, 26, 33, 22, 31 and 26 from Kasuwa-Daji, Kabarawa, Danba, Magami, Tsafe, Kucheri, Kwatarkwashi and Tashar-rawaya respectively constituting 220 out of a total of 1471 farmers.

Primary data was used for this study. The primary data was collected for the study based on 2012/2013 cropping year known as cross-sectional data. The analytical tools that were used to achieve the stated objectives in this study were descriptive statistics and net farm income analysis. Simple descriptive statistics was used to achieve objectives (i), (ii) and part of(iii) while the net farm income analysis was used to achieve (iii) of the study.

2.2 The Model
The net farm income for any farm production enterprise is given as;

$$NFI = \sum_{i-1}^{n} P_i Y_i - \sum_{j-1}^{m} P_i X_j + \sum_{k-1}^{K} FK$$

…………………………………..(1)

Where;

NFI =Net farm income in cotton production enterprises.

$\sum P_i Y_i$ = Total farm income (value) of cotton produced or gross farm income.

Y_i = Cotton output,

P_i = Prices of output and inputs

$\sum P_i X_j$ = Total variable cost used in cotton production enterprise.

X_j = Quantity of variable inputs used

Pxi = Price of input employed by ith cotton farmers

$\sum Fk$ = Cost of fixed inputs in cotton production enterprise.

$\sum$ = Summation (addition sign)

III.   Results And Discussion

3.1 Socio-Economic Characteristics of Cotton Farmers

Socio-economic characteristics that were investigated during the farm survey are those relevant to increasing farmers' efficiency in cotton production in the study area. These socio-economic factors were major occupation, age distribution, level of education, marital status, gender distribution, experience in farming, household composition and access to credit.

Occupation is an important socio-economic attribute determining farmer's livelihood, level of income, wealth and ability to invest in agricultural production. Major occupation prevalent among the respondents was farming representing 95% of the respondents.According to FAO (1999), employment in non-farm activities is essential for diversification of the source of farm household's livelihood.

Age is a socio-economic attribute upon which farmers' abilities and physical disposition in planning, organizing, controlling resources and accomplishing production activities and farm tasks are based. From the sampled farmers, the average age was 50 years. This depicts that most of the farmers are within the middle age. Hence, it suffices to conclude that the productive age group constitutes 67.80% of the respondents which depends largely on the mental and physical labour productivity of cotton farmers in the study area.

Table1: Socio-economic characteristics of cotton farmers

Occupation	Frequency	Percentage (%)
Farming	209	95
Others (livestock rearing, hunting and fishing)	11	5
Age range (Years)		
20 – 39	31	14.10
40 – 59	150	67.80
60 – 75	39	18.10
Level of Education		
No formal education	66	30.0
Attended Primary School but did not complete	30	13.60
Completed Primary School	42	19.10
Had Secondary Education	50	22.70
Above Secondary Education	32	14.60
Marital Status		
Married	162	73.64
Single	35	15.91
Divorced	13	5.91
Widowed	10	4.54
Gender		
Male	198	90.00
Female	22	10.00
Level of Experience		
1 – 5 years	35	15.91
6 – 10 years	43	19.55
11 – 15 years	65	29.54
Above 15 years	77	35.00
Age and Sex		
Adult males above 14 years	825	39.55
Adult females above 14 years	916	43.91
Children		
(Male below 14 years)	131	6.28
(Female below 14 years)	180	8.63
Disabled		

(Male)	20	0.96
(Female)	14	0.67
Access to Credit Facilities		
Yes	109	49.50
No	111	50.50
Total	**220**	**100**

The level of education attained by an individual is a powerful determinant regarding the capacity to produce goods and services in the society.Table (1) shows that majority of farmers representing 30% of cotton farmers had no formal education. Indeed, formal education is a veritable attribute enhancing farmers to be able to innovate, adapt and adopt improved recommended cotton production practices. Muhammed Lawal et al. (2009) in their studies asserted that level of education is expected to influence farmers' adoption of agricultural innovations and decisions on various aspects of farming. They were of the opinion that, education is highly important for sustainable agricultural growth and of the agricultural programme, participants had some form of formal education.

From the study, the result indicates in table (1) that, a large proportion 73.64% of the sampled farmers were married. In the traditional farming system, family labour is substitutable for hired labour or communal labour. In some cases, family labour constitutes a more significant source of labour while hired labour or communal labour serve as supplementary sources of labour in the farm. Indeed, a large family size with corresponding more adult males and females implied more opportunity for the farmers to utilise such labour and enhance his cotton production frontier.

In table(1) 90% of the farmers who produce cotton were males. The female respondents were 10% of the sampled farmers. The result of this study agrees with that of Rahman (2008), that division of labour in rural agricultural activities is gender specific. Jackson (1986) asserted that secluded Moslem women do not farm.

Cotton farmers have various depth of experiences in their farming activities. Table (1) shows that majority 35% of the sampled farmers had experience of above 15 years. This agreed with the findings by Ajani (2000) on productivity in food farming in Northern area of Oyo State, Nigeria. The study showed that year of farming experience increased agricultural productivity among farming households in Nigeria.

Household composition depicts the number of persons in a family living together in a house. The result shown in table 1 revealed that 39.55% and 44% were adult males and females above 14 years respectively. The number of male and female children below 14 years were 6.30% and 9% of the respondents respectively. In accordance with the findings of Okoruwa and Ogundele (2006), large family size does not necessarily translate to higher use of family labour because some of the young able-bodied family member may create preference for other jobs than farming.

Agricultural credit facilities are essential in order to circumvent and overcome the problem of shortage of capital among cotton farmers. Table (1) reveals that about half of cotton growers had access to credit facilities from various statutory financial institutions. In other words, 49.50% of the sampled farmers had access to formal credit while 50.50% of the farmers had no access to credit facilities. This is because most cotton farmers operate small holdings which subject them to vicious circle of poverty of low productivity, low output, low income, low savings and low investment.

3.2 Resource Utilization and Production Technologies in Cotton Production

Various plots were devoted mainly to sole cotton or crop mixtures. The average farm size cultivated was 1.8ha. The study revealed that 28.63% of the sampled farmers operated cotton farms which were less than 1ha. These were small farms employing traditional methods of production.In most labour intensive traditional farms, labour inputs is a factor of production as it is the case in agricultural production. A total of 53.18 man-days was used in cotton production. However, 50.32% came from family sources while 49.68% came from hired labour. (Table 2).

Table2:Labour inputs by activity in Cotton Production (man-days/ha)

Activity	Family labour Man-days/ha	Hired labour Man-days/ha	Total labour input man-days/ha	% of total labour input
Land preparation and ridging	6.5	6	12.5	23.51
Planting	2.1	2	4.1	7.71
Fertilizer application	2.16	3	5.16	9.70
Wedding	4	4	8	15.04

Spraying	4	5.42	9.42	17.71
Harvesting/Picking	8	6	14	26.33
Total	**26.76**	**26.42**	**53.18**	**100**
%	**50.32**	**49.68**	**100**	

Most cotton farmers planted the seed easily available through the agro-service centres in the agricultural development projects nearest to them while others used certified seed procured from the national seed service. The average seed rate was 20.87kg/ha. The planting date in the study area was between mid-May and lasted towards mid-June for better cotton yield.Fertilizer is one of the inputs needed in cotton production. This is because fertilizers were utilized in order to replenish soil fertility and increase cotton yield per unit area of land cropped. The minimum quantity of fertilizer used was 7.69 kg/ha while a maximum of 1,200kg/ha was applied with an average of about 2 bags/ha. Agro-chemicals were utilized as one of the inputs required in production. Some of the chemicals include herbicides and pesticides for the control of weeds and pests respectively. The minimum dosage of agro-chemicals (herbicides and pesticides) used was 5.118litres/ha and a maximum of 107.33litres/ha with an average of about 9.84litres/ha. (Table 2).

3.3 Determination of Costs, Returns and Profitability of Cotton Production

In any production process, various levels of inputs are employed to produce a given level of output. It is rational for farmers to allocate and utilise inputs at minimum cost in order to maximise the level of profits accruing to them. This is a measure of profitability. According to Olukosi and Erhabor, (1988), the net farm income is a very useful tool in determining the profitability of farm enterprises.

Cotton is a cash crop that is commercially produced primarily for sale. This shows that cotton production enterprise can be seen as an economic unit organized by farmers purposely for profits or economic returns. Based on this premise, the expected net farm income is an important factor in cotton production planning and organisation at farm level. The specification of inputs utilised are those that are relevant in cotton production namely, farm size, labour, seed, fertilizers and agro-chemicals. Costs and gross farm income were estimated based on the variable inputs enumerated above so as to reflect actual cost and gross farm income in cotton production.

3.4 Net farm income analysis

The cost used in this analysis include all costs incurred on variable inputs such as seed, fertilizer, labour, agro-chemicals and depreciation on fixed or working assets possessed by the farmers. Depreciation and other charges namely maintenance and replacement were calculated so as to reflect total cost of production. (Table 3).

Table3:Average Cost Per Hectare Associated with Cotton Production

Variable Inputs Employed	Quantity	Cost (₦)	Percentage (%)
Labour	53.18 man-days	25,844.41	55.72
Seed	20.87 kg/ha	1,968.46	4.24
Fertilizer	91.28kg/ha	8,211.55	17.70
Agro-chemicals	9.84L/ha	10,176.59	21.94
Depreciation of tools and implements			
- Maintenance and repairs		52.15	0.112
- charge on rented equipment		72.64	0.156
- Replacement cost		61.47	0.132
Total		**46,387.27**	**100**

The average wage rate in the study area was ₦485.98/man-day. It was assumed that family labour is perfectly substitutable for hired labour. Cotton seed was valued at ₦94.32/kg while fertilizer input was valued at ₦89.96/kg. The average cost involved in producing one hectare of cotton was ₦46,387.27. Labour input accounted for 55.72%. This is a clear indication that most cotton production activities on traditional farms are labour intensive and hence attracted more costs which accounted for more than half of the average costs in cotton farms. It was estimated that the minimum cost a cotton farmer incurred per hectare was ₦12,520.40 while the maximum cost incurred was ₦95,428.43. (Table 4).

The analysis of net farm income was carried out so as to determine the level of profits associated with cotton production. Land was taken as fixed input and data were expressed on per hectare basis among sampled cotton farmers. The net farm income associated with the production of one hectare of cotton are described in table 4.

The analysis revealed that the net farm income realized was ₦64, 419.33 when only hired labour was valued. When all labour (family labour and hired labour) were valued in the analysis, the estimated net farm income reduced to ₦51,414.51. This is a clear indication that family labour contributed immensely in the reduction of cost of labour which if it were to be paid for, would have led to an increase in cost of producing one hectare of cotton thereby reducing farmers' net farm income.

These findings agreed with the work of Alam et al. (2013) that cotton production was profitable. Their study revealed that the average net farm income was ₦21,172.12. The study further revealed that returns on Naira invested by farmers was ₦0.56, meaning that a farmer gains 56 kobo in every one naira invested in cotton production. Similarly, Ibrahim (2008) conducted a research on the economics of sole cotton production in Lau Local Government Area of Taraba State and came out with a similar result of returns on investment of ₦0.76.

Table 4:Cost-returns Associated with Cotton Production

Item of Description	Amount (₦)
Cotton yield (kg/ha)	773.32
Cotton value (₦/ ha) [a]	97,801.78
Labour input (man-days/ha)	
family labour	26.76
hired labour	26.42
3. Total	53.18
Input cost other than labour (₦/ha)	
seed[b]	1,968.46
Agro-chemicals[c]	10,176.59
Fertilizers[d]	8,211.55
Depreciation of tools[e] and implements	186.26
Labour cost (₦/ ha)[f]	
Hired labour	12,839.59
All labour	25,844.41
Total cost (including hired	
Labour only) (₦)	33,382.45
Total cost (including all labour) (₦)	46,387.27
Net farm income (NFI) (₦)per Ha	
Costing only hired labour	64,419.33
Costing all labour	51,414.51
Returns per man-day (all labour)	966.80
Returns per ₦ invested	1.11

Cotton is valued at ₦126.47/kg in the study area.
Seed is valued at ₦94.32/kg in the study area.
Agro-chemicals were valued at ₦1,073.48/L average price from various sources.
Fertilizer is valued at ₦89.96/kg this is the average price from various sources.
Depreciation of tools and implements are valued at   ₦186.26/ha.
Labour is valued at ₦485.98/man-day.

3.5 Labour productivity

Labour productivity is an important parameter that justifies if labour is adequately utilized in most agricultural production enterprises or not. In order to estimate the productivity of labour, the net farm income for all labour (family labour and hired labour) was calculated. The productivity of all labour was obtained by finding the quotient of net farm income using all labour in man-days. The result showed a return of ₦966.80. When this value was compared with the average wage rate of ₦485.98/man-day in the study area, it shows that labour is productive.

This implies that, it is more rewarding for family labour and hired labour to make their own contribution in carrying out farm tasks. This will enhance cost effectiveness thereby increasing the level of net

farm income accruing to farmers. This is because the farm tasks to be carried out will be accomplished within a short period and at stipulated time at the given cost. The return per naira invested was also computed. It was revealed that, returns per naira invested was ₦1.11 in cotton production. This shows that a farmer gains one naira and eleven kobo in every naira invested in cotton production. This revealed that cotton production is a profitable enterprise.

3.5 Test of hypothesis on net farm income (Ho₁)

Test of hypothesis for net farm income associated with cotton production was conducted based on the result of the analysis of net farm income estimates of the parameters $Ho_1: \pi = 0$ in table 5. The test indicated that the computed T-value of the profit function was 18.74 which far exceeds the T-critical value at 1% level of significance. Hence, the null hypothesis which states that cotton production is not profitable in the study area is rejected.

Table 5: Statistical significance of Net Farm Income Associated with Cotton Production

Estimates	Revenue (₦)	Total cost (₦)
Minimum	46,115.22	12,520.40
Maximum	136,700.00	95,428.43
Average	97,801.78	46,387,27
S.D	40,711.78	7,721.90
Profit	51,414.51	
Standard error	2,744.29	
T-value	18.74***	

*** = P<0.01

The result of the test of hypothesis signifies that cotton production is a profitable enterprise. Therefore, there is need to increase the level of awareness of cotton farmers and the would-be cotton farmers about the profitability of this enterprise through adequate extension services and education in this regard. Also, agricultural administrators and policy makers need to take cognisance of this fact and utilize it for policy purpose. This is in terms of timely provision of production facilities and inputs such as improved and certified seed, fertilizers, agro-chemicals and market incentives that will encourage farmers to produce cotton.

IV.   Conclusion And Recommendations

The results of socio-economic characteristics, inpututilization and production technologies exerted direct influence on increased cotton productivity. Also, the analysis of net farm income indicated that cotton production was a profitable enterprise in the study area.Based on the above conclusion, some policy recommendations and suggestions that will help in improving upon the level of growth in cotton production industry are proffered.

i. Appropriate inputs delivery network need to be put in place by government through reactivation of the farmers supply company, inputs supply agencies and registered private participants. The private sector input voucher distribution system will enhance timely farmers' access to inputs at affordable prices and at the right time.

ii. Adequate and intensive research and extension service delivery programme should pursue a consistent and systematic campaign for cotton production. Increased use of appropriate recommended cotton production practices as innovation are proffered.

iii. Cotton is a profitable crop production enterprise. Therefore, agro-service agencies and government should encourage its production by providing subsidies on inputs and price incentives for cotton lint, cotton seed, cottonseed oil and cotton seed cake.

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