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RESOURCE USE EFFICIENCY IN COTTON PRODUCTION AMONG SMALL SCALE FARMERS OF KATSINA STATE, NIGERIA

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ABSTRACT

The paper assessed the resource use efficiency in cotton production among small-scale farmers in Katsina State. The primary data used for the investigation were obtained using an interview schedule. Simple descriptive statistics, farm budgeting technique and production function analysis were used for the analysis. The gross margin per hectare was ₦ 11, 546.85. This shows that cotton production is profitable. The double-log production function analysis showed that all inputs used by the farmers were not efficiently utilized. This means that yield and profit could be increased. Based on the findings, the paper recommends that farm inputs such as fertilizer and agrochemical should be supplied on time and at affordable prices to avoid their under utilization on the farm.

Keywords: Cotton, Gross margin, Efficiency

INTRODUCTION

In Nigeria, agriculture played and still plays an important role in the Nigerian Economy. The sector was the major source of foreign exchange earning before the 70s and also employs about 70 percent of the rural working population. (USDA, 2003).

The cotton industry has played an important role in the Nigeria economy, especially in the pre-oil boom era. It was one of the major foreign exchange earners for the country. Apart from this, the lint removed from the seed was used in the production of textile fabrics, while the short fibre was used for making upholstery, mattresses, etc. In addition, cotton seeds provide edible vegetable oil for human consumption while cotton seed cake is used as raw materials for the livestock feeds due to it's high protein content (Adeniji, 2002; Andrea and Beckman, 1987).

Prior to the oil boom era, the cotton industry was the second largest employer of labour after the public sector (Ousmane et al 2002). Cotton is still the most important of all other fibre crops cultivated and its cultivation is not restricted to the northern savanna zones, but spreads to the derived savanna areas of Kwara, Oyo Ondo and Edo States. Unfortunately, since 1994, cotton production in Nigeria has experienced a sharp decline posing a serious constraint to the expanding cotton dependent industries. Consequently, Nigeria, which was once as major cotton exporting country, is now a net importer (Gbadegesin and Uyovbisere, 1994).

Chikwendu (1993) stated that only 38.0 percent of the present domestic requirement of the Nigerian textile industry is met locally, while the remaining 62 percent is imported. Despite the extensive research on cotton and other efforts aimed at boosting its production in Nigeria, production levels have been on the decline (SPORE 1992; Ibrahim, 2002). In addition, studies by Olugbemi (1992), and Abdullahi (1992), indicated that demand is about 100 percent higher than domestic supply. APMEU (1996), also reported that cotton production index for 1993 and 1994 show a decline of 10% respectively (using 1992 as base year). USDA (2003) also reported that domestic output declined in 2001 and 2002 thereby threatening the survival of Nigeria's textile manucfacturing sector.

The questions are, what could be responsible for the low production level of cotton? Could it be because cotton production is no longer profitable? Or could the decline in production be attributed to inadequate resources and/or inefficiency in the use of resources?

The quest of this study was to examine the cost and returns of cotton production and to find out whether resources are being efficiently utilized in cotton production in the study area. The specific objectives of the study are to determine the costs and returns from cotton production in the study area: estimate the production function for cotton in the study area; and determine the extent of resource use efficiency in cotton production in the study area.

METHODOLOGY

The study was conducted during the 2000/2001 cropping season in the four major cotton production areas of Katsina State namely, Funtua, Faskari, Bakori and Malumfashi. The state is located between latitude $11^0 - 13^0$N and longitude 6^0 and 9^0E of the Equator (Katsina, 1998). The annual rainfall is between 350 to 1000mm in the dry and wet parts of the state respectively. Farming is the main occupation of the people and the major crops grown are groundnut, maize, sorghum, millet and cotton (Ogungbile et al., 1999).

Primary data were used for the study. The primary data were obtained using an interview schedule. Furthermore, one important cotton-producing village was purposively selected in each of the four areas respectively based on its proximity and intensity of cotton production. The villages are Kurami, Gora, Daudawa and Bakori villages. The technique of simple random sampling (balloting) was then used to select 50, 30, 45 and 35 farmers from the list of farmers in each village respectively at 10% proportion (Table 1). This gave a total of 160 farmers for the study.

Table 1: Proportion of cotton farmers selected from sampled Villages.

Village	Estimated Population of cotton farmers.	Number of cotton farmers selected at 10% Proportion
Kurami	507	50
Gora	300	30
Daudawa	450	45
Bakori	350	35
Total	1607	160

Source: KTARDA. (Zone ii Headquarters, Funtua.)

Analytical Tools

The tools of analysis used for this study were simple descriptive statistics; Gross margin analysis and production function analysis:

Sample descriptive statistics were employed to have a summary description of the data collected. This involved the use of central tendencies such as percentages, means and frequency distribution.

Gross margin which is the difference between the Gross farm income (GI) and the total variable cost (TVC) is a useful planning tool in situations where fixed capital is a negligible portion of the farming enterprise as in the case of small scales peasant agriculture (Olukosi and Erhabor, 1988).

$$GM = GI - TVC$$

Where, GM = Gross margin/ha
GI = Gross income/ha,
TVC = Total variable costs/ha

Production Function Analysis

This was used to determine the extent to which the inputs used explained the variability in output. This gives the technical relationship between inputs and output in any production system

(Olayide and Heady, 1982). It is stated in the implicit form as follows:

$$Y = F(X_1, X_2, X_3, X_4, X_5, U)$$

Where, Y = output of seed cotton (kg) , X_1 = quantity of cotton seed (kg),farm size (hectares), X_3 = insecticides ,X_4 = total labour (man-hour), X_5 = Chemical fertilizer (kg), U = random error term

For the regression, the linear, square root, quadratic, double log and semi log functional forms were fitted to estimate the production function. The best regression fit was determined by a combination of criteria such as highest magnitude of the adjusted coefficient of multiple determination (R^{-2}), the highest level of significance of the overall equation (F-statistics), highest level of significant variable (t-statistics) and the conformity of estimated regression coefficients to apriori expectations.. Based on these criteria, (the double log functional form) was selected as the lead equation for the analysis.
The model is specified in its explicit form as follows:

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5}$$

While the linearised form of the model is as follows:

$$\text{Log } Y = a + b_1\log X_1 + b_2\log X_2 + b_3\log X_3 + b_4\log X_4 + b_5\log X_5$$

Where the b's are the estimated regression coefficients and X's and U are as earlier defined.

The Resource use efficiency was computed as follows:

$$r = \frac{\text{The Marginal Value Product}}{\text{The Unit factor Cost}} = \frac{MVP}{UFC}$$

r = the efficiency ratio
MVP = value of one unit of product
UFC = unit factor cost

The MVP was estimated as follows:

$$MVP = MPPX_iP_y$$

$$MPPx_i = \frac{dy}{dx_1} = \frac{bi\bar{Y},}{\bar{X}}$$

$\bar{y}$ and $\bar{x}$ are arithmetic mean values of the yield (y) and input (x) respectively and b_1 is as defined earlier, P_y is the price of unit output.
If r = 1 it implies that resources are efficiently utilized.
r >1, implies that resources are under utilized
r <1, implies that resources are over utilized

RESULTS AND DISCUSSION

Inputs and Output Levels of Cotton Production

The inputs used for cotton production are land, seed, fertilizer, labour and insecticides. While the output is seed cotton. Since the areas cultivated by each farmer vary, data in this section is expressed on per hectare basis. The levels of input used in seed cotton production and the output obtained are shown in Table 2

Table 2: Summary of input-output level of seed cotton production per hectare

Variables	Maximum	Minimum	Mean	Standard Deviation
Land (ha)	12.5	0.75	3.7	2.22
Seed (kg)	370.0	25	29.9	66.67
Insecticides (L)	15	1.0	1.5	3.28
Fertilizer (kg)	550	50	58.6	127.10
Total labour	125	75.0	95.75	156.36
Seed cotton (kg)	11750	700	898	1985.0

Source: Field survey, 2001.

Table 2 show the maximum land, seed insecticide, fertilizer, labour (man hour), and the yield, which was 11750kg per hectare. Then the minimum land, seed insecticides, fertilizer, labour (man-hour) and yields which was 700kg per hectare. The mean yield was 898Kg per hectare, while the standard deviation was 1985kg. The mean yield of seed cotton, which was 0.898 ton per hectare, is far lower than the recommended yield of 1 tonne per hectare under good management (Idem, 1999).

Costs-Returns Analysis

The gross return was computed by multiplying the total yields of each sampled farmer by the average unit price at the time of data collection. The average unit price was found to vary considerably over time, for instance the prices dropped from ₦900.00 per 25 Kg bag of seed cotton, to ₦850.00 and subsequently to ₦800.00, thus the average market price computed for the study was ₦850.00 and average unit price of ₦34.00 per a kilogramme of seed cotton.

The gross return per hectare was calculated by dividing the total gross return by the total land area (589.2 ha), this gave the sum of ₦30, 539.14. In estimating the total cost of production, only the variable costs components were considered. These consist of costs incurred on inputs such as seeds, fertilizer, labour, agrochemical and other cost items such as sacks. Cottonseeds were obtained from different sources, such as Ginning Companies and Seed Companies and extension outfits such as ADP's. An average market price of ₦10, 500.00 per Tonne was adopted for the study, giving a unit price of ₦10.00 per Kg of cottonseed. The total cost of cottonseed was calculated to be =₦313.95 per hectare. The cost of fertilizer in the study area varied between ₦1, 800.00 to N1, 900.00 per 50-kilogram bag. The average price of ₦1, 850.00 was adopted for the study. The average cost was ₦2164.50 per hectare of cotton.

Labour cost constitutes over 70 percent of the total cost of operation as indicated by its share of the total cost of production. Picking or the harvesting operation was the most intensive operation as more labour was devoted to it. Labour costs consist of hired and family labour (which was computed based on the opportunity cost principle) input in man-hours. The wage rate varied depending on the operation to be performed. However, an average wage rate of ₦150.00 per man hour was computed consequently, the average cost was ₦14, 362.50 per hectare. Insecticides were used by most of the respondents, though the high prices coupled with the technicalities involved in their usage had an effect

on the quantities utilised. The total cost of insecticide was ₦1836.00 per hectare of cotton. Other costs such as sacks for storing produce, and transportation were incurred an average of N306.21 was computed per hectare of seed cotton. The variable costs of production consist of the costs of fertilizers, seeds, agrochemical, labour, sacks, hiring and transportation. Tables 3 reveal that the total variable cost was for ₦18, 992.27 per Hectare. The gross margin per hectare represents the difference between the total value of all output per hectare (Gross returns) and the total variable cost per hectare. Table 3 reveals that cotton farmers earned a gross margin of ₦11, 546.85 per hectare implying that cotton production is profitable in the study area. However, the Gross Margin could have been much higher, but the drastic fall in the price of seed cotton made farmers to make the reasonable or fair gross margin reported above.

Table 3: Average Gross margin per hectare of cotton production in Katsina State.

Variables	Average quantity per	Unit price in Naira	Value (₦/ha)
1. Gross Return			
a. Average yield (kg)	898.12	34	30,539.14
2. Variable cost			
a. Seed (kg)	29.9	10.5	313.95
b. Fertilizer (kg)	58.5	37.0	2,164.5
c. labour (man-hour)	95.75	150.0	14,362.5
d. chemicals (l)	1.53	1200.0	1836
e sacks, transport hiring			306.27
3. Total variable cost			18,992.27
4. Gross margin			11.546.85
5. Average rate of return			1.60

Source: Field Survey, 2001

Production Function Analysis

The result of the double-log production function analysis shows that land, labour, seed, fertilizer and insecticide had positive regression coefficients indicating direct relationship between each of them and output (Table 4). The result further reveals that about 86 percent of the variation in output was accounted for by the input included in the model.

Table:4 The Coefficient form Cobb-Douglas production function for cotton in the study area.

Variables	Regression Coefficient	standard error	T-value
Constant	2.237	0.326	6.853**
Farm size (Ha) Log x_1)	0.555	0.198	2.800**
Seed (kg) (Log x_2)	0.019	0.163	0.120^{NS}
NPK fertilizer (kg) (Log x_3)	0.131	0.092	1.413^{NS}
Insecticide (l) (Log x_4)	0.079	0.046	1.699*
Labour (man hour) (Log x_5)	0.219	0.096	2.273**

R^2 0.8605

f-value 197.152**

** Significant at 5 % level of probability

NS Not significant

Resource Use Efficiency

The result of the analysis of Resource use efficiency in cotton production is presented in Table 5.

Table: 5 Efficiency of Resource Use in Cotton production

Resource	MVP	UFC	Efficiency Ratio
Seed	19.72	10.5	1.87
Fertilizer	68.00	38.0	1.78
Insecticide	1568.76	1200	1.30
Labour	69.70	150	0.46

Source: Computed from Field survey data 2001.

Table 5 shows that seed, fertilizer and insecticides were inefficiently utilized because their individual ratios are to one. The ratios indicated that sampled farmers under utilized their seed, fertilizer and insecticide inputs. The reason could be due to high cost of the inputs notably insecticides and fertilizer. The efficiency ratio for labour was less than unity indicating over utilization of labour on the farms. This could be as a result of the predominant use of family labour, which was abundant and not usually costed.

CONCLUSION AND RECOMMENDATIONS

The study has shown that cotton production is profitable in the study area. However resources required for cotton production were not efficiently utilized. This means that yield and profit were not being maximized.

Based on these findings, the following are recommended; Farmers should be supplied with pure seeds and agrochemicals through a revolving fund for improved crop yield levels. Farmers should also as be educated on how to use their resources efficiently in order to check under or over utilization. Finally, ban should be placed on imported printed fabrics so as to increase the demand for lint by the local textile industry thereby ensuring ready market for farmers' produce.

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