PRODUCTIVE EFFICIENCY OF WOMEN FOOD CROP FARMS IN THE DERIVED SAVANNAH ZONE IN NIGERIA

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ABSTRACT

In Nigeria, there is increasing food insecurity occasioned by low food-crop productivity of farms and low purchasing power of consumers. In spite of this, women play significant role in food crop production. However, the extent of productive efficiency among women food-crop farms has not been fully documented. This study evaluated productive efficiency measures of a sample of women farms in the derived savannah region of Nigeria. One hundred and eighty (180) women farmers producing food crops on their independent farms were randomly selected for interview through a well structured questionnaire. Data were analyzed using descriptive statistics, data envelopment analysis (DEA) and one-stage least squares regression method. The major finding showed that the farm holdings are small ranging between 0.4 – 3.0 hectares. Majority of the women farmers are poor and illiterate they relied more on family for labour and land. However, they were relatively efficient with the productive efficiency measures of 0.948 TE, 0.890 AE and 0.844 EE showing that they have little or no tolerance for resource wastage. Factors found contributing to low productive efficiency were land fragmentation and excessive use of farm inputs. Active participation in more agricultural organizations would assist the women in the management and use of farm resources which would result into tremendous increase in food production in the study area.

KEY WORDS: Productive efficiency, Women farmers, food crops, Derived savannah and Data Envelopment Analysis (DEA).
INTRODUCTION

The agricultural sector in Nigeria is vital to the economy for incomes and food security. The sector accounted for more than 60% national income, generated 88% of non-oil foreign exchange and provided paid and self employment to more than 70% of the population in the 60s (Agric.policy, 2001). However, the performance of the sector was undermined by disincentives created by various macroeconomic policies of various governments in Nigeria. The scenario led to decline in agricultural productivity. It declined to about 42% in 2010 (NBS, 2010). The low agricultural output has led to the poor performance of the food sector. Food production has not been able to keep pace with the demand. This has induced tremendous increase in the country’s import bills from about ₦195.8 Billion in 2001 to about ₦1.6 Trillion in 2011 (Coker and Adebayo, 2012) This has subsequently increased the prices of major food staples over the years. As a result most Nigerians spend high level of their income (65%) on food (Akoroda, 2014).

In an effort to combat food shortage in the country, Government embarked on several programs and schemes including National Accelerated Food Production Project (NAFPP) in 1974, the World Bank Assisted Agricultural Developments Projects, (ADPS) 1975; Operation Feed the Nation (OFN) 1976; others are the River Basin Development Authorities (RBDAS) 1977. The Back to Land Programme (BLP) and the Directorate of Food, Roads, and Infrastructures (DFRRI) both in 1988, the National Land Development Authorities (NALDA) 1991, and Special Foods Security Programme (SFSP) 2001. However, these efforts have failed to yield satisfactory results because the problems are still persisting.

Satisfactory results could not be attained because of the persistent failure to recognise the role of women in agriculture and refusal to involve them in the various agricultural programs. Policy makers, development planners and agricultural service deliverers in Africa are gender insensitive. They still generally perceive farmers as male (Durno and Stuart, 2005). This is because traditionally, African women are only to provide a helping hand in the production of crops and livestock, a profession, perceived to be men’s job. They failed to realize that there has been a paradigm shift of responsibility resulting from a number of reasons including; adverse economic conditions, wars and migration of some men away from home in the villages to the cities for non-agricultural jobs (FAO, 2005). The responsibility of farm ownership and management has now been shifted to women. Everywhere in the world most especially in the developing world, women have been actively involved in farming, food processing and preservation. Food and Agricultural Organization (FAO 2005) reveals that women farmers make up more than 40 percent of the developing world’s agricultural labour force and grow at least half of the world’s food supply. In Nigeria, studies have shown that women make up some 60-80 percent of agricultural labour force, and produce two-thirds of the food crops depending on the region (Ogunlela and Muktar 2009, Awoyemi and Adekanye 2005, World Bank 2005). Women are involved in land clearing, crop planting and spraying, as well as in post harvest management of agricultural produce. Despite their enormous contributions to agricultural production not much has been documented in relation to their production efficiency this study is therefore, focusing on the productive efficiency of women farmers.

The theoretical framework for this study rests on the theory of production since efficiency is the major concern in production economic analysis. Efficiency in production is a way of ensuring that products of firms are produced in the best and most profitable way. Measurement of production efficiency is often in a relative
term. It is measured as the distance between observed input-output combinations and the best – practice frontier. The best - practice frontier represents the maximum output attainable from each input level.

Several approaches, which fall under two broad groups of parametric and non-parametric methods, have been used in empirical studies to estimate the best practice production frontier. Of these, the parametric stochastic frontier approach (SFA) (Aigner et al.1977: Meeusen and Van den Broeck 1977) and the non-parametric approach, data envelopment analysis (DEA) (Charnes et al. 1978) are the two most popular techniques. Because DEA is less data demanding, works with multiple inputs and multiple outputs in the absence of market prices and does not require knowledge of the proper functional form of the frontier, error and inefficiency structures (Ceolli,2005), it has been preferred over stochastic frontier analysis.

The objectives of this study include, determining farm level productive efficiency measures for women food – crop farms in the derived savannah of Nigeria, identifying important factors causing differentials efficiency among woman farms and developing policies based on these productive efficiency measures and their determinants.

The outcome of the research is to provide some of the missing link - farm-level factors preventing the achievement of the broad objective of the Nigeria agricultural policy of food self sufficiency. The study is different from similar efficiency studies in literature because it considers agricultural activities of only women farmers on the assumption that both male and female farmers do not face the same input and output markets as well as level of technology and risks.

The concept of DEA

DEA provides a comprehensive analysis of relative efficiency of a farm (or a decision making unit (DMU). It evaluates each DMU and measures its performance relative to an envelopment surface composed of other DMUs. Units that lie on the surface are deemed efficient, those that do not lie on the surface are termed inefficient and the analysis provides a measure of their relative efficiency. In the DEA, the envelopment surface and the efficient projection path depend on the type of model specified which could be input or output oriented. The choice of the model depends upon optimization production process characterizing the firm; input oriented DEA determines how much of the inputs mix a firm would have to change to achieve the output level that coincides with the best practice frontier. Output oriented DEA on the other hand is used to determine a firm’s potential output given its inputs mix if operated as efficiently as firms along the best practice frontier. The envelopment surface will also differ depending on the scale assumptions that underline the model. This could either be constant return to scale (CRS) or variable return to scale (VRS). For the purpose of this study, input – oriented under VRS DEA model was used to determine productive efficiency of women food crop farms. This is because farms tend to have greater control over their inputs than over their outputs (Helena 2005)

Research Methodology

This study was conducted in the derived savannah zone of Nigeria. Two states including Kwara and Kogi States were used. Kwara State lies within 7°45’N and 6°40’E and Kogi State lies within 7°30N’ and 6°42’E. Kwara State has a total population of 2,701,056 with males being 1,550,548 and females 1,150,508. Total population in Kogi State is 3,278,495 comprising of 1,691,737 males and 1,586,758 females (NPC, 2006)
The study area is basically agrarian more than 80 percent of the population are farmers and more than 50 percent of the farmers according to (NBS, 2006) are women in the two states. The region is blessed with suitable ecological and climatic conditions for the production of various agricultural products including cash crops and food crops such as yam, cassava, soya bean, cocoyam, maize, millet, rice, guinea corn, palm produce and cowpea.

Primary data were collected using structured questionnaires. Information was collected on quantity and value of output, quantity and cost of inputs, market and farm gate prices, hired labour and family labour. Others are socio-economic characteristics of farmers such as age, level of education, family size, farming experience, marital status, income level, source of farm credits and loans. Secondary data were also collected through record books and year books.

The selection of respondent women farmers involved four stages. The first stage was a random selection of four ADP administrative zones from the eight ADP strata in the two states. The second stage involved random selection of four extension blocks one from each selected ADP’s stratum. These included Aiyetoro-gbede and Kotankerfi from Kogi State. Ilorin East and Igbaja from Kwara State. The third stage of sampling was a purposeful selection of four villages with a high concentration of women from each block with the help of the list of women farmers provided by the state ADPs. In the fourth, 10 to 16 women farmers were randomly selected from each selected villages on the basis of probability proportionate to size. A total of 180 samples were used for analysis. Three analytical techniques including; descriptive statistics, Data Envelopment Analysis (DEA), and One-stage least square regression analysis were employed to analyze the collected data.

**Analytical Framework**

**Descriptive Statistics**

This involves mainly the use of means, percentage, frequency distributions, minimum and maximum values to show the various findings about the respondents in the study area. The mean and percentage are derived from the following formula:

\[
\text{Mean} = \bar{x} = \frac{\sum X_i f}{\sum f}
\]

\[X_i = \text{Observed Variable}\]

\[f = \text{Number of time the variable occurs}\]

\[
\text{Percentage} = \frac{X_i \times 100}{\sum X_i}
\]

**Data Envelopment Analysis Model**

Following Farrell (1957) it is possible to describe the productive efficiency of a farm through the determination of technical, allocative and economic efficiency of firms. From the output perspective, technical efficiency measures potential increase in output keeping the level of input constant, allocative efficiency under same perspective is a revenue maximizing problem. However, under input perspective, technical efficiency measures the ability of a firm to produce a maximum level of output from a given level of inputs while allocative efficiency measures the ability of a firm to combine inputs in optimal proportion to minimize cost.
The combination of these two measures yields a measure of overall economic efficiency used to explain the productive efficiency of women food crop farms in the study area.

To determine the productive measures, we constructed an input-oriented DEA model assuming that each food crop farm produces quantity of output \((y_i)\) using multiple inputs \((x_i)\) and that each farm \((i)\) is allowed to set its own set of weights for both inputs and output. The data for all farms are denoted by the \(K*N\) input matrix \((X)\) and \(M*N\) output matrix \((Y)\). Using piecewise technology, the input-oriented measure of technical efficiency (TE) was calculated as a solution to the following programming problem;

\[
\text{Min } \theta_i
\]

\[
\text{Subject to } \begin{align*}
-y_i + Y\lambda & \geq 0 \\
\theta x_i - X\lambda & \geq 0
\end{align*}
\]

\(\lambda = 0\)

\(\theta \in (0, 1)\)

Where,

\(\theta_i\) is farm \(i\)’s index of technical efficiency relative to other firms in the sample

\(y_i\) and \(x_i\) represent output and input of farm \(i\) respectively

\(Y\lambda\) and \(X\lambda\) are the efficient projections on the frontier

\(\lambda = \) is an \(n \times 1\) vector of variable weights attached to be estimated

A measure of \(\theta_i = 1\) indicates that the firm is completely technically efficient. \(1 - \theta_i\) therefore, measures the relative technical efficiency of the firms. It also indicates how much firm \(i\)’s input can be proportionately reduced without loss in output.

The above DEA model was constructed under the assumption of constant return to scale (CRS). However, Coelli et al (2005) had pointed out that the assumption of CRS model is only appropriate when farms are operating at an optimal scale that factors such as imperfect competition and financial constraints may prevent some farms from operating at optimal scale. Using the CRS DEA model therefore, when farms are not operating at their optimal level will cause TE measures to be influenced by scale inefficiencies and makes the measures incorrect. Since food crop farms in the research area conducted their activities under imperfect condition due to imperfect information about market such as input and output prices and because the size of farms made them ineligible for institutional loans, we transformed \((\text{Eq 1})\) to variable returns to scale (VRS) model by adding convexity constraint; \(N1\lambda = 1\). This decomposes the TE (CRS) into two components; Pure technical efficiency (PTE) which reflects the ability of the farm to obtain maximal output at an optimal scale and Scale efficiency (SE), which reflects the distance of an observed farm from the -most productive scale size. Farms that are scales efficient are of appropriate size and do not need to be re organized to improve output or earnings.

The VRS DEA model is presented as;

\[
\text{Min } \theta_i
\]

\[
\text{Subject to } \begin{align*}
-y_i + Y\lambda & \geq 0 \\
\theta x_i - X\lambda & \geq 0
\end{align*}
\]

\(N1'\lambda = 1\)

\(\lambda = 0\)

\(\theta \in (0, 1)\)
Where
\[ N1'\lambda = 1 \] is the new constraint
\[ N1 \text{ is a N*I vector of ones} \]
The economic efficiency measure was derived through VRS assumptions by solving the following cost-minimization problem;

Min \( w_i x_i^* \)
subject to
\[ -y_i + Y\lambda = \geq 0 \]
\[ x_i^* - X\lambda = \geq 0 \] (EQ 3)
\[ N1'\lambda = 1 \]
\[ \lambda \geq 0 \]
Where
\( w_i \) represent firm i’s vector of input prices
\( x_i^* \) is the cost- minimizing input bundle faced by farm i. The economic efficiency for farm i was then solved by computing

\[ EE_i = \frac{w_i x_i^*}{\text{Min cost}} \] (Eq 4)

This is the ratio of observed cost to the minimum cost the farm faces if using the optimal input bundle.
The allocative efficiency was then calculated as;

\[ AE_i = \frac{EE_i}{\text{TE}_i} \] (Eq 5)
Which measures farm i’s relative ability to allocate the input-bundle in the cost minimizing way, given the estimated technology.

The variables of DEA model include:-

\( Y_{ij} \) = Vector of outputs including maize, sorghum, yams, cassava and cowpea
\( X_{ijs} \) = Vector of inputs - these include:-
\( X_1 \) = Planting materials (GE)
\( X_2 \) = Family labour (days)
\( X_3 \) = Hired labour (days)
\( X_4 \) = Farm size (Ha)
\( X_5 \) = Fertilizer (kg)

Measurement of Inputs and Output Variables

Maize, sorghum and cowpea seeds were measured in kg on the field. Yam seeds are not common in the area of study; the farmers therefore planted yam setts. A standard yam sett planted weighed about 250 gms. Total yam setts for each farmer were summed up and converted to kg. Similarly, cassava stems were obtained in bundles. One standard bundle contains 50 cassava sticks of 1.0 m each and weighed 5.0 kg. The quantity of each planting material was later converted to grain equivalent for the sake of aggregation by using grain equivalent conversion factors by Clark and Haswell (1970). Labour was measured in standard man day - eight – hour work period. Farm Size measurement was in hectares. Since small scale farmers usually cultivate their
crops on various plots, the numbers of plots cultivated by each woman farmer were measured and summed up to get the total farm size. Fertilizer was in kg.

Maize, sorghum and cowpea outputs from each farm were measured in kg right from the farm. The outputs of yam and cassava crops were measured in tons on the field then converted to kg and later adjusted to Grain Equivalent (GE) using the conversion factors.

Table 1.0: Summary Statistics on Farm Inputs Used Per Woman Farmer in the Study Area

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Mean</th>
<th>Stddev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm size (ha)</td>
<td>0.79</td>
<td>0.5</td>
<td>0.5</td>
<td>10</td>
</tr>
<tr>
<td>Farm plots (No)</td>
<td>2.1</td>
<td>0.84</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Family labour (days)</td>
<td>134.54</td>
<td>36.8</td>
<td>1</td>
<td>170</td>
</tr>
<tr>
<td>Hired labour (days)</td>
<td>132.55</td>
<td>66.4</td>
<td>0</td>
<td>809</td>
</tr>
<tr>
<td>Maize seeds (Ge)</td>
<td>13.6</td>
<td>51.24</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>Sorghum seeds(Ge)</td>
<td>1.06</td>
<td>3.11</td>
<td>0</td>
<td>14.4</td>
</tr>
<tr>
<td>Yam setts(Ge)</td>
<td>167.77</td>
<td>197.92</td>
<td>0</td>
<td>937</td>
</tr>
<tr>
<td>Cassava(Ge)</td>
<td>11.51</td>
<td>7.26</td>
<td>0</td>
<td>16.5</td>
</tr>
<tr>
<td>cowpea(Ge)</td>
<td>6.68</td>
<td>23.21</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>Fertilizer (Kg)</td>
<td>95.20</td>
<td>150.18</td>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td>Agrochemical (Litres)</td>
<td>1.64</td>
<td>2.12</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Farm tools (no)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) Hoes</td>
<td>3.84</td>
<td>1.85</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>(ii) Cutlass</td>
<td>2.46</td>
<td>1.68</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Extension visits</td>
<td>14</td>
<td>12.23</td>
<td>0</td>
<td>48</td>
</tr>
</tbody>
</table>

Table 2.0: Summary Statistics on Farm outputs Per Woman Farm in the Study Area

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize (GE)</td>
<td>932.50</td>
<td>129.30</td>
<td>0</td>
<td>1000</td>
</tr>
<tr>
<td>Sorghum (GE)</td>
<td>55.92</td>
<td>13.6</td>
<td>0</td>
<td>806</td>
</tr>
<tr>
<td>Cassava (GE)</td>
<td>1.48</td>
<td>2.0</td>
<td>0</td>
<td>13.5</td>
</tr>
<tr>
<td>Yam (GE)</td>
<td>409.48</td>
<td>116.62</td>
<td>0</td>
<td>800</td>
</tr>
<tr>
<td>Cowpea (GE)</td>
<td>43.04</td>
<td>19.1</td>
<td>0</td>
<td>168.0</td>
</tr>
</tbody>
</table>
Regression Analysis

Literature specified four major approaches to assessing environmental factors influencing efficiency of a farm. These include; the approach of Banker and Morey (1986), the method proposed by Charnes et al (1981), the approach of adding environmental variables directly into the linear programming formulation and the two-stage method (Coelli et al 2005). The two-stage method was used in this study to assess the influences of farm-based factors on measures of productive efficiency. Cobb-Douglas production function was used to estimate the potential determinants of the productive efficiency measures (PEM). These include: Years of schooling, farming experience, family size, Membership of an Organization (MBO) and number of plots and access to credit. The function is expressed as:

\[
PEM_i = a Z_1^{b_1} Z_2^{b_2} Z_3^{b_3} Z_4^{b_4} Z_5^{b_5} Z_6^{b_6} Z_7^{b_7} e \]

Where

- \( PEM_i \) = Productive efficiency measure (is EE measure being the product of TE and AE)
- \( Z_1 \) = Years of schooling (years)
- \( Z_2 \) = Farming experience (Years)
- \( Z_3 \) = Family size (No)
- \( Z_4 \) = Membership of organization (No)
- \( Z_5 \) = number of plots (No)
- \( Z_6 \) = Access to credit (Dummy Variable Yes = 1 otherwise = 0)
- \( Z_7 \) = Access to extension (Dummy Variable Yes = 1 otherwise = 0)

\( b_1 \) – \( b_7 \) = coefficients to be determined
\( a_0 \) = constant term
\( e \) = error term

For the Cobb-Douglas production function to be easily applied in a form amenable to practical purposes it has to be linearised through conversion into double logarithmic function expressed as:

\[
\ln EE_i = a_0 + b_1 \ln Z_1 + b_2 \ln Z_2 + b_3 \ln Z_3 + b_4 \ln Z_4 + b_5 \ln Z_5 + b_6 \ln Z_6 + b_7 \ln Z_7 + e \]

Where,

- \( EE_i \), \( Z_1 \) – \( Z_6 \), \( b_1 \) – \( b_7 \), \( a_0 \) and \( e \) are as defined above
- \( \ln \) = natural logarithm

RESULT AND DISCUSSION

Socio-Economic Characteristics of Women Farmers

The summary of the socio-economic characteristics is presented in Table 3.0. The table reveals the average household size of 7 persons consisting 4 adult members and 3 children. Women farmers were experienced with an average farming experience of 20 years, had an average of 4.5 years of formal education, a number of farm plots raging between 1and 5 and belonged to one or two or more agricultural associations with less than half of the sample having access to credit facility.
Table 3.0: Descriptive Statistics for Selected Socio-economic characteristics of Women Farmers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming Experience (Years)</td>
<td>1</td>
<td>50</td>
<td>20.42</td>
<td>12.26</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>0</td>
<td>14</td>
<td>4.5</td>
<td>1.58</td>
</tr>
<tr>
<td>Family Size (No)</td>
<td>2</td>
<td>20</td>
<td>7.80</td>
<td>4.72</td>
</tr>
<tr>
<td>Adult Members (No)</td>
<td>1</td>
<td>17</td>
<td>4.6</td>
<td>2.98</td>
</tr>
<tr>
<td>Children (≤ 15 years) (No)</td>
<td>0</td>
<td>10</td>
<td>3.06</td>
<td>2.43</td>
</tr>
<tr>
<td>No of plot</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>0.84</td>
</tr>
<tr>
<td>Access to extension</td>
<td>0</td>
<td>48</td>
<td>14</td>
<td>12.23</td>
</tr>
<tr>
<td>Membership of association</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>1.23</td>
</tr>
<tr>
<td>Access to credit</td>
<td>0</td>
<td>45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PRODUCTIVE Efficiency

The efficiency measures for the sample women food crop farms are presented in Table 4.

Table 4.0: Efficiency measures for sample women farms (N = 180)

<table>
<thead>
<tr>
<th>Efficiency measures</th>
<th>Mean</th>
<th>Maximum</th>
<th>Minimum</th>
<th>No. of efficient farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Efficiency (EE)</td>
<td>0.844</td>
<td>1</td>
<td>0.12</td>
<td>2</td>
</tr>
<tr>
<td>Allocative Efficiency (AE)</td>
<td>0.890</td>
<td>1</td>
<td>0.29</td>
<td>5</td>
</tr>
<tr>
<td>Technical Efficiency (TE)</td>
<td>0.948</td>
<td>1</td>
<td>0.41</td>
<td>12</td>
</tr>
<tr>
<td>Pure Technical Efficiency (PTE)</td>
<td>0.846</td>
<td>1</td>
<td>0.20</td>
<td>137</td>
</tr>
<tr>
<td>Scale Efficiency (SE)</td>
<td>0.936</td>
<td>1</td>
<td>0.10</td>
<td>13</td>
</tr>
</tbody>
</table>

The mean efficiency measures of the farms including technical, allocative and economic efficiency measures are 0.948, 0.890 and 0.844 respectively. The fact that the means for all the measures are more than 80% implied some degrees of productive efficiency on the part of the women farms and this tends to show that the women farmers would not allow much waste of resources. However, the result showed some levels of inefficiency in the use of farm resources implying that the input mix of the women farmers in the study were not consistent with cost minimization, as such; they could not obtain maximum possible output from the use of resources and technology available to them. The mean technical inefficiency of (1 – 0.948) or 5.2%, allocative inefficiency of (1 – 0.890) or 11% and economic inefficiency of (1 – 0.844) or 15.6% implies overutilization of some resources as a result of wrong mix resulting into excessive cost of production. To be productively efficient and achieve an output level that will coincide with the best practiced frontier, an average inefficient farm would have to reduce the level of input used by 5.2% which will consequently reduce cost of production by 15.6%. In other words the farms should adopt appropriate mix of resources with least costs. The outcome of this study agrees with Awoyemi and Adekanye (2005); Gender analysis of economic efficiency in cassava-based farm holdings in South-Western Nigeria, they discovered that female cassava farms were not cost effective, their input mix were not consistent with cost minimization.

The scale efficiency of 0.936 showed that an average woman farm was yet to get to the optimal level. The main reason may be because of the relatively small scale production of the women farms in the research area.
Most (87%) of the farms were still at the stage of increasing return to scale (IRR) where there is more proportionate change in output with a little change in input level. These findings showed that there is still some room for improvement in food crop production in the study area without necessarily changing the present available technology. This finding conforms with Vedat and Kerem (2010). They found out that all their sample farms exhibited increasing returns to scale. The samples farm were also relatively small.

**Result of One - Stage Least Squares regression analysis**

The factors affecting productive efficiency of women food crops farms in the Derived Savannah of Nigeria was determined through the factors influencing the overall farm efficiency - the economic efficiency which is the product of technical and allocative efficiency. This was done by estimating the earlier stated Cobb-Douglas function and the explicit result is given as:

\[
\text{Log EE} = -0.5360 + 0.0071 \ln x_1 - 0.027 \ln x_2 + 0.194 \ln x_3 + 0.1061 \ln x_4 \\
-0.4092 \ln x_5 + 0.0492 \ln x_6 + 0.089\ln x_7 + e 
\]

\(-4.60)*** (0.48) (-2.97)** (4.01)*** (1.99)*

\(-5.17)*** (0.46) -0.325)

The result is presented in table 5

**Table 5.0 Estimates of the One - stage Least Squares Regression Analysis**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parameters</th>
<th>Coefficients</th>
<th>t values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>a_0</td>
<td>-0.5360</td>
<td>-4.60***</td>
</tr>
<tr>
<td>Education</td>
<td>b_1</td>
<td>0.007127</td>
<td>0.488342</td>
</tr>
<tr>
<td>Year of farming</td>
<td>b_2</td>
<td>0.027134</td>
<td>(-2.972891)**</td>
</tr>
<tr>
<td>Family size</td>
<td>b_3</td>
<td>0.194</td>
<td>4.01***</td>
</tr>
<tr>
<td>Membership of</td>
<td>b_4</td>
<td>0.1061</td>
<td>1.99*</td>
</tr>
<tr>
<td>association</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of plots</td>
<td>b_5</td>
<td>-0.4092</td>
<td>-5.172***</td>
</tr>
<tr>
<td>Access to credit</td>
<td>b_6</td>
<td>0.0492</td>
<td>0.46</td>
</tr>
<tr>
<td>Extension</td>
<td>b_7</td>
<td>-0.089603</td>
<td>-0.325835</td>
</tr>
<tr>
<td>F cal</td>
<td></td>
<td>23.33</td>
<td></td>
</tr>
<tr>
<td>Prob &gt; f</td>
<td></td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td>R^2</td>
<td></td>
<td>53.37</td>
<td></td>
</tr>
</tbody>
</table>

Note: *** = 1%, ** = 5% and * = 10%

**Factors affecting productive efficiency of Women Farms**

The result of the OLS Regression shows that four of the six variables have significant impact on the productive efficiency of the farms. These include – family size (P<0.01), farming experience, membership of association, and number of plots (P<0.05). Family size is positively correlated with the efficiency and it is significant at 1% level, implying that a large family size enhances productive efficiency on women farms. This
signifies the importance of family size in the provision of cheap family labour for food production. Larger farm families provide farmers with a variety of labour (children, youth, men and women), which leads to division of labour and specialization. This finding agrees with Seidu (2008) that large family size enhances efficiency on non-irrigated lands.

Number of plot is significant at 1% level and is negatively correlated with productive efficiency. This shows that land fragmentation causes decline in efficiency. It makes mechanization and cost of production more expensive and adds to the distance that will be covered by the farmers. This agrees with Parikh et al (1995); Kebede, (2001) and Adewuyi (2002) that land fragmentation leads to inefficiency. Similarly the coefficient of Year of farming is significant at 5% level and also had negative effect on the efficiency of the women farms. A possible explanation for the estimated effect is that new entrants are more knowledgeable about recent technological advances than their older counterparts. They are more likely to adopt new and better techniques than older farmers. This result is consistent with the findings of Mario (2006), Yusuf and Malomo (2007), Adewuyi (2002) They found out that increase in farming experience caused efficiency of farms to decline. However, membership of farmers association is positively significant. This implies that women farms who are members of farmers association tend to be more productive presumably due to their enhanced ability to acquire technical knowledge through sharing of information on crop husbandry, marketing channels and others at association level. This finding agrees with Seyoun et al (1998) and Yusuf and Malomo (2007), Binma et al (2004) and Chirwa (2007) on Membership of association. The estimated coefficients of both years of education and extension visits are not significantly related to the efficiency of women farms. This is because it is not higher education or number of extension visits that matter in economic efficiency but technical ability to achieve optimal combination of inputs. The finding is consistent with Sharma et al., (1999) findings. The coefficient of access to credit though positive is not significant suggesting that it does not contribute much to efficiency of women farmers in the study area. The fitness of the model is confirmed by the significance of f-statistics at 1%. This implies that all the variables had a joint impact on the dependent variable.

**CONCLUSION**

Women farmers in the study are predominately illiterates and small-scale food producers who cultivate on fragmented farm land and learn the art of farming from their experience and those of their forefathers. They relied largely on family labour, their input mix were not consistent with cost minimization, as such; they could not obtain maximum possible output from the use of resources and technology available to them. Factors found contributing to the shortfalls in productive efficiency among women farms are land fragmentation and years of farming.
7.4 RECOMMENDATIONS

Following from the findings and conclusion the following recommendations are made.

The strong relationship existing between economic efficiency and family size, an important source of family labour is a pointer to the fact that women farmers have to rely heavily on family labour to satisfy the household needs, this may have negative implication on the rural children who are suppose to be in schools considering their age, but been used to provide farm support. Therefore, for a better tomorrow of the rural children and economic development of the country, labour substituted modern farm implements specifically designed for female farmers should be provided.

Also the negative but significant relationship between economic efficiency and farming experience has shown that experience alone is not enough for appropriate combination of resources for maximum output. There is therefore, the need for the policy makers to make adequate provision for technical training for the purpose of increasing food productivity in the study area in particular and Nigeria in general.

The positive relationship between economic efficiency and membership of farmers associations shows that women farmers gain technical skills from cooperative activities. Formation of more cooperative societies should therefore be encouraged.

REFERENCES


