Optimum Farm Plan for Food Security among Smallholder Farmers in Imo State, Nigeria

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The paper determined optimum farm plan for food security among smallholder farmers in Imo State, Nigeria. Data were collected with structured and validated questionnaire from 180 smallholder crops farmers in Imo State. Data were analyzed using descriptive statistics (mean, frequency distribution and percentages), budgetary analysis and linear programming model. Results show that the mean age of the farmers was 41 years, mean household size was 9 persons, mean farm size was 1.25 hectares mean farming experience was 19 years and mean level of education was 8.3 years. The enterprises that contributed greatly to the smallholder farmers’ net return were food crops and cash crops with net returns per annum of N122666 and N116850 respectively. The profit lines as determined with the linear programming model were 6.8 and 4.9 for food crops and cash crops respectively, and this is the optimal feasible solution.


Key words: Food security, optimum farm plan, smallholder farmers, Imo state

1. Introduction

Food security means access by all the people at all times to the food required for them to lead an active healthy and productive life. Food security is not synonymous with food sufficiency. Food security is possible without food sufficiency if there is adequate capacity to acquire additional food from external source to meet food requirement (Olayide, 1980; Alagba et al, 2009). Food is a major concern of every country. Various reasons have been given for the decline of food output in Nigeria, and they include the cultivation of low yielding crop varieties, the absence of low cost and adaptable technology (Olayide, 1975), lack of breakthrough in agricultural investment, unwillingness of the entrepreneurial class to devote organizational ability to food production, and low status accorded to farmers in the society (Aderinola, 1989; Ezekiel et al, 2009).

Despite the fact that there has been concerted efforts on the part of government, donor agencies and farmers to accelerate the growth in food demand and supply, there is still short fall in food supply, which is further aggragated by the disparity between the estimated annual population growth of 3.5% compared to an estimated 2.0% annual rate of food production (Ojo et al, 1993). This shortfall in food production leads to massive food importation, which drains the country’s foreign exchange reserves (Ezekiel, et al, 2009).

The research question Nigeria now is, how can food security be achieved? Attainment of food security is a matter of utmost concern at both the household and national levels. Hence, this paper is therefore designed to;
(1) examine the socioeconomic characteristics of the smallholder farmers in Imo state,
(2) determine the net returns earned by the farmers, and
(3) determine the best farm enterprise combination to achieve optimum level of production.

2. Materials and methods

This study was conducted in Imo state, Nigeria. The state comprises of three agricultural zones, namely; Owerri, Orlu and Okigwe, and subdivided into 27 Local Government Areas (LGAs).
The state has land area of about 5,100.10 Square kilometers (Imo State Statistical Year Book, 2004) and estimated population of 3.7 million people (FGN, 2006). Agriculture is the major occupation of the people and food production is patterned by seasonal distribution of rainfall. Food scarcity as experienced by most households in Imo state.

Sample Selection
A representative sample was selected through a multistage sampling technique. Two LGAs were purposively selected from each agricultural zone, so as to ensure the selection of actual LGAs where crops production is dominant and to exclude urban LGAs. From each LGA, three communities were randomly selected making a total of 18 communities. The list of communities was got from the community development officer at the LGA Headquarters. The sampling frame was the list of registered crops farmers in the communities with the All Farmers Association of Nigeria (ALFAN) Owerri office. From this sampling frame totaling 205, 242 and 185 for owerri, Orlu and Okigwe Agricultural zones respectively, proportionate and random sampling techniques were employed to select 58, 69 and 53 farmers from owerri, Orlu and Okigwe Agricultural zones respectively giving a sample size of 180 farmers for the study.

Data Collection
Data were collected mainly from primary source. The primary data were obtained through the use of structured and validated questionnaire supplemented with personal observation. Questionnaire were administered through cost route approach. Data were collected on variables such as socioeconomic characteristics of farmers such as age, household size, farm size, farming experience and level of education. Data collection lasted for 11 months, between February and December, 2010.

Data Analysis
Data were analyzed using descriptive statistics (mean, frequency distribution and percentages), budgetary analysis and basic linear programming model.

Descriptive statistics were used to analyze socioeconomic characteristics of the farmers.

Budgeting analysis was used to determine the net return of farmers for each enterprise in the study area.

The Budgetary or Net return model is specified as follows;
NR = TR – TC
Where;
NR = Net Return
TR = Total Revenue
TC = Total Cost (TVC + TFC)
TVC = Total Variable Cost
TFC = Total Fixed Cost

The basic Linear Programming (LP) model was specified to maximize Total Gross Margin (TGM) for each of the enterprise to ascertain the most optimal enterprise combination and production levels within the limit of the resources constraint specified.
The model as used by Ezekiel et al (2009) is specified as:
Maximize TGM = \sum_{J=1}^{n} C_i \times X_j \quad \quad (1)
Subject to,
\sum_{j=1}^{n} a_{ij} \times X_j \leq b_i \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 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developing countries cultivate small plots and their farming system is subsistence in nature.

The mean farming experience of the smallholder farmers was 19 years, indicating that the smallholder farmers have acquired enough experience to engage into profitable enterprises to improve food security. The mean level of education was 8.3 years, which implies that most of the farmers are literate enough to use improved farming practices and adopt recommended technologies to improve food security in the study area. These findings are similar to those of Ezekiel et al. (2009) and Amao (2009).


The estimated gross margin and net returns for each of the enterprises is presented in Table 2. The table shows that the average contribution of each enterprise to the smallholder farmers was ₦203,167 (33.04%) for cash crops, ₦190,305 (30.95%) for food crops, ₦142,016 (23.09%) for fruits, and ₦79,463 (12.92%) for vegetables. This result indicates that the enterprises that contributed greatly to the smallholder farmer’s net return were the food crops and cash crops enterprises with net return per annum of ₦122,666 and ₦166,850 respectively.

Table 1. Summary of socioeconomic characteristics of farmers

<table>
<thead>
<tr>
<th>Variable</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>41</td>
</tr>
<tr>
<td>Household size (No. of persons)</td>
<td>9</td>
</tr>
<tr>
<td>Farm size (Ha)</td>
<td>1.25</td>
</tr>
<tr>
<td>Farming experience (years)</td>
<td>19</td>
</tr>
<tr>
<td>Level of education (years spent)</td>
<td>8.3</td>
</tr>
</tbody>
</table>

Table 2. Estimated Gross Margin and Net return for each enterprise

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CASH CROPS</th>
<th>FOOD CROPS</th>
<th>FRUITS</th>
<th>VEGETABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>₦203,167</td>
<td>₦190,305</td>
<td>₦142,016</td>
<td>₦79,463</td>
</tr>
<tr>
<td>Total Revenue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Variable Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of hired labor</td>
<td>₦37,406</td>
<td>₦25,675</td>
<td>₦18,905</td>
<td>₦7,445</td>
</tr>
<tr>
<td>Imputed cost of family Labor</td>
<td>₦8,115</td>
<td>₦8,946</td>
<td>₦5,439</td>
<td>₦7,084</td>
</tr>
<tr>
<td>Cost of inputs</td>
<td>₦19,317</td>
<td>₦5,503</td>
<td>₦5,307</td>
<td>₦2,105</td>
</tr>
<tr>
<td>Total VC</td>
<td>₦64,838</td>
<td>₦30,124</td>
<td>₦32,651</td>
<td>₦17,498</td>
</tr>
<tr>
<td>Gross margin</td>
<td>₦138,329</td>
<td>₦140,811</td>
<td>₦109,365</td>
<td>₦61,965</td>
</tr>
<tr>
<td>Fixed cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation on capital items</td>
<td>₦6014</td>
<td>₦5209</td>
<td>₦4516</td>
<td>₦3073</td>
</tr>
<tr>
<td>Interest on loan</td>
<td>₦15,465</td>
<td>₦12,306</td>
<td>₦9,075</td>
<td>₦7,115</td>
</tr>
<tr>
<td>Total FC</td>
<td>₦21,479</td>
<td>₦17,515</td>
<td>₦13,591</td>
<td>₦10,188</td>
</tr>
<tr>
<td>Total Cost</td>
<td>₦86,317</td>
<td>₦67,639</td>
<td>₦46,242</td>
<td>₦27,686</td>
</tr>
<tr>
<td>Net return</td>
<td>₦116,850</td>
<td>₦122,666</td>
<td>₦95,774</td>
<td>₦51,777</td>
</tr>
</tbody>
</table>

Determination of the Best Farm Enterprise Combination

Linear programming was used to determine the optimum Gross Margin and profit line of the two enterprises (food crops and cash crops). The linear programming equation was subjected to three constraints; land, capital and labour. The profit line was found to be 6.8 and 4.9 for food crops and cash crops respectively, and this is the optimal feasible solution.

4. Conclusion

The study determined the optimum farm plan for food security among smallholder farmers in Imo State Nigeria. The enterprises that contributed immensely to the smallholder farmers’ net return were food crops and cash crops with net return of ₦122,666 and ₦166,850 respectively. The profit line resulting from linear programming analysis were 6.8 and 4.9 for food crops and cash crops respectively, and this is the optimal feasible solution. It is therefore recommended that concerted effort should be made by both private and public stakeholders in agriculture to facilitate sustained food security status through more investment in food and cash crop production that have shown high profit margin.

References
