Economic analysis of oil palm and food crop enterprises in Edo and Delta states, Nigeria

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Abstract: Sustainable and stable mixed Oil palm food crop enterprise in Nigeria requires that farmers are guided by economic rationale for the choice of Oil palm food crop combination. The study determines the profitability of Oil palm Food crops combinations among small holder oil palm farms in Edo and Delta States Nigeria. Multi-stage sampling technique was employed for the study. Nine Local Government Areas (LGAs) with the highest concentration of oil palm farmers were selected. Five villages were selected from each LGA. Three farmers from each village were randomly selected, giving 60 farmers from Edo and 75 from Delta States as respondents. Data were collected on quantities and price of farm inputs and outputs. The seven crop combinations identified were Oil palm/plantain (OP), Oil palm/cocoyam (OC), Oil palm/cassava/maize (OCaM), Oilpalm/cassava/cocoyam (OCaC), Oilpalm/plantain/cocoyam (OPC), Oilpalm/maize/cocoyam (OMC) and oil palm/plantain/ cocoyam/maize (OPCM). Budgetary analysis and discounted cash flow technique were used in analyzing the data. The budgetary analysis shows that OC combination gave the highest return of N84,207:00/ha while OCaC combination recorded the largest negative return of N187,162:00/ha. The result of the profitability analysis shows that all the seven cropping systems considered are profitable. Sensitivity analysis indicate that the profitability of inter cropping of oil palm with plantain and oil palm with cocoyam are very stable. Mixed cropping of oil palm with maize and cocoyam, oil palm cassava and maize, oil palm plantain and cocoyam, oil palm plantain cocoyam and maize, oil palm cassava and yam are stable. Given the price, yield and other uncertainties in agriculture and specifically in the given situation, the probability of attaining the profits prescribed by the estimates are higher for the very stable cropping systems.

Keywords: Oil palm, food crops, Small holder farms, Profitability Analysis, budgetary analysis

INTRODUCTION

Intercropping of oil palm with food crops is the prevalent practice among the small- holder farmers. A wide variety of food crops are intercropped with the oil palm by this group of farmers. Productivity in a typical farmers field is however low due to inappropriate agronomic practices. Past efforts to develop appropriate technology to increase the productivity of the oil palm and food crops cropping systems showed that intercropping of the oil palm with various food crops had no adverse effects on the growth and development of the oil palms(Onwubuya, et al.,1989). More recent trials (Udosen et al., 2005) showed the benefit of appropriate cropping mixture and planting sequence on the productivity of the system under 4-year intensive intercropping. Typically, all these old trials were carried out under standard oil palm spacing of about 9mx 9m triangular, and this permit the growing of most food crops in the oil palm interrow for
only the first 3 to 4 years of oil palm planting after which the palm canopy closes. However for various reasons among which are population pressure on available land, labour utilization and some economic reasons, the farmers would usually like to intercrop their palms continuously throughout the life of the palm. Previous studies on the intercropping of oil palm spacing of 9mx9m triangular have shown that it is beneficial to plant food crops in the wide oil palm interlines during the first four years before the canopy closes so fertility of the soil should be enriched with inorganic fertilizers after several years of intercropping. The oil palm spacing of 9mx16m and 9mx20m have been recommended for continuous intercropping with food crops as fresh fruit bunch yields per hectare were better at these spacing (Ugbah et al., 2009). However the economic implication of intercropping oil palm with various food crops under normal oil palm spacing of 9mx9m triangular as presently practiced by small holder oil palm farms have not been empirically determined. The relative profitability of the existing and potential intercropped and mixed cropping enterprises among the oil palm farming households are determined to estimate the most probable income and expenditure to be expected by these farmers.

METHODOLOGY

The study from which this paper was drawn was carried out in the lowland Rainforest and Mangrove Savanna Zones of Edo and Delta States, Nigeria respectively. The states are two of the 36 states in the country. A multistage sampling technique was used to get the required sample. The states currently have 18 local government and 25 local government areas and have been stratified into 3 zones by the Edo State Agricultural Development Project (Edo ADP) and into 3 zones by the Delta State Agricultural Development Project (DADP). Oil palm farmers in the nine local government areas form the sample frame for the study. The choices of these nine locations were based on the intensity of oil palm production in these areas.

The second stage of sampling involved the purposive selection of villages within these local government areas in which Edo ADP and Delta ADP had contact farmers participating in oil palm cultivation. The last stage was the random sampling of oil palm farmers that were interviewed.

A sample of 135 farmers was taken but only 130 farmers gave consistent responses which were used for the analysis.

Theoretical frame work

This paper relies on budgetary and discounted cash flow techniques.

Budgetary Analysis Concept

A scheme of action prepared in advance is a plan. Farm plan may represent any envisaged change in the organization and operation of the farm. The aim of the whole process is to achieve better allocation of resources or better combination of farm enterprises. However, the goal of planning might be merely to estimate the most probable income and expenditure to be expected from a given enterprise. One of the simplest ways in which farm plans may be documented is through budgeting, which is an attempt to estimate the future outcome of a plan in quantitative terms. Provided a budget is worked out on reasonable assumptions, it can be used to set up income and expenditure
targets against which actual performance can constantly be checked as the plan comes into operation, so that defects in management can be corrected before they have gone too far (this is known as budgetary) (Adesimi, 1988). However, the discrepancies between the budget and the actual performance might be as a result of operational weaknesses.

There are some basic data needed in preparing a budget. They are termed input-output data. These input-output data are estimates of the physical quantities of each resource, seed, fertilizer, labour that will be needed, and of the quantities of output of each kind of product that may be expected to result from the use of these resources. There are two main sources of these input-output data in Nigeria.

(a) Data relating to past experience of the farm itself
(b) Average data computed by National or State Agricultural or Statistical Departments.

The evaluator must be very careful in the process of preparing the input/output data for a farm budget. Estimates of the variable inputs such as fertilizers, seeds, pesticides must be directly related to individual crop hectarage.

There are two types of budgeting analytical tools. These are:

(a) Partial budgeting: This is used when only a partial change in existing plan is being considered. So that if possible, most of the cost and receipt items on the farm will not change. It is considered as a rough form of marginal analysis (Bernard and Nix, 1973).
(b) Complete budgeting; this is appropriate when establishing a new farm.

Several criticisms of budgeting have been advanced, by (Bernard and Nix, 1973), and Adesimi (1988). Firstly, budgeting analysis does not give optimal or most profitable solutions, unlike the mathematical programming techniques. Secondly, economic principles such as the possibilities of diminishing marginal returns or increasing marginal costs, supplementary or complementary relationships between enterprises and resources and discontinuous or lumpy inputs should be considered in drawing up budgets. However, the techniques of budgeting do not seem to ensure that these factors are considered and, in practice, diminishing marginal returns are often ignored, constant average costs and returns are the generally used assumptions. Thirdly, there is also the problem of estimating future prices and yields of outputs of farm. Certainly, uncertainty such as fluctuations in prices and yields exist and even the most skilful and experienced adviser may find it difficult in such cases to forecast results exactly, especially in each individual years. However, the sensitivity analysis caters for the uncertainties in price and yields of output by providing new outcomes when inputs and prices are varied.

Discounted Cash Flow Analysis Concept

In the determination of the profitability of a project or an investment over a period of time, modern economic theory prescribes the use of discounted measures in preference to undiscounted measures. The rate of return on capital and payback period are conventional undiscounted measures of profitability which fail to take into account the earning life of the investment and the time value of money. The discounted measures of profitability, which are
the benefit/cost ratio (B/C), the internal rate of returns (IRR), and the net present value (NPV) measures, overcome the weaknesses of the conventional methods by taking into account the time value of money, the economic life of the investment, and the exact pattern of cash flows. They are used in comparing investment projects of different sizes and different economic lives through the use of present value indices.

The approach directs attention on cash rather than on “profit after depreciation and before tax” thereby excluding depreciation, interest payments and income taxes from operating costs. Depreciation is excluded because the capital investment schedule used in the approach already takes care of the replacement of all depreciable facilities. Interest payments are excluded because the opportunity cost of capital is involved in the discounting process, and income taxes are excluded because they are considered transfer payments and not costs.

In most projects, especially agricultural projects, the time path for committing resources and their yields are different because costs and benefits occur at different times, and the two flows must therefore by reduced to a common denominator to justify comparison. The discounting procedure is used in the process by applying the present value formula:

\[ PV = \sum_{i=1}^{n} \frac{a_i}{(1+r)^i} \]

Where \( a_i \) = either the annual net benefits, or annual costs,
or the annual benefits
\( r \) = the discount rate.
\( PV \) = present value of costs, or benefits or net benefits.

The following three situations define the three discounted methods.

1. When in the formula \( a_i \) refers to gross costs in one case and gross benefits in another so that the two present values are compared given a discount rate \( r \), the benefit/cost ratio method is applicable.
2. If the \( a_i \) values are net benefits and the discount rate \( r \) is known, the NPV method is applicable.
3. Given the situation in (2) above but with \( r \) unknown so that the value of \( r \) is computed which equates the NPV to zero, that value of \( r \) is called the internal rate of return (IRR)

These three methods have their merits and demerits when used in the selection or ranking of projects. The net present value method referred to in this section as the discounted cash flow analysis is computationally the simplest. In the determination of profitability, an investment is profitable if its net present value is positive. For ranking profitable ventures of similar nature and life span, investments with higher net present values are relatively more profitable.

Analytical technique

Budgetary analysis of the crop enterprises

Budgetary analysis has in recent years been employed to decide on which alternative production method the farm operators should adopt. It has been employed to calculate the costs and returns from a year’s historical farm operation data (Okoruwa, 1984). The budgetary analysis carried out in this study was used to highlight the likely returns expected from individual crop enterprises as well as the mixed enterprises. Observations
made during the exercise revealed that oil palm farms most of the time are intercropped with cassava, cocoyam and plantain. However, using the data collected, seven representative crop enterprises in the study area were identified.

The budgetary analytical method involves the identification of different farming operations. The cost implications of the various farming operations of a given enterprise as well as returns from farm produce of the same enterprise are also expected to be identified and documented. The principal farming operations considered in arriving at the costing of farming operations in the annual and perennial crops enterprise are underbrushing, liming out, opening of paths including blocking, cutting and removing of logs, felling using motor saw, beating down, cutting and making pegs, cutting of fire traces. Burning, pegging, re-alignment, preparation of wire collars, planting including holding and carrying seedlings from nursery to field; fixing of wire collars, sowing of cover crop seeds, fertilizer application in the year of planting including field maintenance. Others are harvesting, processing, pest and disease control operations. These operations constitute the variable and fixed costs of the individual crop enterprise or their mixture. The farm revenue is the total value of entire farm output or product of the farmer, factors like crop yield and prices were taken into consideration before arriving at farm revenue.

**Profitability Analysis**

**Discounted cash flow Analysis Procedure**

Use was made of estimates and data collected through interviews to develop and evaluate “ex ante” prototype multi-cropping systems which were then used to test the hypothesis that well planned intercropped enterprises are more profitable than the mixed cropped enterprises currently practiced by the farmers. This was done by comparing the relative profitability of three intercropped and four mixed cropped systems. To estimate the net present values, annual costs and returns from each of the crop enterprise were budgeted for over a twenty five year production period. The annual differences between gross returns and total costs resulted in annual net revenues for each of the twenty five years thus generating a twenty five years net cash flow. The net present value criterion was used as a test of the profitability of each enterprise (Gittinger, 1982) and for comparing the relative profitability of the seven enterprises involved.

**RESULTS DISCUSSION**

**Results of Profitability Analysis**

The objective of profitability analysis was to test the hypothesis that better planned intercropped enterprises are more profitable than the mixed crop enterprises currently practiced by the oil palm households. This hypothesis was tested by comparing the net present values estimated for the potential inter- and mixed cropped farm enterprises’ practical values compared are presented in Table 1 which shows that all the cropping systems are profitable since all their net present values are positive for the discount rate used. The enterprises are ranked as in Table 2 in order of profitability which also corresponds to the order of their NPV magnitudes calculated at 18 percent discount rate.

According to the ranking, cropping systems 1 and 2 (CS\textsubscript{1} and CS\textsubscript{2}) which represent the intercropping of oil palm with plantain and of oil palm with cocoyam respectively and which also represent the improved, better...
planned, prototype cropping systems, are shown to be more profitable than cropping systems 6 and 7 (CS_6 and CS_7) which are currently practiced by the oil palm farmers.

This confirms the hypothesis being tested. In addition, the results show that intercropping of plantain proves to be the most profitable of all the seven cropping systems, the inter-cropping systems are more profitable than the mixed cropping systems. The results also tend to confirm the view that under the technology presently available to small farmers, intercropping is preferable to mixed cropping.

**Sensitivity Analysis Results**

A sensitivity analysis was deemed useful in determining the level of confidence or dependability that could be attached to the profitability results. The analysis was to test the stability of the profitability established for each of the seven cropping systems. The results are summarized in table 3. The results indicate that the pure cropping of plantain and the two inter-cropping systems (CS_1 and CS_2) are very stable with respect to their profitabilities. Their profitability potentials are maintained even when (I) their total costs of production are doubled, (II) their total revenues are reduced by one half owing either to a drop in the prices of the product or in the yields or in both prices and yields and (III) their total costs are increased by 50 percent simultaneously with a 50 percent drop in total revenues. The mixed cropping of oil palm (CS_3, CS_4, CS_5, CS_6, and CS_7) are shown to have fairly stable profitability potentials. But, become unstable when their total costs are increased by 50 percent simultaneously with a 50 percent drop in total revenues. The seven cropping systems becomes unstable when total cost increase by 100 percent with a simultaneous drop in total revenue by 75 percent.

**The Implication of Results**

The results of the profitability analysis have shown that all the seven cropping systems considered are profitable. The objective was to ascertain the profitability of the mixed cropping systems currently practiced by the oil palm households and to compare their profitabilities with those intercropping systems considered suitable for the oil palm farmers. The results also indicate that under the available technology in the study area, properly maintained intercropping systems are more profitable than the mixed cropping systems.

The results of the sensitivity analysis indicated that; (I) the profitabilities of intercropping of oil palm with plantain and oil palm with cocoyam are very stable, while (II) those of the mixed cropping of oil palm with maize and cocoyam, oil palm cassava and maize, oil palm plantain and cocoyam, oil palm plantain cocoyam and maize, oil palm cassava and yam are stable. This means that given the price, yield and other uncertainties in agriculture and specifically in the given situation, the probability of attaining the profits prescribed by the estimates of this study are higher for the very stable cropping systems.

The implications of those results are that the oil palm farmers’ practice of intercropping system over mixed cropping also affects the size of the area cultivated by the oil palm farmers. The inability of the oil palm farmers to expand the area cultivated arises on account of (i) the difficulties encountered in clearing and preparing forested land for planting, (ii) inadequate supply of capital, and
The dependence of the oil palm farmers almost exclusively on their family labour. This state of affairs further justifies their practice of inter-cropping. Inter-cropping is not only more profitable but helps achieve the oil palm farmers’ most essential objectives—food supply and cash for their subsistence needs. The fact that the oil palm farmer can achieve these basic objectives once he has successfully deforested and developed two to three hectares of land, leaves him with little incentive or motivation for expansion under those difficult conditions.

Summary of the Results of the Profitability Analysis

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>Rank</th>
<th>NPV at 18% discount rate (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_s1$ (Oilpalm intercropped with cocoyam)</td>
<td>1</td>
<td>883,277</td>
</tr>
<tr>
<td>$C_s2$ (Oilpalm intercropped with plantain)</td>
<td>2</td>
<td>830,459</td>
</tr>
<tr>
<td>$C_s3$ (Oilpalm mixed with maize and cocoyam)</td>
<td>3</td>
<td>786,126</td>
</tr>
<tr>
<td>$C_s4$ (Oilpalm mixed with cassava and cocoyam)</td>
<td>4</td>
<td>782,790</td>
</tr>
<tr>
<td>$C_s5$ (Oilpalm mixed with plantain and cocoyam)</td>
<td>5</td>
<td>729,427</td>
</tr>
<tr>
<td>$C_s6$ (Oilpalm mixed with plantain, cocoyam and maize)</td>
<td>6</td>
<td>715,754</td>
</tr>
<tr>
<td>$C_s7$ (Oilpalm mixed with plantain, cocoyam and maize)</td>
<td>7</td>
<td>660,895</td>
</tr>
</tbody>
</table>

Source: Field survey 2009 and secondary data from Nigerian Institute for Oil Palm Research (NIFOR)
Summary of the sensitivity analysis of results effects on cropping systems (NPV is at 18% discount rate)

<table>
<thead>
<tr>
<th>Variations</th>
<th>CS₁</th>
<th>CS₂</th>
<th>CS₃</th>
<th>CS₄</th>
<th>CS₅</th>
<th>CS₆</th>
<th>CS₇</th>
</tr>
</thead>
<tbody>
<tr>
<td>No variation</td>
<td>830,459</td>
<td>883,277</td>
<td>729,427</td>
<td>782,790</td>
<td>715,754</td>
<td>786,126</td>
<td>660,895</td>
</tr>
<tr>
<td>100% increase in TC</td>
<td>421,451</td>
<td>530,596</td>
<td>255,729</td>
<td>320,276</td>
<td>188,531</td>
<td>363,873</td>
<td>39,703</td>
</tr>
<tr>
<td>50% decrease in TR</td>
<td>221,282</td>
<td>266,262</td>
<td>136,423</td>
<td>155,026</td>
<td>126,439</td>
<td>168,131</td>
<td>42,660</td>
</tr>
<tr>
<td>50% increase in TC</td>
<td>27,141</td>
<td>91,320</td>
<td>(111,890)</td>
<td>(43,176)</td>
<td>(169,781)</td>
<td>(59,669)</td>
<td>225,424</td>
</tr>
<tr>
<td>and 50% decrease in TR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% increase in TC</td>
<td>(470,296)</td>
<td>(394,294)</td>
<td>(611,013)</td>
<td>(583,742)</td>
<td>(734,962)</td>
<td>562,232</td>
<td>(856,285)</td>
</tr>
<tr>
<td>and 75% decrease in TR</td>
<td></td>
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</tbody>
</table>

Source: Derived from Table 1

REFERENCES

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