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RESOURCE UTILIZATION AMONG COCOA FARMERS IN EDO STATE, NIGERIA

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ABSTRACT

Cocoa farmers in Edo State are mainly smallholders, usually with large household sizes and limited resource availability. These farmers are faced with the problem of how best their enterprises can be combined on available land and other production inputs to meet their needs. The study was thus designed to identify the level of utilization of production resources by cocoa farmers in Edo State, with the aim of identifying the best combination of resource utilization in cocoa production systems that would adequately meet the farming households' need for food and income on a sustainable basis. A combination of purposive and simple random selection techniques was adopted in obtaining the 171 cocoa farmers for the study. Descriptive statistics and Linear Programming were employed in analyzing the data. Results showed that the average farm size of cocoa farmers in the study area was 2.97 hectares while the average annual cost of lease per hectare of farmland was found to be ₦12,090.21. The linear programming analysis showed that four enterprise combinations selected from the identified 79, on the basis of frequency, over-utilized labour and insecticides. However, the combination of cocoa with plantain, kolanut and oilpalm did not over-utilize labour and insecticides. Fertilizer was under-utilized in sole cocoa enterprise. The study therefore concluded that the combination of cocoa with plantain as food crop and tree crops such as oil palm and kolanut would give better yield/economic returns

Keywords: Dual Prices, inputs, Linear Programming, Slack, Surplus, Smallholders, Sustainability

INTRODUCTION

In recent times, the need for the diversification of the Nigerian economy by exploring the full potentials of Agriculture, both at National and State levels has been canvassed. The current downward trend in the price of crude oil at the international market has helped in driving home this point. Agriculture has always played a key role in Nigeria's foreign trade. Apart from providing employment for about 65% of the population, between 1962 and 1968, agriculture was said to be the major source of foreign exchange in Nigeria (UNEP and FGN, 2007). Crops such as cocoa, rubber and oil palm were money spinners both for the farmers and the Nation. It is reported that the near disappearance of the West African rain forest is largely influenced by cocoa production (Gockowski *et al*., 2000 and Nkamleu and Nodey, 2003).

Based on the crucial role cocoa has played and will continue to play in the Nigerian economy, it has become imperative to scale up production of the crop so as not only to generate more foreign exchange but to also provide employment opportunities for the teeming unemployed youths in the country. This has even become more important with respect to the current decline in crude oil prices. What has come out clearly is that the continuous overdependence on crude oil to drive the Nigerian economy will not suffice in the long run. It is imperative that the economy be diversified to attain the objectives of the vision 2020. Cocoa production offers a veritable option given the immense contribution it has made to the Nigerian economy in the past. Thus, there is need to increase the output of cocoa in Nigeria by improving the productivity as well as the incomes of the farmers.

According to Coelli (1995), productivity improvement can be achieved through three main ways: improved efficiency, technological change and scale improvement. Nkamleu *et al.* (2010), opined that growth (increased production) in cocoa sector in Africa has been achieved by increasing the area of land cultivated (i.e. Coelli's third alternative) rather than by improving yield. The pressure on land is now high mainly due to competing demand in line with modern developmental trends. The way forward is to make more efficient use of existing land.

Nkamleu *et al.* (2010) noted that the technology gap ratios in Nigeria and Cote d'ivoire were highest in Africa with 0.96 and 0.92 scores respectively. This is an indication that the technologies in both countries were near possibilities when compared to Ghana and Cameroon which were very low in term of the available technologies. With the available technology, production is yet to meet the expectation and demand of the World market. Therefore the problem seems not to be that of availability of technology but that of the efficiency in the combination of inputs, land and technology to achieve the desired production (Coelli's first alternative).

More importantly, it is expected that the cocoa farmers who are mainly smallholders, usually with large household sizes and limited resource availability are still able to provide the minimum food requirement for the farm families by simultaneously producing the basic food crops for the family upkeep along with cocoa within the limited land area, thus introducing a different dimension of efficiency (land use efficiency) in terms of enterprise combination.

From the foregoing, the subject of efficiency is not limited to increasing cocoa output for the farmer but more of ensuring that while the output is increased, the basic household food requirements are also met within the limited available resources. Thus the farmer is expected to combine his resources effectively to meet the requirements of income, household food needs and other needs on a sustainable basis. This becomes more complex since the farmer usually has an array of crops that can be grown on his land and that most of the crops can equally be produced using the same resources. Therefore, the problem confronting the farmer is that of the choice of enterprises that can be optimally combined using the same land area.

Having the assurances that the best technologies for cocoa production in Africa are available in Nigeria including that of enterprise combination techniques, the research questions derivable would be: (i) how best can the various enterprises of interest to the farmer be combined to attain

optimal level of production? (ii) what factors militate against improvement in the cocoa sector?

The objective of the study was thus to identify the various crops that are combined with cocoa and the level of resource use among the farmers as well as to identify the challenges faced by the farmers in the production processQuite a lot has been done on enterprise combination on tree and annual crops. While most studies focused on the best ways of combining tree crops and annual crops so as to ensure regular income for farmers in government established farm settlements who are not cocoa farmers only, Omobowale (2000) considered cocoa in combination with other crops but also deviated by not including tree crops that are intercropped with cocoa in the study. More recently, Osarenren and Emokaro (2015) looked at cocoa production under different management systems in Edo State, again, without including other crop combinations. Most studies conducted on enterprises combination have been restricted to pre-identified combination types without any effort to take inventory of all the combinations possible within the area of study. This is the gap that this current research effort was designed to fill.

METHODOLOGY

Area and Scope of Study: Edo State was created in 1991 from the defunct Bendel State and lies between Longitudes 06º 04' E and 06º 43' E and Latitudes 05º 44'N and 07º 35'N with a total land area of 19,281.93 km^2. It is bound by Delta State in the South, Ondo in the West, Kogi State in the North and in the East with Kogi and Anambra States (Edo State Government and Edo Community 2014).

Edo State is endowed with fertile land that supports agricultural crops; hence it is an agrarian State. The crops grown are rubber, oil palm, cocoa, yam, cassava, maize, rice and plantain. Others are sugarcane, cashew, groundnut, soya beans, tomatoes, cotton and tobacco. The State is also a haven for various kinds of fruits and leafy vegetables. There is also a thriving animal husbandry industry, with cattle, goats, pigs, rabbits and sheep being the main products. Edo State's riverine areas are prime areas for aquaculture (Edo State Government and Edo Community 2014).

According to the NPC report 2006, Edo State has a population of 3.2 million people (1,633,946 males and 1,599,420 females) with an annual growth rate of 2.7%. Politically, the State belongs to the South-south geopolitical zone of the country and is divided into 18 Local Government Areas (LGAs). There are seven LGAs in the Southern part which lie in the rain forest belt, six LGAs are in the Northern part of the State and share in the climatic conditions of the derived savannah and the remaining five LGAs are located in between the Southern and Northern zones of the State (Edo State Government and Edo Community 2014).

Edo State has a tropical climate characterized by two distinct seasons: the wet and dry seasons. The wet season occurs between April and October with a break in August. The dry season lasts from November to April with a cold harmattan spell between December and January. The temperature averages about 25 °C in the rainy season and about 28 °C in the dry season. The climate is humid tropical in the South and sub-humid in the North (Edo State Government and Edo Community 2014).

. Ovia North East, Ovia South West and Uhunmwode LGAs are known for cocoa production in the Southern part of the State. The presence of large population of migrant cocoa farmers from neighboring States easily attest to this. The system of cocoa farming in Nigeria (including Edo State) is predominantly mixed farming where cocoa is intercropped with other trees and or arable crops (Olaiya *et al.* 2006).

Sampling Procedure and Data Collection

The study relied mainly on primary data, sourced from the cocoa farmers in the study area. A two-stage sampling procedure was carried out and this was done as follows; in the first stage, Edo South, which is one of the three agro-ecological zones of the State, based on Edo State Agricultural Development Programme (Edo ADP) delineation, was purposively selected. Edo South consists of seven Local Government Areas (LGAs). Again, from among these LGAs, Ovia North East, Ovia South West and Uhumwonde LGAs were purposively selected. This became necessary for ease of data collection as the three LGAs constitute the major cocoa belt in Edo South given their soil and climatic suitability which accounts for the high cocoa production in the areas (CRIN, 2008).

The third stage involved the random selection of nine cocoa producing communities from the three identified LGAs. All the cocoa farmers available in the nine selected communities were interviewed. A total of 196 respondents in all, were eventually selected for the study as shown in Table 1.

Twenty-five copies of the completed questionnaire were found to be unsuitable at the data analysis stage and had to be discarded. Thus 171 copies of questionnaire were used for analysis in this study, giving a response rate of 87%.

Data were collected using the survey method (from April to June, 2012) with the administration of a well structured questionnaire complimented by personal observation and interviews with the support of relevant secondary data. The questionnaire was designed to capture data that were relevant for achieving the objectives of the study such as socio-economic, production and market data. The study made use of the facilitators of the Cocoa Livelihoods Program to reach the respondents.

Table 1 Distribution of Respondents and their Communities

Community	LGA	Number of Respondents selected
Egbeta	Ovia North East	23
Uhen	Ovia North East	40
Igbekhue	Ovia North East	20
Okokpon	Ovia South West	15
Obobaifo	Ovia South West	22
Ikoha	Ovia South West	19
Erua	Uhunmwode	18
Iriwe	Uhunmwode	22
Eko-Aimufua	Uhunmwode	17
Total		**196**

Source: Computed from Survey Data, 2012

Analytical Techniques

Descriptive Statistics: Descriptive tools such as the mean, tables, percentages etc were used to summarize and present

the socio-economic variables elicited from the respondents in the study along with their access to rural services and farm resources.

Linear Programming Model

The Linear Programming model was used to determine resource utilization for the selected enterprise combinations.

Model specification

This particular model was specified as:

1. Max $Z = \sum^{T}_{t=1} Mt$, where $Z = M_1 + M_2 + ---+ M_t$ and
2. $M_1 = P_1Y_1 - P_{x1}X_1 - Px_2X_2 - P_{x3}X_3 - P_{x4}X_4 - P_{x5}X_5$
3. t= 1, 2, ---T

Subject to: Resource constraints (Labour, insecticides, herbicides, fertilizers, fungicides)

$\sum^{T}_{t=1,} x_{jt} \geq 0$

Definition of symbols

Z = the sum of gross margins for chosen enterprise combination for the whole period. M= the gross margin for a particular enterprise in the combination.

Py = the price of the output for each enterprise.

Px = price of input x.

X_1 = total number of standard man-days used in the year.

X_2 = quantity of herbicides measured in litres.

X_3 = quantity of fungicides measured in grammes.

X_4 = quantity of insecticides measured in litres.

X_5 = quantity of fertilizers measured in kilogrammes.

Y = quantity of output for each enterprise in the combination.

RESULTS AND DISCUSSION

Resource Utilization, Constraints and Associated Cost: The land acquisition pattern adopted, rates charged and labour types used by farmers in the study area are presented in Tables 2.1, 2.2 and 2.3. The respective sections are discussed under the various subheads.

***Land*:** The average farm size cultivated by the farmers was 2.97 hectares while the average cost of lease per hectare of land was found to be ₦12,090.21/annum. The cost of purchasing one hectare of land out rightly was found to be ₦312,500.00 on the average, across the study area. With respect to the land acquisition pattern in practice, 145 respondents indicated practice of freehold system of land ownership acquired through inheritance (48%), gift (2%) and outright purchase (35%).

Although, the linear programming model did not impose restriction on land, it is noteworthy that one of the major problems facing the respondents was that of access to land as there had been persistent encroachment into Government reserves to establish cocoa farms and destruction of farm lands due to land ownership conflicts between farmers on one hand and between farmers and organizations which acquired such land from the host communities on the other hand.

***Labour*:** The major source of labour was hired labour, supplemented by family labour. The hired labour comprised both daily and yearly paid labourers. From the study, 95 respondents (56%) used yearly paid labourers while the remaining 76 (44%) relied on daily paid labourers to carry out their farm activities. Of this 56% using yearly paid labour, 46% had one labourer while the remaining had between two and six labourers engaged as yearly paid workers.

The agreement was such that the labourer puts up with the farm family and become "members" of that family for the period of the contract which is usually renewed annually. All feeding expenses were borne by the employer including that of accommodation and the labourer was expected to carry out all the farming activities relating to production and sometimes processing, depending on details of the agreement. The study showed that between ₦ 36, 000 and ₦120,000.00 was paid annually to a labourer, with an average amount of ₦79,485.00 This varied from community to community depending on the experience and negotiating skills of the respective labourer.

The study also indicated that this source of labour was usually in high supply from other States such as Cross River, Delta and Akwa-Ibom, with few of them from the South-Western part of the country. While majority of the migrants from the South-West practiced lease-hold system of farming, those from the aforementioned States were the main sources of farm labour. The following operations were carried out: pruning, spraying, weeding, harvesting, fermentation and bagging. The family labour participated in activities such as harvesting, fermentation, drying and bagging.

Analysis of Labour Cost in Farming Practices

Yearly Paid Labourer: One yearly paid labourer had the capacity to manage operations of two hectares of cocoa farm without engaging in other farming activities throughout the year.

Average cost of one yearly paid labourer per annum = ₦79,485.00

Monthly household expenditure on one labourer = ₦2,636.14

Annual household expenditure per labourer = ₦ 2,636.14 x 12 months = ₦31,633.68

Total annual expenditure on one yearly paid labourer = ₦111,118.68

Daily Paid Labourer:

The average man-day covered per hectare = 60 man-days

Average cost of daily labour (man-day) = ₦ 1,087.87

Cost of daily labour per hectare per annum = 60 x 1, 087.87 = ₦65,272.20

Cost of daily labour for two hectares = ₦ 65, 272.2 x 2 = ₦130,544.40

Based on these analyses, it could be argued that it is more cost efficient for cocoa farmers in the study area to engage the services of yearly paid labourers. Other benefits derived from engaging yearly labour were; reduction in incidence of work stoppage due to labour scarcity and the fact that yearly paid labourers often helped out in other management activities on the farm as well as contributing their effort to domestic chores.

Table 1. Method of Land Acquisition by Respondents

Acquisition Pattern	Frequency	Percentage (%)
Freehold:		
Inheritance	83	48.54
Gift	3	1.75
Outright Purchase	59	34.50
Leasehold:	26	15.20

Source: Computed from Survey Data, 2012.

Table 2. Types of Labour used by Respondents

Labour type	Frequency	Percentage (%)
Daily paid labour	76	44.40
Yearly paid labour	95	55.60

Source: Computed from Survey Data, 2012.

Table 3. Labour Rates Paid by Respondents

Labour type	Minimum (₦)	Maximum (₦)	Mean (₦)
Daily paid labour	600.00	1200.00	1,000.00
Yearly paid labour	36,0000.00	120,000.00	79,484.50

Source: Computed from Survey Data, 2012.

Linear Programming Model Analysis: The Linear Programming Model (LPM) imposed restriction on labour used for farm operations. The average amount of labour devoted to farm operations was estimated to be 60 man-days. Results from the LPM analysis (as shown in Tables 3.1 and 3.2) indicated that labour was in excess in all the four selected combinations indicating that labour as a resource was not adequately utilized. Further use of extra unit of labour would not amount to any net addition to productivity but rather lead to further wastages and reduction in profitability.

The excessive use of labour resource was more in combination I (cocoa sole) with about nine units than in any other combination. Combination III (cocoa, plantain and cocoyam) followed with surplus of about three man-days while the least was combination II (cocoa and plantain) with about one man-day.

Fertilizers Constraints: The study showed that only 13 (7.6%) respondents used fertilizers in their production in spite of the importance of fertilizer usage in cocoa production. Reasons mainly adduced for non-usage of fertilizers included; lack of awareness of the importance of fertilizers, inability to access fertilizers, inadequate finance and poor knowledge of the types and methods of fertilizer application. The average quantity of fertilizers used was estimated to be about 73 kg/ ha.

The LP model also imposed restriction on fertilizer use but only on combination I (Table 3) and the results showed that fertilizer was underutilized. Thus, indicating that an additional use of one unit (kg) of fertilizer would increase gross margin by a factor of ₦600.00 as shown in the dual prices. However, the model also indicated the upper limit of 0.682 kg beyond which fertilizer application would no longer be productive. This means that there will be net positive movement in gross margin if fertilizer use is increased from the current 0.630 kg to 0.682 kg.

Herbicides Constraints: Only 33 (19.3%) respondents made use of herbicides for weed control. This showed that there was more emphasis on the use of manual labour for farm activities especially weeding. The average quantity of herbicide used was about 5 l/ha.

From the LP model, herbicides were not used for combination I, under-utilized for combination III and over-utilized for combinations II and IV. However, the use of additional unit of herbicide seemed not to have had any positive effect on the gross margin except for combination III with an additional margin of ₦14,019.00, but it is expected that reduction in use of herbicides for combinations II and IV would have a positive effect only by saving cost for the farmer.

Consequently, while it is expected that a reduced use of herbicides for combinations II and IV, an increase in the use of herbicide for combination III may help reduce the use of labour and increase gross margin by saving cost of labour. This decision was reached by comparing the cost saved in reducing manual labour with the cost of buying and applying herbicides.

Fungicides Constraints: Fungicides appeared to be the most commonly used agrochemical among cocoa farmers in the study area, probably due to the prevalence of black pod disease. A total of 141 respondents out of 171 representing 82.5% used fungicides. The average application rate was estimated to be 3,739 grammes per hectares (37 sachets). The level of awareness about the use of fungicides was high among the farmers as the respondents generally knew the different brands of fungicides and their effectiveness in the market.

On testing the LP model on fungicides use, the resource was found to have been over-utilized in sole cocoa (combination I) and cocoa, plantain, kola nut and oilpalm (combination III) as shown in Table 3.2. This could be attributed to the presence of other tree crops in the cocoa farm as, according to Asare *et al.* (2009), trees can act as barrier against diseases in cocoa. Meanwhile, fungicide was underutilized for combinations II and IV. An increase in the use of fungicide for combination II (cocoa and plantain) would lead to an increase in gross margin by ₦335.93 and the same unit for combination IV will increase profit by ₦ 419.26 thus indicating that more fungicides are needed for those combinations (II and IV). However, any one unit increase in the use of fungicides for combinations I and III would not increase profit but rather increase cost except the resource is acquired freely.

***Insecticides Constraints*:** Results showed that about 60% (102) of the respondents used one type of insecticides or the other. The average quantity of insecticides used was about 5 litres. From the L.P.M., combinations I, II and IV over-utilized insecticides such that any additional use would not increase gross margin by any amount. This means that gross margin could be maximized when the resource is utilized to an acceptable level.

For combination III, the insecticide used was inadequate hence no surplus resources. The dual prices showed that any additional use of this resource could increase gross margin by ₦1,590.60 (Table 4).

Table 3. Resource Use Constraints by cocoa production systems

Combination	Slack/Surplus	Dual prices (₦)	Current value (₦)	Lower limit (₦)	Upper limit (₦)
Labour Constraints:					
I. Sole cocoa	8.83	0.00	27.79	18.96	No upper limit
II. Cocoa and plantain	0.08	0.00	7.83	7.75	No upper limit
III.Cocoa, plantain, kola, oilpalm	0.24	0.00	58.53	58.29	No upper limit
IV. Cocoa, plantain, cocoyam	3.16	0.00	9.36	6.20	No upper limit
Fertilizer Constraint:					
I. sole cocoa	0.00	600.00	0.63	0.00	0.68
Fertilizer Constraint:					
I. sole cocoa	0.00	0.00	0.00	0.00	No upper limit
II. cocoa and plantain	0.05	0.00	1.85	1.80	No upper limit
III. cocoa, plantain, kola, oilpalm	0.00	14,019.00	0.57	0.56	0.63
IV. cocoa, plantain, cocoyam	0.04	0.00	0.95	0.91	No upper limit

Source: Computed from Survey Data, 2012.

Table 4. Resource Use Constraints by cocoa production systems

Combination	Slack/Surplus	Dual prices	Current value	Lower limit	Upper limit
Fungicide Constraints:					
I. sole cocoa	2.97	0.00	39.19	36.23	No upper limit
II. cocoa and plantain	0.00	335.93	32.25	0.00	32.42
III. cocoa, plantain, kola, oilpalm	0.73	0.00	146.43	145.71	No upper limit
IV. cocoa, plantain, cocoyam	0.00	419.26	37.70	0.00	38.81
Insecticides Constraints:					
I. sole cocoa	0.35	0.00	3.50	3.15	No upper limit
II. cocoa and plantain	0.04	0.00	7.45	7.41	No upper limit
III. cocoa, plantain, kola, oilpalm	0.00	1,590.60	7.86	7.09	7.89
IV. cocoa, plantain, cocoyam	0.11	0.00	3.70	3.60	No upper limit

Source: Computed from Survey Data, 2012.

CONCLUSION

The study concludes that there is a high level of enterprise diversification among farming households in the study area. It was however observed that the combination of cocoa with plantain as food crop and other tree crops such as, oil palm and kolanut would give better yield/economic returns.

RECOMMENDATIONS

1. Farmers should be encouraged to grow cocoa in combination with other crops especially tree crops like kola nut and oil palm and food crops like plantain. This will provide opportunity for higher income, improved food security and efficient land use as it enhances the cocoa ecosystem and ensures greater yield.
2. Genuine sources of fertilizers, improved varieties of cocoa and other inputs should be made accessible to the farmers at affordable rates.
3. Based on the L.P.M. analysis, the amount of labour man-days currently applied by cocoa farmers in the study area should be reduced. This will help to save cost and increase profit for the farmers, for instance, activities such as manual weeding can be partly substituted with the use of herbicides. This also helps to reduce the problem of shortage of labour supply and increase the number of hectares managed by one yearly paid worker at the same rate.
4. Cocoa farmers in the study area should engage the services of yearly paid workers which was shown to be more cost effective, while at the same time also guaranteeing steady supply of labour.
5. Government should encourage financial institutions to lend to cocoa farmers as a panacea to the problem of poor access to credit. Cocoa farms could serve as securities for such credit facilities.

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