

Optimal Arable Crop Plan and Child Farm Labour Reduction in Rural Households of Ogun State, Nigeria

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ABSTRACT The study was carried out to model an optimal arable crop plan that minimizes child farm labour use in Ogun State, Nigeria. A multistage sampling technique was used to select a total of 400 rural households from the State. The household survey involves an interview of 594 children, 400 household heads and a focus group discussion section in four locations. The data collected were analyzed using both descriptive and inferential statistics in line with the study objectives. The linear programming model was used to develop an optimal arable crop farm that maximizes economic returns to the farmers while simultaneously allowing for maximum school attendance and involvement. The optimal farm model revealed that a restructuring of the crop enterprise plan could increase the annual farm income by about 15.3 percent, while at the same time minimizing the child farm labour involvement in the State. The study recommends that reducing child labour, will require facilitating access to credit to the resources-poor rural households. Also, that government should provide assistance to arable crop farmers in the areas of subsidizing the costs of production inputs (seeds, tractor hiring, fertilizers and other agrochemicals), and that research efforts should be geared towards developing simple, affordable, and adaptable machines/implements, and other farm labour-saving devices.

INTRODUCTION

Agricultural production is the mainstay of the Nigerian economy; considering the fact that over 80 percent of the economically active populations are involved in agricultural production and that over 90 percent of the food consumed in the country is from the local agricultural production. It is the second largest earner of foreign exchange; next to the non-sustainable petroleum sector, and also it provides a ready market for industrial products. (Ayanwale 2002).

Children represent the future of human race. In the less developed countries, those who grow to school age grow up under a blanket of diseases, malnutrition, lack of food and inadequate schooling, in these circumstances children drift into the labor market. It is estimated that world wide millions of children work, although the world generally agreed that it is unacceptable for children under specific age to do certain type of work. International Labor Organization, ILO (2002) set that child labour is defined as labor furnished by persons below their official minimum age of employment, which is 15.

The Millennium Development Goals (MDGs) of the United Nations, for the reasons highlighted above, encapsulate increasing resources productivity in agriculture as part of its set objectives with key measurable indicators. It recommends

States to embark on projects that target the rural areas, where the bulk of agricultural activities take place; and in doing this must as of a necessity first explore potential impediments to growth and development of the rural areas.

CBN (2004) report on the distribution and profile of poverty in Nigeria indicates that the rural areas are worse off, and that the propensity of a household falling below the poverty line is higher in the rural areas. The report also indicated that rural households are of low educational level which dovetails into low incomes. In rural economies, the more equal the incomes and assets, the more powerful the growth effect in poverty reduction. As inequality increases; as a result of poor human capital development from child labour, the linkage of growth to the poor weakens, and in the more unequal of rural economies, growth tends to bypass poor people completely. The quality of rural development is, thus, a basic determinant of the quality of the future social development of a country. For the purpose of this study, child farm labour excludes involvement in house chores or after school paid or unpaid activities. Child labour is defined as any farm activity in which children (less than 18 years) are involved that warrants loss in school days and/or time. It is defined to mean all farms or farm related activities that the opportunity cost is schooling for children between 7-17 years.

Problem Statement

Developing economies are characterized by a low level of human capital development, which not only impedes present but also future productivity. In the light of this, Glick and Sahn (2000) reported that the elimination/reduction of human capital development impediments is a sure way of promoting economic growth and the elimination of poverty in developing countries. Table 1 shows the distribution of child labour in the world economies. The proportion of child labourers to the total child population is highest in Sub Saharan Africa.

The absence of high technical input (human knowledge and technologies), which is a major precursor of low productivity has been described as the outcomes of promoting child labour at the detriment of educational development.

The emerging evidences on the magnitude and spread of child labour especially in farm households, has again beam the lights on the issue of labour productivity in agricultural production. The question now being highlighted bears on a present decision that affects a future outcome. Child labour that affects the intellectual

development of the child, though satisfying an immediate (short termed) need, will in a future period negatively influence the productivity of the factor of production (labour). In the light of these, the study will seek to answer the following research questions:

- What households, child and community variables/factors determine the decision to involve in child farm labour?
- What is the region specific optimal arable crop model that maximizes economic returns and minimizes child farm labour use intensity

Study Objective

The broad objective of the study is to carry out an assessment of the determinants of child farm labour in rural households in Ogun state, Nigeria.

Specifically, the study will:

1. analyze the socio-demographic characteristics of children that are engaged in farm labour
2. determine an optimal farm model that maximizes economic returns from arable crop farming while at the same time minimizing child farm labour use

STUDY AREA

The study was carried out in the rural households of Ogun State, Nigeria. Ogun State commonly known as the gateway state is in South-Western Nigeria, and lies within the tropics. It is bounded to the West by Benin Republic; to the South by Lagos State and the Atlantic Ocean; to the East by Ondo State; and to the North by Oyo and Osun States. It was carved out from the old western region in 1976. It has an estimated land area of 16,409.26 square kilometers of which over 70 percent are suitable for arable crop production. The estimated human population is 2,338,570 (NPC 2000), with a projected 2005 estimates of 3,214,161 people (CBN 2005). Agricultural food crop production is the economic backbone of the State though cash crop production, fisheries and forestry is also common.

Data and Sampling Techniques

A total of 400 households were selected for the survey using the multistage sampling

Table 1: Distribution of children in economic activities by region in year 2000

<i>Economic activities</i>	<i>Levels (Millions)</i>	<i>% of total</i>	<i>% in Total child population</i>
5-14 Years Old	211		17.6
Industrialized Economies	2.5	1	2
Transition economies	2.4	1	4
Asia and the Pacific	127.3	60	19
Latin America & Caribbean	17.4	8	16
Sub Saharan Africa	48	23	29
Middle East and North Africa	13.4	6	15
15-17 Years Old	140		42.4
Industrialized Economies	115	8.1	31.3
Transition Economies	6.0	4.2	29.1
Asia and the Pacific	86.9	61.7	48.4
Latin America & Caribbean	10.3	7.3	25.0
Sub Saharan Africa	18.1	12.8	44.8
Middle East and North Africa	7.5	5.3	31.8
Total	351		23

Source: ILO (2002)

approach. The four (4) zones of the Ogun State Agricultural Development Programme (OGADEP) were used as the first sampling stratum. The four zones are the Abeokuta, Ikenne, Ijebu and Ilaro zones. Simple random sampling was used to select a total of hundred (100) villages, twenty-five (25) from each zone, after urban towns were isolated from the sample frame. The second stage of selection was the purposive selection of four (4) households from each of the selected community and 10 households were then purposively selected from each community.

Analytical Technique

The Linear Programming (LP) model is specified to optimize a production objective subject to some sets of production constraints (factors of production). The model is specified thus:

$$\text{Max. } Z: \sum a_i x_i \dots\dots\dots 1$$

$$\text{Subject to: } \sum b_{ij} \leq G_j$$

Where, a_i = The Gross Margin (GM) of the i th crop enterprise

X_i = Size of the i th crop enterprise (ha)

b_{ij} = j th activity level of the i th crop enterprise

G_j = household's maximum or available levels of j th activity/ input

The input matrix of the LP model to be optimized was specified by incorporating an activity level for minimal use of child farm labour in the enterprise production (levels that doesn't interfere with or diminish the school periods), the time allowance modeled in the plan was for an involvement of less than 4 hours per day. An optimal farm plan was modeled in the study for the arable crop farms. The linear programming model was used to optimize the plan that returned the highest economic benefit while at the same time minimizing the use of child farm labour, subject to the rural household's production constraint.

The farm plan was modeled based on the hypothesis that the crop production system adopted by the households was a major reason for the incidence of child farm labour. The model dual objectives were both for highest economic returns (profit maximizing goal) and a reduction in child farm labour use, in seeking an arable crop mix that takes into consideration the school time of farm children. The school time allowances made was for a minimum of 30 hours on week days in calculating the available children work days.

Table 2: Socio-demographic characteristics of children interviewed

Socio-demographic characteristics	Frequency	Percent	Mean	Min.	Max.	Standard
<i>Sex</i>						
Male	384	64.6	Na	Na	Na	Na
Female	210	35.4				
<i>Age Range</i>						
7-10 years	142	23.9				
11-13 years	193	32.5	12.8	7	17	2.51
14-17 years	259	43.6				
<i>Child Living Status</i>						
Child of household head	410	69.0	Na	Na	Na	Na
Not child of household head	184	31.0				
<i>Mothers' Status</i>						
Mother resident	385	64.8	Na	Na	Na	Na
Mother not resident	209	35.2				
<i>Highest Educational Level of Child (yrs)</i>						
Primary 3	59	9.9				
Primary 4	49	8.3				
Primary 5	94	15.8	6.3yrs	2yrs	10yrs	2.94
Primary 6	103	17.3				
JSS 1	93	15.7				
JSS 2	86	14.5				
JSS 3	87	14.6				
SSS 1	23	3.9				
<i>Schooling Status</i>						
Child in school	520	87.5	Na	Na	Na	Na
Child not in School	74	12.5				

Source: Analysis of Field Survey (2005) Na. Not Applicable

Households' Characteristics and Child's Farm Labour Distribution

The age range shows that most (about 44 percent) of the children interviewed for the study are within the age range of 14-17 years. The mean age of the children was found to be 12.88 ± 2.51 years. The range of household size also revealed that majority (about 94 percent) of the children is from households with 4-12 persons per household. However, the mean household size was found to be 8.35 ± 2.32 persons per household, indicating that the average household in the study area has large families, Table 2.

The results also revealed that majority (about 75 percent) of the children interviewed were not involved in other economic activities apart from farming. This may be due to the non-availability of other income earning activities apart from farm and agriculturally related works in the rural areas. On the years of involvement in farm work, the

study shows that majority (about 60 percent) of the children, have been involved in farm work for a minimum of 5 years. The mean years of involvement in farm work was 7.6 years. This may be due to the fact that, farm activities in the area are taken as an integral part of the family livelihood and members are easily and quickly integrated into it as shown in Table 3.

The analysis on the proportion of weekly school time spent on the farm activities by the children as a measure of child farm labour participation intensity is also presented in the table. The result revealed that the average hours spent on farm work of the weekly school hours (30 hrs) was about 5.26 hours. The implication of this distribution is that though there is regular school attendance (in terms of days/week), there is however a consistent rate of sacrifice of school time hours to farm work. The outcome of the farm work effect on school time as presented provides an understanding of the children performance

Table 3: Household farm and child's farm work distribution

<i>Farm and work characteristics</i>	<i>Frequency</i>	<i>Percent</i>	<i>Mean</i>	<i>Min.</i>	<i>Max.</i>	<i>Std. Dev.</i>
<i>Farm Size</i>						
< 0.50 ha	134	22.6	0.93	0.23	2.60	0.6
0.50-1.00	276	46.5				
ha1.01-1.50	111	18.7				
ha1.51-2.00ha	33	5.6				
> 2.00 ha	40	6.7				
<i>Crop Enterprises/Mix</i>						
Cassava/pepper	36	6.1				
Cassava/yam	115	19.4	Na	Na	Na	Na
Maize/cassava	161	27.1				
Maize/cassava/pepper	26	4.4				
Maize/cassava/yam	59	9.9				
maize/vegetables	13	2.2				
Maize/yam/vegetables	222	20.6				
Sole yam	19	3.2				
Yam/pepper	43	7.2				
<i>Other Economic Activities Apart from Farming</i>						
Not involved	448	75.4	Na	Na	Na	Na
Involved	146	24.6				
<i>How Long has Child been on Farm Work?</i>						
< 3 years	33	5.6	7.6	1	12	2.09
3-5 years	33	5.6				
> 5 years	354	59.6				
<i>Estimates of Farm Work Value on Family Farm (Naira/Week)</i>						
< N100	55	9.3	205.2	80	1287	116
N100-N150	121	20.4				
N151-N200	130	21.9				
N201-N250	45	7.6				
N251-N300	25	4.2				
> N300	218	36.7				
<i>Does the Child Works in Other Farms Apart from Family's</i>						
No	526	88.5	Na	Na	Na	Na
Yes	68	11.4				

Source: Analysis of Field Survey (2005)

and academic development as a result of their farm involvement. Anyanwale (2000) in a similar study in Nigeria, found out that an average of 7.55 hours of school time is spent weekly on farm activities and that, farm involvement was the reason for about 35.9 percent lateness to school by the children. Azer (1999) in a similar study in Egypt also found out that involvement of the child in farm activities can result to as much as 25 percent of total absence from school.

The Optimum Arable Crop Model

For the dual objectives maximizing model the input matrix (Table 4), used for the optimization in interactions had 8 arable crops as enterprise variables for selection, and 5 production constraints.

The arable crops included in the model were selected as crops that were cultivated by at least 30 percents of the households. This was used as the selection criterion to give the model a state-wide focus. The crops included for selection are fruits vegetables (Fv) which as indicated earlier are okra, pepper, melon and tomatoes; leafy vegetables (Lv); yam (Ym); cassava (Cv); Groundnut (Gn); Cocoyam (Cy); Maize (Mz) and Rice (Rc).

The production constraints are land, adult male and female labour, children labour supply and capital. Capital as a factor of production in the model was calculated as the total variable cost less the cost of family labour as adopted by Ogunfowora (1974), Celtin (1992), Okoruwa (1994) and Anya (2003). The objective function was specified to maximize the Total Gross Margin (TGM) from the selected crops per hectare. The technical co-efficient for each of the enterprise modeled were based on averages for each of the production constrain; except for land (ha) incorporated as a choice condition for the

Table 4: Modeled enterprises and gross margin (naira/ha)

Crop	Variable	Gross margin (N'000)
Fruits vegetable	Fv	30.62
Leafy vegetables	Lv	30.46
Yam	Ym	86.52
Cassava	Cv	52.14
Groundnut	Gn	18.44
Cocoyam	Cy	21.71
Maize	Mz	39.55
Rice	Rc	41.72

Source: Summary statistics of field data (2005)

enterprises. The constraints maximum (right hand side maximum), is the overall average (across enterprises) to indicate the maximum limits that is available for the plan for each of the production constraint. This as observed by Celtin (1992) is to ensure that the resulting plan is within the feasible region of the average farmer in the state.

The result of the Linear Programming analysis for the input matrix specified above is shown in Table 5.

Table 5: The basic farm plan

Activities selected	Units (Ha)	Contributions (Naira)	Activities not in basic solution	Opportunity (Naira)
Fruits	0.15	4593.29	Leafy Vegetables	5164.89
Vegetables			Groundnut	40189.18
Yam	0.41	35482.21	Cocoyam	35708.64
Cassava	0.20	11935.21	Rice	46838.79
Maize	0.22	8658.52		
Maximized Objective N60669.23				

Source: Summary statistics of data (2005)

Four (4) crops were selected in the basic solution; these are maize, yam, cassava and fruits – vegetable in the decreasing order of scale. The model selection for the optimal plan and the scales are; maize (0.42ha), yam (0.21ha), cassava (0.20ha) and fruits vegetables (0.15ha). The maximized objective function (TGM) from the iteration process is N60669.23, The optimal farm plan specifications for enterprise choice and scale were found to result to a higher return than the State' average (N52602.11) from arable crop production. The model resulted to a 15.3 percent increase in the Gross Margin (GM) for the average arable crop farm in the State. Apart from the better economic return the model will also ensure the reduction of child farm labour to the level to allow full school time involvement in schooling.

The optimal farm plan for the selected enterprise scales also illustrates the opportunity cost of the enterprises. The opportunity cost is indicated for non-selected enterprise. The opportunity cost is the penalty for producing non-selected crops. As evident from Table 6, while the greatest penalty (opportunity cost) is for rice production (loss of N46838.79) the least penalty is for leafy-vegetables (N5164.8) the implication of this is that, forcing a unit (1ha) of rice and leafy vegetables into the plan will result to a reduction of the TGM by N46838.7 and

Table 6: Optimal farm plan resources status

Resource	Status	Shadow price (Naira)	Slack/ surplus
Farm land (ha)	Tight	30782.79	0
Adult male labour (md)	Loose	0	106.38
Adult female labour (md)	Loose	0	139.92
Children labour (md)	Tight	3809.91	0
Capital (N'000)	Tight	860.18	0
Maximized Objective		₦60669.23	

Source: Summarized LP result (2005)

₦5164.8 respectively. The penalty will decrease for rice, groundnut, cocoyam and leafy vegetables in that order. The greatest penalty of the plan from rice production corroborates the findings of Okuneye (1995) and Oloruntimilehin (2000) who found that for rice production to be profitable in the state, there has to be a relaxation efforts (input subsidies and assess to credits) in the production constraints.

CONCLUSION

The study revealed that the present scale (subsistence) and arable crops enterprises combinations were also important contributory factors to child farm labour in the state. It was found out that the resources-poor farmers utilize mainly home-produced resources/farm inputs, and family labour for their labour intensive production. The linear programming model farm plan indicated that, even with the present farm production resource regime, it is possible to restructure the arable crops production plan in such a way as to increase economic returns by about 15.3 percent while at the same time minimizing child farm labour.

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