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Smallholder Farming System under a Structural Adjustment Programme: The case of Foodcrop Production in Oyo North Area of Oyo State

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Abstract

The introduction of the Structural Adjustment Programme (SAP)) with its attendant increase in both the costs of the various inputs and the obtainable revenue has brought about a need for resource adjustment at all levels of production. This paper examines the optimum enterprise mix, using mix-constraint linear programming model, for smallholder foodcrop producers in Oyo North Area of Oyo State, Nigeria, both before and after the introduction of SAP.

The findings revealed the need for subsistence farmers to continue with mixed cropping of cassava, maize, yam and cowpea on a farm size of 1.88 hectares, however with sorghum cultivation dropping off the production plan. Commercial orientated farmers will still have to monocrop, but with cassava planted on 3.08 hectares to replace cowpea enterprise planted on 1.19 hectares, suggesting a need for assistance in the area of land preparation. Subsistence orientated farmers obtained higher income (gross margin) per resource utilised in the SAP period relative to pre-SAP, while commercial farmers obtain less income per resource utilised during the SAP period, suggesting a higher opportunity cost of farm resource. Therefore there is the need for resource adjustment on the farms in order to obtain optimum returns.

Introduction

The government of Nigeria is facing an increasingly difficult task of feeding the fast growing population which is at present estimated at 88.5 million (NPC 1992). This is revealed by the highly increasing cost of basic food items and the food price indices, in both urban and rural areas, which has increased almost eightfold in the 1980-90 decade. The food situation is a paradox in the sense that Nigeria is endowed with abundant human and natural resources to bring about food self-sufficiency. Johnson *et al* (1969) noted that "thousands of Nigerian smallholders can be relied upon as a driving force for the transformation of Nigeria's agriculture because they are willing to accept new crops and new management practices, and are also responsive to favourable prices and opportunities to earn income by producing and working."

The fact that the galloping increase in food price indices is not limited to the urban areas alone (Table 1) indicates that the crisis is of a fundamental nature, since the rural areas are supposed to be the source of production of the food crops. The Nigerian government has been tackling this food problem through various measures right from the 1970s when the food deficit situation started manifesting. Some of these measures are in form of programmes such as the National Accelerated Food Production Programme (1973); River Basin Development Authorities (1976); Operation Feed the Nation (1976); the Land Use Decree (1978): Green Revolution

TABLE 1: FOOD PRICE INDICES (1977 - 1990) 1975 =100

Years	1976	1977	1978	1979	1980	1981	1982	1983
Urban	130	152.0	196.3	210.2	233.5	303.0	327.7	410.0
Rural	122	144.7	168.5	182.3	195.2	243.7	264.6	326.4

Years	1984	1985	1986	1987	1988	1989	1990
Urban	585.3	575.7	619.2	652.5	1099.6	1691.4	1770.8
Rural	464.9	487.7	482.3	526.4	956.9	1458.2	1505.5

Source: CBN Annual Reports and Statement of Accounts (Various issues).

(1980); and the World Bank Assisted Agricultural Development Projects. However none of these programmes has been able to solve the problem. As regards the nature of production, Kwatia (1986) noted that "these commodities (foods) were produced by independent smallholders which ensured a significant commercial impacts in parts of the rural economy".

Smallholders are defined as farmers whose total holding is less than 10 hectares (Olayide 1982). These constitute over 90 percent of Nigerian farmers. Idachaba (1991) noted that over 95 percent of Nigerian farmers are small-scale farmers cultivating less than 2 hectares. These farmers are therefore significant in the nation's bid towards ensuring an adequate and stable supply of food.

The Structural Adjustment Programme (SAP) was introduced in 1986 in order to correct the imbalance between the growth of the various sectors of the economy and the attendant distortions in resources allocation. Hence SAP was to provide an overall favourable climate for the producers of the foodcrops so as to boost the supply of these foodcrops in the country. Prior to the introduction of SAP, the cultivation of foodcrops which was essentially undertaken by peasant farmers primarily to meet household consumption was pursued by many farmers in most parts of the nation with the objective of making as much income as could possibly be realized (Adesimi & Ladipo 1983).

Given the overall environment provided by the SAP, this study is intended to make a comparative study of the optimal enterprise mix among the smallholders in the Oyo North area of Oyo State in both the pre-SAP and during the SAP\regime in order to examine the effect that SAP has had on the resource allocation decisions of these smallholders. It will also examine the effect of subsistence on the resource allocation on the farm.

Study Area

The study area covers some 12310km^2 or 23 percent of Oyo State* and consists of four local government areas (Ifedapo, Irepo, Kajola and Oorelope) in the north of the State. This area is predominantly a food crop growing area and it was the enclave of the former Oyo North Agricultural Development Project (ONADEP). The farming families in the study area was estimated to be 108,229 in 1988 and most of the farming families have an average farm size of about 2 hectares (ONADEP 1986).

The area is bordered by Benin Republic to the West, Kwara State to the North, Oyo and Ogbomoso Local Government areas to the East and Ogun State to the South. The vegetation is generally derived savannah with only a slight bimodal pattern in the rainfall. This makes the area unsuitable for two main cropping per year.

Methodology:

The data which formed the basis of the analyses and write up for this study were collected during an intensive survey of the study area during the 1987/88 production

season. Cost-route method of data collection was used to improve the quality of the data so collected. The farmers were visited at least once fortnightly in order to reduce the reliance on memory recall and ensure that adequate records of the operations on the farm were taken. The records of the pre-SAP year (1985-86 season) were however taken from memory and some from the scanty records kept.

A multistage sampling technique was employed to select about 100 farmer respondents. Based on the farming population distribution in the study are published by the ONADEP, the whole survey area was divided into 15 wards, with a random selection of a sample of 7 farmers per ward making a total of 105 farmers. Due to various reasons ranging from lack of interest of the participant farmers because of lack of material rewards, to job abandonment by enumerators midway into the survey year, only 71 farmer respondents were eventually used for the analysis.

Based on the objectives of the study, a mixed-constraint linear programming model was used to determine the optimal combination of enterprises to farmers in the study area. The model was designed to maximise the gross margins from the cultivation of enterprises which are grown in the area. The LP framework used can be stated mathematically as follows:

$$\text{Maximise } Z = \sum_{i=1}^{M} C_i X_i \quad \ldots\ldots(1)$$

subject to the following constraints

$$\sum_{j=1}^{M} C_i X_i a_{ik} x_i \leq bk \quad \ldots\ldots(2)$$

$$\sum_{j=1}^{M} Y_{ji} X_j a_{ik} x_i \geq dj \quad \ldots\ldots(3)$$

where,

Z = sum of the gross margins of the various activities during the survey period;

C_i = gross margin per hectare of the ith activity during the survey period;

X_i = hectare of the activity during the survey period;

m = number of activities

aik = per hectare requirement of the K resource by the ith activity during the survey period;

Yji = the yield per hectare of crop j in the ith activity during the survey period;

Xj = hectare of the activity in which crop j appears during the survey period;

n = total number of activities in which crop j appears;

d_j = minimum quantity of crop j required for subsistence by a household per year.

In equation (3) above, an additional subsistence constraint was imposed on the programme by specifying the minimum subsistence production of crops rather than the minimum hectarage of cultivated land. The minimum subsistence requirement was estimated during the field work and the over all average per household was utilised. The activities defined were those predominant foodcrops in the study area and they are as defined as follows:

CAS: — Cassava enterprise;

MAZ — maize enterprise;

YAM: — yam enterprise;

COWP: — cowpea enterprise;

MEL: — melon enterprise;

SOG: — sorghum enterprise.

The initial programming matrix is shown in Table 6. Two variants of the LP model were run separately in order to take care of the production decisions of the traditional farmers. The traditional farmers were postulated to have a dual goal of profit maximisation and food survival (safety - first rule), according to Adesimi (1988). In order to capture this goal, the LP was run as specified above (Farm Plan 1). While in order to take care of the profit maximising goal (which is usually assumed nowadays with increased monetisation of the economy) we removed the last six constraints and then solve the resultant matrix for the optimal farm plan (Farm Plan II). The LINDO software package was used to run the programme.

Results

Farm Plan I:

The result of the LP model in Table 2 indicates mixed cropping in order to achieve the dual goal of profit maximisation and meeting the subsistence needs of the farmer. Both the Maize and Yam enterprises retained their apportioned farm plots of 0.67 and 0.16 hectares respectively in both the pre-SAP and SAP regimes.

Cassava and cowpea plot sizes need to be increased from 0.27 to 0.58 hectares and 0.24 to 0.47 hectares respectively while sorghum enterprise would have to be dropped in this SAP regime.

There is an almost 100 percent increase in gross income with less use of resources. The income accruable is more in this SAP period even at 50 per cent

sensitivity analysis.

Farm Plan II

This programme which was run on the basis that the goal of the farmer is commercialization by removing the subsistence constraints stressed monocropping in both

TABLE 2: OPTIMAL FARM PLAN 1 WITH MULTIPLE GOAL

Variables	Optimal Levels	
	Pre-SAP	Sap
Cas	0.27	0.58 hectares
Maz	0.67	0.67 hectares
Yam	0.16	0.16 hectares
Cowp.	0.24	0.47 hectares
Sor.	0.49	—
Income*	N1,077.86	2,067.72 hectares
Unused land	6.89	6.82 hectares
Unused labour (land preparation)	132.51	129.85 mandays
Unused labour (Planting)	95.25	94.60 mandays
Unused labour (weeding)	102.96	99.41 mandays
Unused labour (harvesting)	152.96	145.07 mandays
Unused borrowed cap.		₦457.32
Dual price of op. cap.		₦ 1.73

Source: LP solution (1989).

* Income is defined as the gross margin obtained
i. e. Total Revenue less Total variable cost.

regimes. It emphasised cowpea planted on a farm size of 1.19 hectares yielding an income of N1238.63 in the pre-SAP era, while cassava planted on 3.08 hectares yielding an income of N2286.23 was emphasised in this SAP period. At 25 and 50 percent increase in gross margins, the income obtainable in the SAP period consistently outweigh that of the pre-SAP regime (Table 4 and 5).

TABLE 3: OPTIMAL FARM PLAN WITH COMMERCIAL GOAL

Variables	Pre-SAP	Sap
	Cowp. 1.19 hectares	Cass. 3.08 hectares
[illegible]	N1238.63	N2286.23
Unused land	7.52	5.62 hectares
Unused labour (land prep.)	124.58	103.75 mandays
Unused labour (planting)	97.83	87.10 mandays
Unused labour (weeding)	106.24	68.72 mandays
Unused labour (harvesting)	163.49	90.10 mandays
Unused borrowed cap.		501.58
Dual price of op. cap.		2.51

Source: LP Solution (1989).

TABLE 4: OPTIMAL FARM PLAN 1 WITH VARIABLE GROSS MARGINS

Income Accruable	25 percent increase	50 percent increase
Pre-SAP	N1,347.31	N1,616.79
SAP	N1,764.20	N2,117.04

Source: LP solution (1989)

This result is consistent with the findings of Okuneye (1985); Zziwa (1987) and Adesimi (1988) that at different places, multiple cropping is the best option to use in order to simultaneously achieve the farmer's goal of subsistence and commercialisation. Also Olayide et al (1971) came up with findings which alloted about 57 percent of cultivated land to cassava enterprise for optimum profit to be obtained in the farming system of the area where this study was carried out.

TABLE 5: OPTIMAL FARM PLAN II WITH VARIABLE GROSS MARGIN

Income Accruable	25 percent increase	50 percent increase
Pre-SAP	N1,548.29	N1,857.96
SAP	N2,857.76	N3,429.37

Source: LP solution (1989).

Summary and Policy Implication

The study was aimed at finding out the optimal mix of enterprises for smallholder foodcrops farmers in the Oyo North Area of Oyo State both in the pre-SAP and SAP era, and examining the effect of subsistence constraint on the resource allocation on the farm.

Based on their farm holdings and the production goals set out by the farmers, it was found that mixed cropping* should be adopted when the farmer aims at meeting subsistence needs of his family while producing for the market. However, a fully commercially oriented farmer will be better off cultivating sole crops.

From the results, more resources were utilized during the SAP period than in the pre-SAP period. This may be due to the higher income obtainable during the SAP regime.

In the pre-SAP era, farmers with commercialization objectives utilized less resources than those with dual objectives except in the use of labour for land preparation. This could be due to greater use of hired labourers by commercial farmers. The subsistence constraint might have compelled the farmers to use their family labour for land preparation. However during the SAP regime, more resources were utilized by commercial farmers than those with dual objectives. This could be because of greater income obtainable from the farm during the SAP regime.

When compared on the basis of income accruable per unit resource utilized, farmers with dual objectives will be obtaining higher income in this SAP period than in the pre-SAP period. For the commercial farmers, income obtainable per unit resource is less in this SAP period than in the pre-SAP period except for labour for land preparation.

The dropping of cowpea for cassava in the SAP period might be due to the high costs of chemicals and other inputs necessary for cowpea cultivation; however more land is allocated to the cassava enterprise with higher returns per unit land area, that is, more judicious use of labour resources.

* The mixed cropping could take the form of "sequential cropping' where crops are planted and harvested followed by further crops in the same year or 'relay cropping where mixtures overlap especially with regards to cassava enterprise.

TABLE 6: INITIAL LP MATRIX

ENTERPRISES		CAS	MAZ	YAM	COWP	MEL	SOR.	CONSTRAINT LEVEL
Gross Margin*	Pre SAP	607.45	389.00	1995.17	508.89	295.91	448.40	Maximize
N/hectare	SAP	742.80	882.36	3896.99	1039.59	686.78	356.47	
Land		1	1	1	1	1	1	8.707
Labour (land prep.)		39.98	24.01	49.99	24.01	24.01	24.01	153.59
Labour (planting)		12.99	9.98	14.94	9.98	9.98	9.98	103.24
Labour (weeding)		45.00	24.99	49.99	24.99	14.99	24.99	124.80
Labour (harvesting)		69.99	15.98	72.98	32.68	26.01	21.04	177.33
Operating capital		296.40	494.00	741.00	617.50	543.40	494.00	369.34
Borrowed capital		247.00	296.40	494.00	296.40	296.40	296.40	667.78
Min cassava		5.540	0	0	0	0	0	1.50
Min maize		0	0.615	0	0	0	0	0.41
Min yam		0	0	0.630	0	0	0	1.50
Min Cowpea		0	0	0	0.169	0	0	1.10
Min melon		0	0	0	0	0.113	0	0.05
Min sorghum		0	0	0	0	0	0.453	0.22

*The gross margins were included in turns.

Source: Field survey 1988.

The policy implications of the above findings is that there is the need for smallholder farmers to adjust their holdings in line with the current economic climate. For a survival conscious farmer in need of subsistence, mixed cropping is recommended with cassava, maize, yam and cowpea enterprises using up about 1.88 hectares and yielding an income of N2067.72 during the SAP era. A commercially oriented farmer will have to cultivate cassava on a plot size of 3.08 hectares to earn an optimum income of N2286.23 in the SAP period as opposed to an income of N1238.63 from 1.19 hectares of cowpea in the pre-SAP period.

The enhanced income obtainable is indicative of a bright prospect for foodcrops farmers under the adjustment programme. However the less income per resource obtained by commercial farmers is suggestive of a higher opportunity cost of resource utilised on the farm in the SAP period.

Going by the versatility of the cassava crop and its prominence in the cropping systems of smallholders, they could be advised to plant more of this crop to boost their income. However, there is the need for government's assistance in the area of land preparation where the cost has become prohibitive. Government should also endeavour to reduce the cost of farm inputs by the maintenance of some level of on-farm subsidy to enable other profitable enterprises on the farm to be cultivated, such as cowpea enterprise which uses a lot of chemical inputs.

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