

PJN

ISSN 1680-5194

PAKISTAN JOURNAL OF
NUTRITION

ANSI*net*

308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Food Security and Resource Allocation among Farming Households in North Central Nigeria

H. Ibrahim, M. Bello and H. Ibrahim
Department of Agricultural Economics and Extension, Faculty of Agriculture
Nasarawa State University, Keffi, Nigeria

Abstract: The study determined the food security status of farming households as well as an optimal farm plan that can enhance the food security status of farming households in Nasarawa State. Data was collected from 180 farming households using random sampling. A food security line and linear programming model were used for data analysis. Majority of the farming households (58.9%) were food insecure. The optimal farm plan recommends the production of Cassava, Maize/Cowpea, and Bennisseed and Groundnut/Yam enterprises at 0.64, 0.34, 0.35 and 0.22 ha respectively to yield a net return of 141692.89 Naira. The major food security crops were identified to be Maize, Cassava and Yam. It was concluded that an effective allocation of resources can enhance the food security status of farming households. The study recommends the encouragement of the production of Cassava, Yam and Maize and the introduction of participatory family planning techniques among the food insecure households.

Key words: Optimal farm plan, food security, farming households, calorie, linear programming

INTRODUCTION

Nigeria is the most populous country in Africa with an estimated population of about 140 million (National Population Commission, 2006). Approximately 68% of this population consists of women and children with over 70% residing and securing their livelihood in the rural areas (Maziya-Dixon *et al.*, 2004). The Nigerian agricultural sector is of notable relevance in the country's economic development and growth. It contributes more than 48% of the total annual GDP, employs about 68% of the labour force, accounts for over 70% of the non-oil exports and provides over 80% of the food needs of the country (Adegboye, 2004). Despite these notable roles, food insecurity rank top most among the developmental challenges facing Nigeria (Babatunde *et al.*, 2007). The level of food insecurity has continued to rise steadily in Nigeria since the 1980s (FAO, 2000). It rose from about 18% in 1986 to about 41% in 2004 (Sanusi *et al.*, 2006). Recently, Nigeria made some progress in the area of per capital daily calorie intake and the proportion of under nourished people. The average national per capital daily calorie intake increased from 2050 kcal in 1979-1981-2430 kcal in 1989 -1991 and to 2700 kcal in 2000-2002 (FAO, 2004). Also, the proportion of undernourished people decreased from 13% in 1990-1992 to 9% in 2000-2002 (FAO, 2005). This implies that the country is making progress toward achieving the Millennium Development Goal number one (to eradicate extreme poverty and hunger). However, the current utilization of food items especially maize and soybeans for bio fuel production as well as the fear of an anticipated drought in the country and inadequate rainfall witnessed in some part of the country during the 2008

rainy season, have led to the problem of food shortages and soaring prices of food items in Nigeria and indeed globally. This represents a major threat to the steady progress the country is making towards the achievement of the Millennium Development Goal number one. In addition, the situation cannot be unconnected with a detrimental impact on the livelihood of Nigerians especially the low income earners and rural dwellers. As observed by Schuh (2002), food security is a poverty problem. Thus, the lack of food is due to the inadequate means to acquire it and not due to short fall in food production. This implies that the increase in the price of food items will erode the purchasing power of rural households and ultimately plunge them into extreme poverty and hunger.

However, an effective management of available resources through an efficient resource allocation pattern will enable a farming household get as much income as possible from its production and consequently improve its economic access to food required by its members (Mohammed and Omotesho, 2004). For this study, food security refers to the ability of a household to secure, either from its own production or through purchases, adequate food for meeting the dietary needs of all its members (Maziya-Dixon *et al.*, 2004).

Furthermore, the nutritional problem of the rural poor can be overcome either by strengthening the households' resources base or by enhancing their control and management of these resources (Morris, 2001). It therefore becomes very imperative to determine quantitatively, the current food security status of farming households in north central Nigeria vis-à-vis the

increasing prices of food items. This information is relevant for targeting assistance and for the formulation of policies and measures to cushion the effects of the rising prices of food items. The main objective of the study is to determine the food security status of farming households as well as an optimal farm plan which can be used as a guide for resources allocation by farmers to enhance their food security status.

MATERIALS AND METHODS

The study was conducted in Nasarawa State, Nigeria. The State is located in the North central zone of Nigeria. It is between latitude 7^o and 9^o North and longitude 7^o and 10^o East and shares common boundaries with Benue State to the South, Kogi State to the West, the Federal Capital Territory (FCT), Abuja to the North-East, Kaduna and Plateau states to the North-East and Taraba to the South-East. The physical feature of the State is slightly mountainous. The population for this study comprised of the farming households in the study area. A Local Government Area was randomly selected from each of the three Agricultural Development Project (ADP) Zones in the state. From each local government area, five farming communities were randomly selected. Finally, 12 farmers were randomly selected from each farming communities to give a total of sixty farmers in a local Government area and one hundred and eighty farmers for the study.

Primary data were collected using structured questionnaire. The data was collected based on 2007/2008 cropping season. Information collected included, labour input, capital input, output and prices of inputs and outputs, farmer socio-economic characteristic such as age, farming experience in crop production, level of education, household size and credit use, income, farm size, age of household head, membership of cooperative society, educational status, access to consumption credit, quality of food from own production and household size. Descriptive statistics, food security line and linear programming were used for data analysis.

A Food security line was used to classify households into either food secure or food insecure depending on which side of the line they fall. The food security line was the recommended daily per capita calorie intake of 2470 kcal (Olayide, 1982). The household calorie intake was obtained through the household consumption and expenditure data. The quantity of every food item consumed by the household in 3 days was converted into its calorie content. This was further converted into per capita calorie by dividing the estimated total household calorie intake by the adjusted household size in adult equivalent. Furthermore, the per capita calorie intake was converted into daily per capita intake by dividing by 3 days. A household whose daily per capita calorie intake is up to 2470 kcal capita intake is

regarded as food secure and those below 2470 kcal were regarded as food insecure households. Furthermore, a linear programming model was used to obtain an optimum farm plan that will ensure food security for the farming households in the zone. The linear programming model is specified as:

$$\begin{aligned} \text{Max Gross return } Z &= \sum_{j=1}^n C_j X_j \\ \sum_{j=1}^n a_{ij} X_j &\leq a_i && \text{Land constraint} \\ \sum_{j=1}^n b_{ij} X_j &\leq b_i && \text{Labour constraint} \\ \sum_{j=1}^n c_{ij} X_j &\leq c_i && \text{Fertilizer constraint} \\ \sum_{j=1}^n d_{ij} X_j &\leq d_i && \text{Seed constraint} \\ \sum_{j=1}^n e_{ij} X_j &\leq e_i && \text{Insec tidces constraint} \\ \sum_{j=1}^n f_{ij} X_j &\leq f_i && \text{Food security constraint} \end{aligned}$$

$X_j >0$; i.e. the non negativity condition where the constraints are the rows in the models; Z = objective function; X_j = Area under j th crop production activity; C_j = Gross margin per unit of the j th crop activity/per hectare a_{ij} = Land co-efficient for the j th crop; b_{ij} = Quantity of labour for j th crop activities/hectare; c_{ij} = Quantity of fertilizer for j th activity/ha; d_{ij} = Quantity of seed for j th crop activity/ha; e_{ij} =Quantity of insecticide for j th crop activity/ha; f_{ij} =crop output/ha in kilo calories for j th crop activity; a_i = Available land in ha; b_i = Human labour available in man days; c_i = Available fertilizer in kilogram; d_i Quantity of seed available in kilogram; e_i = Quantity of insecticides available in liters; f_i = Total household calorie requirement for a year; n = Number of crop production activities; The shortfall/surplus indexes were calculated for the sampled households based on the food security line. The shortfall/surplus index (P) measures the extent to which households are below or above the food security line. It is expressed as:

$$P = 1/M \sum_{j=1}^M G_j$$

Where:
 $G_j = (Y_j - R)/R$
 G_j = Deficiency or surplus face by households
 M = Number of food insecure households
 Y_j = Calorie available to the j th household
 R = Recommended per capita calorie intake

RESULTS AND DISCUSSION

Socio economic characteristic of respondents

Age of respondents: Age distribution of respondents is very important in any production activity, since there is

inequality in the production capacity of adults and children. The result in Table 1 reveals that majority of the respondents (47.78%) were within the age group of 35-44 years, while about 24.44% of the respondents were within the age bracket of 45-54 years. The mean age of the respondents in the study area was 46 years.

Gender of respondents: Majority of the respondents (76.7%) in the study area were male (Table 2). This is because households in the study area were male headed households. Only 23.3% of the respondents were females.

Household size of respondents: The result in Table 3 reveals that 44.44% of respondents have household sizes with about 11-15 members while about 24.5% of the respondents have household sizes with more than 15 members. The mean household size was 12 persons. Nonetheless, about 13% of the respondents among farming households have household sizes less than 11 members.

Education distribution of respondents: The result in Table 4 shows that majority of the respondents (46.7%) in the study area attained the level of secondary education while less than 7% of them had Quran education. However, 23.3% of the respondents in the study area had no formal education.

Farm size distribution of respondents: Land in the study area is used for continuous cultivation. The average size of farm land in the study area was 2.16ha (Table 5). The result further revealed that 27.2% of the respondents had land area within the range of 3-4.99 ha, while less than 4% had farm sizes of about 5 ha in size. However, the predominant range observed was between 1-2.99 ha.

Occupational distribution: Crop production especially in the rainy season is the major occupation of the respondents in the study area. A few respondents (31.1%) engage in other economic related activities such as trading, tailoring, public services, commercial driving among others besides farming (Table 6). In essence they are not primarily into farming.

Mode of land acquisition among the farming household: The results in Table 7 revealed that majority of the respondents (72.8%) have a secure land tenure arrangement because they acquire their farm land through inheritance. Other respondents (27.2%) were either renting or leasing the land. These categories of respondents do not have a secure land arrangement because the land can be easily be retrieved from them.

Membership of cooperatives: The membership of cooperatives is a common practice among households in the study area. Majority of the respondents belong to

Table 1: Age Distribution of Respondents

Age (years)	Frequency	Percentage
25-34	16	8.89
35-44	86	47.78
45-54	44	24.44
55-64	16	8.89
> 64	18	10
Total	180	100

Source: Field Survey, 2008

Table 2: Gender of respondents

Gender	Frequency	Percentage
Male	138	76.7
Female	42	23.3
Total	180	100

Source: Field survey, 2008

Table 3: Household size of respondents

Household size	Frequency	Percentage
< 5	32	17.8
5-10	24	13.3
11-15	80	44.44
16-20	32	17.8
> 20	12	6.7
Total	180	100

Source: Field survey, 2008

Table 4: Educational status of respondents

Highest education level attained	Frequency	Percentage
Non formal education	42	23.3
Quran education	12	6.7
Primary education	42	23.3
Secondary education	84	46.7
Total	180	100

Source: Field survey, 2008

Table 5: Distribution of respondents by farm size

Farm size	Frequency	Percentage
1-2.99	124	68.9
3-4.99	49	27.2
5 and above	7	3.9
Total	180	100

Source: Field survey, 2008

Table 6: Economic activities

Economic activities	Frequency	Percentage
Primarily into farming	124	68
Not primarily into farming	56	32
Total	180	100

Source: Field survey, 2008

Table 7: Mode of land acquisition in the study area

Farm size	Frequency	Percentage
Inheritance	131	72.8
Rentage	49	17.7
Lease	17	9.5
Total	180	100

Source: Field survey, 2008

Table 8: Membership of cooperative

Member status	Frequency	Percentage
Member	120	66.7
Non member	60	33.3
Total	180	100

Source: Field survey, 2008

various farming group (Table 8). However, 33% do not belong to any cooperative group.

Cropping enterprises among the farming households:

The crop production systems obtainable in the study area were identified and the result is presented in Table 9. The result shows that both sole and mixed cropping systems are practiced by the farming households in the study area. In terms of land area cultivated, about 60.64% of the farm land cultivated was devoted to sole crop enterprises. The mixed cropping enterprises occupy the remaining 39.36%. The commonest sole cropping enterprises were cassava, Bennisseed, Maize, and Groundnut; while Groundnut/Yam, Maize/Cowpea, Cassava/Groundnut and Maize/Sorghum were the commonest mix cropping enterprises practiced in the study area. In addition, majority of the crop farms (34.85%) are planted with Cassava as a sole crop. Among the mixed cropping enterprises, the largest land area (19.26%) was under the Maize/Cowpea mixture.

Food security status among farming households:

Based on the recommended daily farming household (R) of 2470 kcal, 41.1% of the farming households were food secure while 58.9% of the farming households were food insecure. Thus, more than half of the households were substantially consuming less than the daily per capita calorie requirement. The result in Table 10 shows that the average farm size of the food insecure farming households (1 ha) was less than that of the food secure farming households (2.1 ha). A similar finding was made by Muhammed-Lawal and Omotesho (2004). The average household size (adult equivalent) for the food secure farming household was seven persons while the food insecure farming households had an average household size of ten individuals. This finding agrees with that of Babatunde *et al.* (2007) in a recent study.

The shortfall/surplus index (P), which measure the extent of deviation from the food security line, shows that while those that are food secure exceeded the minimum daily per calorie requirement by 53%, the food insecure households fell short of the minimum daily per capita calorie requirement by 34%.

Basic optimal farm plan from linear programming analysis:

The result of the optimal farm plan using the linear programming analysis is presented in Table 11. The result shows that sole cassava and maize/cowpea were the crop production activities that entered the optimal farm plan and equally met the food security needs of the farming households. The programme value of 141692.89 Naira was obtained. This means that an average farming household in the study area will earn 141692.89 Naira in the production of the four enterprises that entered the optimum farm plan. The level of activity for Cassava, Maize/Cowpea, Bennisseed and Groundnut/

Table 9: Enterprise combination for crop production

Crop combination	No. of plot	Total area cultivated	Percentage of total area cultivated
Sole maize	10	6.90	8.47
Cassava/Groundnut	7	5.20	6.38
Sole bennisseed	21	11.02	13.52
Maize/sorghum	5	3.84	4.71
Groundnut/yam	14	7.40	9.08
Sole groundnut	3	3.10	3.80
Maize/cowpea	25	15.70	19.26
Sole cassava	30	28.40	34.82
Total	115*	81.50	100

Source: Field survey, 2008

Table 10: Summary Statistics of Food Security Indices for the Farming Households

Food security indices	Food Secure	Food Insecure	Total
Number of household	74	106	180
Percentage of households	41.1	58.9	100
Household size (Adult equivalent)	7.47	10.19	8.34
Farm size	2.10	1.00	1.5
Per capita daily calorie available	3021	1566	2269
Shortfall/Surplus (P)	0.53	0.34	

Recommended per capita daily calorie Intake (R) is 2470 kilo calorie; Source: Field survey, 2008

Table 11: Summary of the optimal farm plan

Basic Activities in the plan	Unit of activity	Level of activity
Objective function	Naira	141692.87
Crop production activities	ha	
Sole cassava	"	0.64
Sole bennisseed	"	0.35
Maize/cowpea	"	0.34
Groundnut/Yam	"	0.22
Total	"	1.55

Source: Field survey, 2008

Table 12: Resource use level

Resource	Use status	Use	Surplus/slacks
Land (ha)	Not fully Utilized	1.67	0.93
Labour (manday)	Fully Utilized	215	-
NPK	Not fully Utilized	193.71	22.29
Urea	Fully Utilized	108	-
SSP	Not fully Utilized	141.73	2.27
Maize	Not fully Utilized	3.94	21.06
Cowpea	Not fully Utilized	22.55	9.45
Cassava	Not fully Utilized	9.46	18.54

Source: Field survey, 2008

Yam enterprises were at 0.64, 0.34, 0.35 and 0.22 ha respectively. This finding imply that the production of the crop production activities recommended by the optimal farm plan would meet the food security needs of the households and also provide monetary income for meeting other household needs such as health and education.

Optimal resource use level in the optimal farm plan:

The resource used by the farming households in their crop production activities includes land, labour, fertilizer (which include NPK, Urea and SSP) and seeds of Maize,

Table 13: Summary of non basic activities and their opportunities cost

Excluded activity	Opportunity cost (Naira)
Sole Maize	5693.03
Sole Ground nut	6663.39
Cassava /Groundnut	8692.87
Maize/Sorghum	7245.87

Source: Field survey, 2008

Table 14: Relative contribution of crops to food security in the study area

Crop	Estimated calorie supplied	Percentage of total calorie supplied
Maize	872	34
Cassava	745.6	29
Cowpea	98.24	3.8
Rice	72.43	2.8
Yam	502	19.55
Sorghum	276.4	10.8
Total	2566.67	100

Source: Field survey, 2008

cassava and cowpea and the calorie requirement. The allocation and use level of the resources are presented in Table 12. The study of the resources shows that all resources were not fully utilized in arriving at the optimal farm plan except for labour (215 mandays) and Urea fertilizer (108 kg) which were fully utilized. The non-fully utilized resources include land, NPK fertilizer, SSP fertilizer, maize seed, cowpea seed and stem cuttings. This implies that these resources were inefficiently utilized by the farming households in the study area.

Non basic activities and their opportunity cost: These non basic activities and their opportunity cost are presented in Table 13. The opportunity cost shows that the programme value will decrease if a unit of the non basic activity which did not enter the programme were forced into the programme. The optimal cost of production will increase by the opportunity cost value of each excluded activity. The non basic activities that did not enter the programme include, Sole Maize, sole Groundnut, Cassava/ Groundnut and the Maize/Sorghum enterprises. The excluded activity with the highest and the least cost penalty were Cassava/Groundnut and Sole Maize enterprises, respectively.

Relative contribution of crop available for consumption from own production to household food security: The relative contributions of crop available for consumption from own production was determined to identify which crop contributes the most to household's food security. The result as shown in Table 14 reveals that about 34% of the total daily calorie available in the households was supplied by Maize followed by Cassava which supplied (29%) and lastly Yam (19.55%). This implies that Maize, Cassava and Yam were the most important food security crops in the study area.

Conclusion/recommendations: It can be concluded from the study that majority of the farming households in the study are food insecure and the production of crop enterprises based on an efficient allocation of resources as recommended by the optimal farm plan would

improve the food security status of the food insecure households. Based on the finding and conclusion of the study, the following recommendations are hereby made. Food insecure household should be encouraged to increase the production of cassava, Yam and maize to enhance their food security status. Cowpea production should also be encouraged as it serves as the major source of protein for farming households in the study area. The extension services in the state should educate farmers on how to allocate and efficiently use the limited quantity of farm resources at their disposal. Participatory family planning techniques should be introduced especially among the food insecure household. Farming households should be further enlightened on the nutritional implication of various food items such as fish, soyabean and egg especially for growing children to increase protein intake in their diet.

REFERENCES

- Adegboye, R.O., 2004. Land, Agriculture and Food Security in Nigeria, 3rd Faculty Lecture, Faculty of Agriculture, University of Ilorin, Nigeria.
- Babatunde, R.O., O.A. Omotesho and O.S. Sholatan, 2007 Socio-economic characteristics and food security of farming households in Kwara State, North-Central Nigeria. *Pak. J. Nutr.*, 6: 49-58.
- FAO., 2005. Food and Agricultural Organization on the State of Food Insecurity in the World, Rome, pp: 2
- FAO., 2000 The State of Food Insecurity in the World 2001. Rome, pp: 4-7.
- FAO., 2004. The State of Food Insecurity in the World: When people live with hunger and fear of starvation, Food and Agricultural Organization of the United Nations, Rome, Italy.
- Maziya-Dixon, B.I.O., E.B. Akinyele, S. Oguntona, R.A. Nokoe, Sanusi and Hariss Eds, 2004. Nigeria Food Consumption and Nutrition Survey 2001-2003 Summary, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria.
- Mohammed-lawal, A. and O.A. Omotesho 2004. Resource allocation in food crop production and farming household food security in kwara state, *Agro Search*, 6: 15-21.
- Morris, S.S., 2001 Measuring nutritional dimension of household food security. *Food Security in Practice, Methods for Rural Development Projects*, International Food Policy Institute -IFPRI, Washington D.C., 11-29.
- National Population Commission, 2006 National Population and Housing Survey. National Population Commission, Abuja, Nigeria.
- Olayide, S.O., 1982. Food and Nutrition Crises in Nigeria, Ibadan, University Press.
- Sanusi, R.A., C.A. Badejo and B.O. Yusuf, 2006 Measuring household food insecurity in selected local government areas of lagos and ibadan, Nigeria. *Pak. J. Nutr.*, 5: 62-67.
- Schuh, G.E., 2002. Global food security economic perspective an electronic. *J. US Department of State*, 7: 15-17.