



OPTIMAL FARM PLAN AND FOOD SECURITY SITUATION AMONG AGROPASTORALIST HOUSEHOLDS IN GIWA AREA OF KADUNA STATE, NIGERIA

A. B. Mohammed¹, A. F. Ayanlere¹, A. O. Omotesho² and A. Muhammad Lawal²

¹Kabba College of Agriculture, Ahamadu Bello University, Kabba, Kogi State, Nigeria

²Department of Agricultural Economics and Farm Management, University of Ilorin, Nigeria

E-Mail: bashraj25@yahoo.co.uk

ABSTRACT

This paper presented the food security situation among agro pastoralist households in Nigeria. Primary data were used for the study and which were obtained with the aid of interview schedule translated to the respondent in Hausa language. A two stage sampling technique was applied on eighty seven agro pastoralist household which were randomly selected from six villages with the number selected proportionate to the size of each village. The analytical tools used for study include simple descriptive statistics, food security index and linear programming. The descriptive statistics analysis revealed that the agro pastoralist household in the study area have large farmlands acquired mainly through rent. The analysis also revealed that sorghum and maize/sorghum enterprises were the most prevalent cropping enterprises in the study area. Using the basic calories and protein required approach per capital per day per household size, 65% and 35% percent of the households were identified as food secure and food insecure respectively. The optimal farm plan that ensure food security among agro pastoralist suggest that an average Agro pastoralist household should devote 0.35 hectares to the production of maize/ sorghum and 2.6 hectares to the production of maize/ cowpea.

Keywords: agropastoralist, food security index, linear programming and Kaduna state.

INTRODUCTION

Agropastoralist are a group of people (nomads) who are known for rearing livestock and are now settled to cultivate land for subsistence. This group of people practices mixed farming and as such this study tends to analyze their food security status.

Food is a basic necessity for the existence of man food in the appropriate quantities and quality is required for a healthy and productive life and hence the need for food security.

Food security is defined as access by all people at all times either through own production or through purchase to enough food for an active, healthy life (Maziya - Dixon *et al.*, 2004).

Food security may also be defined as access by all people at all times to sufficient food for a healthy and productive life. This definitional framework implies that four major elements constitute food security; these are availability, adequacy, accessibility and sustainability of access. Availability connotes the physical presence of food in large amounts, accessibility suggests sufficient purchasing power or ability to acquire quality food at all times while utilization and sustainability in a larger context embrace the supply, demand and adequacy of food at all times.

Agropastoralist produce the bulk of the livestock product in the country. Livestock is an important source of nutrition and food security it provides high quality food in the form of meat, eggs, milk and dairy product which can contribute significantly to diversity and improve the diet of both rural and urban populations. Livestock products are excellent source of protein and some key micronutrient that are generally scarce in grains

and most staples. In HIV/AIDS action, livestock products are highly valuable for their nutrition and health values. Crop-livestock system increase food security through diversifying food, nutrition and income sources it represent a valuable practice for efficient resources management and sustainable agriculture (Smith *et al.*, 1997) these integrated practices provide a mutually beneficial interaction between crop and livestock resources making optimal use of scarce resources generating synergies and increasing the labour, economic and ecological viability of agriculture. However in terms of food consumption, agropastoralist consume only a little portion of their livestock product. They rarely consume meat except during festival periods. This practice obviously raises a lot of concern as to whether agropastoralist are able to meet their food security need from the consumption of crops and minimal consumption of livestock product and as such the study tends to determine the extent of food security and the optimal farm plan that would ensure food security among the agropastoralist households in the study area.

Theoretical and conceptual framework

Lawal (2001) defined agropastoralists as a group of people known for rearing animals and are now settled to cultivate land for subsistence. An agropastoralist household consists of group of people who live and carry out their production and consumption activities together as a unit within their environment. (Lawal, 2001). Agropastoralist households in the study area are assumed to meet their food need majorly from their own production and little if any from purchase. There are basically two approaches to the measurement of food security the



quantitative and qualitative approach however the quantitative approach was adopted for this study.

In a study on food security olayide, (1982) gave the threshold for food security as the ability of the household to meet 2470kcal of energy and 65g of protein per capital as bench mark. In view of Joseph and Ajayi (2002), the recommended minimum nutrient requirement to be consumed per day per capital is 2191kcal and 65-68g crude protein out of which at least 40% must be animal protein. Studies by goldsmith et al, (1967) and deville degovyet *et al.* (1978) observed that most diets contain adequate amount of all nutrients required for good and healthy living once it is taken in quantity that is enough to meet the individual energy requirement. However in a study on food security olayemi (1998) gave the threshold for food security as the ability of household to meet 2260kcal of energy and 65g of protein per capital below which household are classified as food insecure. Based on this threshold household calorie and protein available from own production and from the purchase of crops consumed was used in the determination of food security of agropastoralist household in the study area. It is estimated through the calorie and protein value of the respective crop items produced and purchased.

METHODOLOGY

The study was conducted in Giwa area of Kaduna state. It lies between 11-30W and 7-45E. It is located North West of Zaria in the northern guinea savannah and the southern tip of the Sudan savannah and about 640m above sea level.

Agriculture remains the major occupation of the people in the area. Farming in the area is mainly traditional in nature and the main emphasis is on the cultivation of crops and keeping of livestock in a mixed farming system. The major crops grown in the area include maize, sorghum, millet and cowpea. The major livestock species kept in the area include cattle sheep goat and poultry. Primary data were used for the study. The primary data were obtained using interview schedule translated to the respondents in Hausa language. A total of 87 agropastoralist were interviewed based on the total number of agropastoralist households in the study area. Data were collected on socio-economic variables, such as age, sex, household size educational background, family labour, cropping pattern as well as livestock and crop production activities. Secondary data were collected from Local Government Secretariat and the National Animal Production Research Institute [NAPRI].

Descriptive as well as quantitative statistics were used to analysis the data. To determine the extent of food security and the optimal farm plan among the agropastoralists household the food security index and linear programming methods were used. Simple descriptive statistics was used to have summary description of the data collected. This involved the use of central tendency such as percentages, means and frequency distribution. To measure food security a household food security index was constructed by defining

a minimum level of nutrition necessary to maintain healthy living. It also indicates the "Food Security Line" for the population under study. Households above this line are classified as being food secured. The food security line used in this study was measured by the daily recommended level of calorie and protein which are 2260kcal and 65g respectively olayemi (1998). A similar approach was used by Lawal - Muhammed (2003) and Boyode (2004). The nutrient content of both produced and purchased food items were used to estimate both the calorie and protein availability in the household. The quantity of crop and livestock products produced and purchased in kilogram were converted to calorie and protein respectively and divided by adjusted house hold size and by 365days to obtain the calorie and protein consumed per day per household.

$$\text{Food security index } k = \frac{\text{Household daily per capital calorie/ protein consumed (X)}}{\text{Household daily per capital calorie/ protein required (Y)}}$$

Where $X/Y = K$

Thus for a house to be food secure K must be greater than or equal to one ($K \geq 1$) otherwise the house hold is food insecure. A linear programming model was used to determine the optimum farm plan among the agropastoralist households. To determine optimal farm plan for the agropastoralist household a linear programming model was fitted and was estimated as follows:

$$\text{Max } z = \sum (p_j q_j - c_j)$$

S.T

m

$$\sum_{j=1}^m a_{ij} X_{ij} \leq b_i$$

J=1

Where Z = gross margin in naira per hectare

P_j = price of J^{th} crop per unit in naira

q = quantity of J^{th} crop in kg

C_j = total variable cost per activity in naira per hectare

a_{ij} = specific level at which j^{th} activity is to be carried out

b_i = level of i^{th} resources

X_i is the specific level at which j^{th} activity is to be carried out

M = number of resources that ranges from 1-8, i^{th} resources ranges from 1 to 3

b_1 = average land available per household (Ha)

b_2 = average labour available per household in man-day. Using Normans (1973) conversion ratio, 1 day of woman work and a child work were estimated at two-third and half man – day, respectively. Eight hours of work by man is one man – day.

b_3 = average capital per household in naira. It covers the cost of purchased inputs such as seeds and chemical.



RESULTS AND DISCUSSIONS

Socio-economic characteristics of the agropastoralist household

The socio-economic characteristics of agropastoralist in Giwa area of Kaduna state are

represented in Table-1. The mean age of the respondent was 46 years. Majority of the respondents (60%) were between the ages of 31 - 50 years.

Table-1. Agropastoralist personal characteristics (n=87).

Variables	Frequency	Percentage	
Age (years)			
21 – 30	7	8.05	
31 – 40	30	34.48	(46)
41 – 50	22	25.29	
51 – 60	20	23.00	
Total	87	100	
Greater than 60	8	9.20	
Educational status			
No formal education	19	21.84	
Quranic education	53	60.92	
Nomadic education	11	12.64	
Primary education	4	4.60	
Secondary education	0	0	
Total	87	100	
House hold size			
Less than 5years	32	36.78	(7)
5 – 10	47	54.02	
11 – 15	8	9.20	
Total	87	100	
Variables	frequency	percentage	
Land acquisition			
Inherited	6	6.9	
Purchased	19	21.84	
Rent	47	54.02	
Government land	15	17.24	
Total	87	100	
Farm size (Ha)			
1.2.99	21	24.14	
3.4.99	28	32.18	
5.6.99	20	23.00	(4.74)
7.8.99	9	10.34	
9 hectares and above	9	10.34	
Total	87	100	
Crop diversification (Number)			
2 -3	35	40.23	
4 – 5	38	43.68	
6 – 7	14	16.07	
Total	87	100	
Livestock type			
Cow, sheep, goat poultry (C.S.G.P)	40	45.98	
Cow, sheep, goat, poultry and guinea fowl (C.S.G.P.G)	22	25.28	
Cow, goat and poultry (C.G.P)	15	17.24	
cow, sheep and goat (C.S.G)	10	11.50	
Total	87	100	

Source: Field survey 2005 (figures in parenthesis are means)



This implies that a good number of the agropastoralist household heads were middle aged and able bodied men that can actively take part in the production process and hence make positive contribution to food security. The study also revealed that less than a quarter of the respondents (21.84%) are illiterate while more than half of them (60.92%) have Quranic education signifying that majority of the respondents are illiterate and will be able to comprehend extension guide in Arabic languages. This could have a positive impact of their agricultural activities and hence their food security status. Furthermore the study shows that more than half of the respondent (54.02%) had family size ranging from 5-10 persons. The mean family size is 7 people. This could imply that most respondent family are of average size and would go a long way in reducing the cost of hired labour in the study area.

The land ownership pattern showed that above 54% of the agropastoralist household acquired their land through rent while about 17.24% employed free ownership at no cost. This would possibly increase productivity and hence ensures food security among them. The study also revealed that the agropastoralist household cultivated on the average a farm size of 4.74 hectares this shows that most of the agropastoralist possess very large farms and

only a few (24.14%) had less than three hectares. This implies that, the agropastoralist have enough land that would meet their food need and hence attain a high food security status. The extent of crop diversification among the agropastoralist shows that the entire respondent interviewed cultivated two or more crops. Majority of the respondent cultivated 2-5 crops. Less than a quarter of the respondents (16.07%) cultivated more than six different crops. This implies that the level of diversification among the agropastoralists is high and could have a positive effect on their food security status.

The livestock ownership structure of the agropastoralist household revealed that the major livestock species in the study are cattle, sheep, goat and poultry. In terms of population cattle ranked highest while sheep ranks least.

Cropping pattern

The cropping pattern in a particular area is determined by the climate, soil type, labour available and capital the physical and socioeconomic characteristics of the study area is favorable for the production of crop like cereals and grain legumes crops cultivated were either as sole or in mixtures with two or three crops.

Table-2. Cropping pattern of household.

Crops in pure stands/combination	No. of agropastoralist crop	Percentage % *
Millet sole	22	25.29
Sorghum sole	29	38.33
Soil bean sole	11	12.64
Maize sole	21	24.14
Rice sole	11	12.64
Pepper sole	9	10.34
Groundnut sole	7	8.05
Millet / maize	8	9.20
Maize and sorghum	36	41.38
Sorghum / millet	8	9.20
Sorghum / soil bean	19	21.84
Maize / cowpea	11	12.64
Maize / soil / pepper	6	6.90
Popcorn / pepper / millet	2	2.30

Field survey 2005

*multiple responses

The cropping pattern of household shows that sorghum, millet and maize were the most important crop in pure stands while maize / sorghum and sorghum / soil bean were most important crop combination based on the percentage of agropastoralist involved in their production. The study further revealed that the most prevalent cropping pattern are cereal and legume based, sorghum and maize /

sorghum enterprises were the most common cropping enterprises. Implying that sorghum and maize are the most important crop in the study area.

Food security status among agropastoralist

The result of the extent of household food security in the study area is presented in Table-3.



www.arpnjournals.com

Table-3.

Food security status	Number of agropastoralist household	Percentage %
Food secure (cal and protein)	57	65.52
Food insecure (calorie deficient)	4	4.60
Food insecure (protein deficient)	7	8.05
Food insecure (calorie and protein)	19	21.84
Total	87	100

Field survey 2005

Based on the food security line used for the study i.e., the daily recommended level of calorie and protein which are 2260kcal and 65g respectively, the study shows that more than half of the respondent about (65%) are food security while 34.48% were food insecure from the food insecure household less than 10% of the agropastoralist

household were protein as well as calorie deficient. Further analysis shows that the food insecure household sold more of the total output of crop produced than they consumed. This implies that their being food insecure is poverty driven rather than a productivity issue thus they need to sell to fulfill other basic household needs arises.

Table-4. Percentage of total crop output sold and consumed by agropastoralist households.

Food security	Total output of crop in Kg grain equivalent	Quantity consumed	Quantity sold	% quantity consumed	% quantity sold	% given as gift and reserved a for planting
food secure	3845	2211.84	990.18	57.52	25.75	16.73
Household						
Food insecure	3709	1226	2483	33.05	66.94	-
Household						

Field survey 2005

The optimal farm plan for agropastoralist household

A linear programming is widely used mathematical technique designed to assist managers in decision making and resource allocation food security among the agropastoralist is viewed from the crop

produced as well as that purchased linear programming is used for the study to know the optimal farm plan that would ensure food security among the agropastoralist and suggest how efficient resource should be allocated.

Table-5. Summary of the optimum farm plan for agropastoralist household.

Objective function real activity	Existing activity level (Ha)	Opportunity cost (#)
Objective function	#48, 190.45	
Real activity (ha)		
Maize (X1)	0	6894.26
Rice (X2)	0	3187.28
Soil bean (X3)	0	3447.76
Millet (X4)	0	7307.76
Sorghum (X5)	0	4096.68
Maize / sorghum (X6)	0.3588	0
Sorghum / soil bean (X7)	0	5387.31
Maize / cowpea (X8)	2.5878	0

Field survey 2005

**Table-6.** Resource use land of Agropastoralist household.

Resources	Used	Surplus/Slack
Land (ha)	2.94	00
Labour man hour	30.28	517.10
Capital ₦ (Ha)	3, 586.14	23456

Source feud survey 2005

The result on Table-5 shows that only two out of the eight crop enterprise enter the solution this are maize / sorghum and maize /cowpea with a total land area cultivated of 0.36 and 2.6 hectares, respectively. The study further revealed that millet, followed by maize and sorghum / soy bean were the least profitable and forcing them into the solution would reduce the objective function by #7, 309, #6, 894 and #5, 387, respectively.

Further analysis on the resources use level among the agropastoralist household Table-6 show that when available resources and top enterprise were combined maize/sorghum occupied 12.25% of the available land where maize/cowpea occupied 82.25% of the total available land which indicate that is the most limiting constraint to optimum production as all the quantities available were utilized.

CONCLUSIONS AND RECOMMENDATION

In this paper, we employed linear programming analysis to know the optimum farm plan that would ensure food security among the Agropastoralist household, we also characterize Agropastoralist household into food secure and food in secured based on their calorie and protein intake. The socio economic characteristics of the Agropastoralist household were also analyzed. the result showed that the Agropastoralist household in the studies area have large farm land acquired mainly through rent sorghum and maize sorghum were the most prevent common cropping enterprise in the study area. The Agropastoralist households in the study area are food secured in view of the fact that the average calorie and protein consumed in the area is more than the minimum per capital requirement From the study it can be concluded that the major enterprise that ensure food security among Agropastoralist from own production only are maize/sorghum and maize/cowpea, respectively.

Based on these findings the following recommendations are made:

Production incentives such as fertilizers and improved seed should be subsidized by Government and provided at the grass root level to the Agropastoralist in other to boost the production of the most important food security crops in the study area.

The food insecure household should be encouraged to increase the production of maize, sorghum and cowpea to enhance their food security status.

Emphasis should however be placed on sorghum production as it serves as a major source of protein in the study area.

Also effort should be intensify to developing agricultural education through adult literacy programs as 21.84% of the Agropastoralist have no former education.

Finally programs could be arranged in Arabic language because majority of them have Quran education.

REFERENCES

- Bayode T. 2004. The place of yam in Rural Household Food Security in Kogi State. Unpublished B. Agric project submitted to Department of Agricultural Economics and Farm Management, University of Ilorin, Nigeria.
- De Ville de Gouyet, C., J Seaman and U. Geifer. 1978. The management of nutritional Emergencies in Large population WHO Geneva.
- Goldsmith G.A., R. Revelle, C.L. Beale, J.W. Brackett, R.W. Engel. W.A. Gatner, O.C. Johson, T. Meyers, M. Milner and R.E. Shank. 1967. The world's food problem.
- Joseph J.K. and S. Ajayi. 2002. Agricultural product and man. History and Philosophy of science: General Study approach. Akaji M.A and E.T Jolayemi (Eds.). Report of the panel on the world food supply Vol. 11. The White House. pp. 118-141.
- Lawal A.B. 2003. Economics of Mixed farming System among Agropastoralist in Sabon Gari local government Area of Kaduna State. Published B. Agric. Project Submitted to Department of Agric Economics and rural Sociology A.B.U. Zaria.
- Maziya-Dixton B., J.O Akinyele, E. B. Oguntona, S. Nokoe, R.A. Sanusi and E. Harris. 2004. Nigeria food Consumption and nutrition survey 2001-2002 summaries. International institute of tropical agriculture.
- Muhammad -Lawal A. 2003. Cereal production and rural Household Food security in some local Government area of Kwara State. M.Sc. thesis, Department of Agricultural and Farm Management, University of Ilorin, Nigeria.
- Olayemi J.K. 1998. Food Security in Nigeria. Research Report No. 2. Development Policy Centre, Ibadan, Nigeria. 30: 1-78.
- Olayide S.O. 1982. Food and nutritional crisis in Nigeria Ibadan University Press Oversea Development Institute. 1997. Global Hunger and food security after the world Food Summit. ODI Briefing Paper (1) February. London: Overseas Development Institute.