Greener Journal of Agricultural Sciences
ISSN: 2276-7770; ICV: 6.15
Vol. 4 (4), pp. 130-135, May 2014

http://gjournals.org/GJAS

Research Article (DOI: http://dx.doi.org/10.15580/GJAS.2014.4.012714070)

Description and Optimization of Sedentary Production System (Jubraka) in Nuba Mountains, Western Sudan

***Ahmed Mohammed, Murakah Mohammed, Dr. Ibrahim Adam Eldukheri and Elkhalil Elnour Breima**

Agriculture Research Corporation (ARC). Sudan, Elobied Research Station.

ARTICLE INFO

Article No.: *012714070*
DOI: *10.15580/GJAS.2014.4.012714070*

Submitted: *27/01/2014*
Accepted: *09/05/2014*
Published: *15/05/2014*

****Corresponding Author***
Ahmed Mohammed
E-mail: *amorakah @yahoo.com or kbriema@ yahoo.com*
Phone: *+249912688261 or +249118895792*

Keywords:
sedentary production system, jubraka, socio-economic factors, linear regression analysis and linear programming

ABSTRACT

This study was carried out in Nuba Mountains seasons (2008-2009). The main objectives of the study are, to describe, analyze and identify possible optimization for the sedentary production systems (jubraka). And to identify the socio-economic factors that affecting the level of production. Primary data were collected using structured questionnaire. A representative sample size of 50 farmers was selected using multi-stage clustered design. Group discussions using guidelines questions were also used to augment information collection. Secondary data were collected from the relevant institutional sources. Descriptive statistics, linear regression analysis (Cob-Douglas function) and linear programming (LP) were applied to analyze the data. From the linear regression the results showed that (land, labor, capital) have positive effectiveness with different significant. The linear programming results also revealed that Dura and Sesame entered the optimal solution.

INTRODUCTION

The Nuba mountains area is inhabited by more than sixty different tribes of different origins and accordingly different livelihood sources and strategies exist. Agriculture in Nuba Mountains constitutes the main source of livelihood for the majority and is the base for any current and future economic growth in the region. There are several patterns of agricultural production in the Nuba Mountains and even different from other part of the country i.e. the home garden (jubraka), which are principally used for growing early maturing field crops to meet household consumption needs before the normal crop maturation time. The other two sub-systems are the traditional production and the semi-mechanized one. The traditional agriculture system is distinguished by its small or middle area, in addition to farmers in this sector often use the traditional tools to grow definite crops including (Dura, cowpea, sesame, okra, groundnuts, …etc).The semi-mechanized farming system is distinguished by its middle or small area and use of mechanization, at least in land preparation and threshing of produce (Annual report, 2007).

MATERIAL AND METHODS

This study which was carried out in Nuba Mountains' area covers most of southern Kordofan state, and lies between longitudes 29 – 31 ° and latitudes 10 - 12 ° north. Clay soils dominate in the Nuba Mountains and rocky lands as well. There is also gardud soil in the flat plains of the area as well as the black cotton soils.

In this study primary data were collected using structured questionnaire. A representative sample size of 50 farmers was selected using multi-stage clustered design, A Group discussions using guideline or check list were also used to augment information collection. Multiple visits were organized to collect information in short duration, for both the administration of the questionnaire and filling gaps for group discussions. The primary data covered resource utilization and production characterization, mainly basic information about the socio-economic characterization of Nuba farmers. And the secondary data were collected from the relevant institutional sources. In order to achieving the research objectives the study used descriptive statistics measures along with Statistical test regression analysis and linear programming models.

RESULT AND DISCUSSION

Socio-economic characteristics

The gender structure of farm households as referred to socially constructed roles, learned behaviors and expectations associated with females and males. It includes the ways in which those differences, whether real or perceived have been valued, used and relied upon to classify women and men and to assign roles and expectations to them. The survey results table (1) showed that the majority of farmers (78%) in Nuba Mountains were males. Reflecting that women farmers were involved in nearby farm (Jubraka) because of their other reproductive engagement.

Siddig (1999) stated that farmers' age is one of the demographic characteristic which influences the quality of decision and his attitude toward accepting new ideas. Table (1) showed that the highest percentage of the farmers in the survey was found within the productive age of 40-65 year.

On the other hand farmer education in general can be defined as accumulation of knowledge and experience to prepare an individual farm (Ahmed, 1996; Siddig, 1999). From the survey two- third of farmers has attended primary and secondary school education (table 1). This will enable them to make the better choice for their resources allocation, understand the technical packages and addressing the farm problems and ultimately reduce the expected risk and increase farm output and income.

The success of farming process and hence the amount of the quality of output depend on perfect and timely conduction of the different farm practices which in turn depend on quality and quantities of inputs used. Among which, farm labor or agricultural machinery and traditional tools of cultivation. Also the application of the recommended improved cultural practices was found to be useful in various aspects (Eaton, et al., 2007). From table (2) the land preparations in Nuba Mountains, in jubraka were performed in May (40%) while cultivation date started in June (68%). The results reveal that 60.7 % of the farmers use local tools for lands preparation, while 22% and 1.3 % use tractor and animal drawn implements respectively. In addition to that most (77.9%) of the farmers use traditional way for seeding, weed control and threshing. Also 70.7 % of farmers use local seed table (3).

Production problems

The survey results revealed that 41.2% of problem came from pests and 23% from challenge between cattle tenders and farmers while 18% from diseases and only 17.8% from scarcity of rainfall as depicted in table (4). Also table (5) revealed that 87.8% of farmers have no extension service In spite of technical information and new innovation on the field of agriculture. Also the study indicated that 66% of farmers have no available seeds.

Women farm (jubraka) contribution in household income

Traditionally women in Sudan have always been active in agriculture and food security; in western Sudan, women have always been more active in agriculture within and outside the household compound. They contribute as much as 80 -90% of labor for household production and roughly 70% of total labor for agriculture production and their contribution in food security in this region is through "jabarik", farms in which multi-crop were grown. With regards to Nuba Mountain agriculture the results revealed that (table 6) women also contribute much in household food security by cultivating their own farms (52%) and

contributing to family farms with considerable portion (64%). Almost the majority of women reported that (82%) their farm income is spent for their families needs. This implies that like other women the region Nuba women were contributing much for household food security through direct contribution.

Table (1): Socio-economic characteristics of farmers'

Items	Percentage (%)
1. Gender	
Male	78
Female	22
2. Age (years)	
Less than 15	5.5
15-40	31
40-65	45.5
65 and above	18
3. Educational level	
Illiterate	22
Khalwa	17.3
Primary	30
Secondary	22.7
University	8

Source: field survey 2008-2009

Table (2): Land preparation and sowing date

land preparation						Sowing			
Month	march	April	May	June	July	May	June	July	August
	4%	26%	40%	28%	2%	6%	68%	24%	2%

Source: field survey2008-2009

Table (3): Technical packages, seed types and sources, weeding and harvest

land preparation			
Local tools	Tractor disc	Animal tract	Local +tractor disc
60.7%	22%	1.3%	16%
Way of cultivation seeds			
By hand	By tractor disc		Hand + tractor disc
78%	14.7%		7.3%
Varity of seed			
Improved	Local		Improved + local
21.3%	70.7%		8%
Source of seeds			
Farm	Market		organization
65%	27%		8%
Weeding method			
By traditional tools	By herbicides		Traditional + herbicides
90.7%	1.3%		8%
Way of threshing			
By hand	By harvester		Hand+ harvester
65%	20%		15%

Source: field survey 2008-2009

Table (4): Farmer's perception to production problems

Items	%
Pests	41.2%
Diseases	18%
Conflicts over resources	23%
Low rainfall	17.8%

Source: field survey 2008-2009

Table (5): Farmer's access to extension and seed services

Items	%
Extension service:	
Access	11.2%
Not access	87.8%
Available of seed varieties:	
Available	44%
Not available	66%

Source: field survey 2008-2009

Table (6): Women farms and contribution to family income

Women agriculture						
Separate owner ship		Farm management			Contribution in family income	
Separate farm	Non-separate	Women	Other family member	husband	Contribute	No contribution
48%	52%	32%	64%	4%	82%	18%

Source: field survey 2008-2009

Regression models

In this study, to address the nature of relationship between dependent and independent variables and level of influences, the Cobb-Douglas production function was chosen and has been transformed from non-linear to linear after taking the natural logrithium of both sides.

The general form of the equation is written as:

$Y = AX^{a}_{1} X^{b}_{2} X^{c}_{3} e^{u}$

Where y = output (dependent variable) of all activities of dura, sesame, cowpea, maize and okra in monetary term, A = intercept, X_1 = land in fedaan, X2 = labour in man- days, X3 = capital in Sudanese genih SDG (independent variables) and u is the error term, a, b, c are regression parameters. Then the transformed form is:

LNY = alnX1+blnX2 + clnX3+ u.

Regression result

Table (8) showed that the explanatory powers or the determination measures of the explanatory variables (R square) was 63%, these coefficients mean that around 63% of the explained variations in the output in jubraka is explained by the variables included in the equations. Moreover, the F-test of each equation indicates its overall significance so, the estimated equations can be written as:

$Y = 3.87\ X_1^{0.285}\ X_2^{0.291}\ X_3^{0.052} u$

Or $Ln\ y = 3.87+0.285\ln X_1 +0.291\ln X_2 + 0.52\ln X_3 +u$

Land (feddan) influences the output by 28.5 with high significantly at 0.000. This result indicated that, when land increase by 1% output increased by 28.5% in case consistently the others factors.

Labor (man days) influences the output by 29.1 with significantly at 0.018. This result revealed that: when increasing the labor input by 1% increases output by 29.1% in case consistently the others factors.

Capital (SDG) influences the output by 5.2 with high significantly at 0.000. This result revealed that: when increasing the capital input by 1% increases output by 5.2% in case consistently the others factors.

Solving linear programming model

The objective function: maximize Z

$Z = ax_1 + bx_2 + cx_3 + dx_4 + ex_5$

Where a, b, c, d, e are coefficients of objective function

The general formula of the inequalities:

$Ax_1 + Bx_2 + Cx_3 + Dx_4 + Ex_5 \ldots\ldots\ldots\ldots \leq H$

Where *A, B, C, D, E* are the coefficients of constraints inequalities

H is the right hand side (RHS)

Model for Jubraka

By letting X_1 = Dura, X_2 = Sesame, X_3 = Cowpea, X_4 = maize and X_5 = okra, then algebraic version of the model became:

$Max\ Z = 214.6X_1 + 105.3X_2 + 125.7X_3 + 98.3X_4 + 223.7X_5$

Such that:

$1.39X_1 + 0.57X_2 + 0.65X_3 + 0.8X_4 + 0.25X_5 \leq 3.66$

$19.66X_1 + 11.89X_2 + 14.07X_3 + 12.92X_4 + 12.75X_5 \leq 71.29$

$83X_1 + 31.87X_2 + 34.19X_3 + 16.6X_4 + 25X_5 \leq 190.66$

And: $X_1, X_2, X_3, X_4, X_5 \geq 0$

Table (7) revealed that, by the results of linear programming of jubraka when the area that form the structure of the crops which achieve an attractive return is 1.4 feddan dura, 0.6 feddan sesame and 0.7 feddan cowpea and 0.3 Feddan okra and the rest of the space for other crops of the total area of 3.7 feddan ideal. From that table five crops can be grown in jubraka: Dura, sesame, cowpea, maize and okra each of which has specified per feddan requirement for land, labour and capital. Production of (1.39) Dura requires 19.66 days and 83(SDG) capital cost, production of (.57) sesame requires 11.89 days and 31.87(SDG) capital cost, production of (.65) cowpea requires 14.07 days and 43.19(SDG) capital cost while production of (.8) maize requires 12.92 days and 16.6(SDG) capital cost and production of (.25) okra requires 12.75 days and 25 (SDG) capital cost. A total of 3.66(feddan), 71.29(days) and 190.66(SDG) are potentially available, being the amount providing by land, labour and capital respectively.

The activity gross margins in the objective function differ for each unit (feddan) of Sesame, Cowpea and Maize while Dura and Okra are much more profitable though, with a gross margin of (214.6), (223.7) (SDG) respectively. Table (9-10) revealed that Okra and Dura was the most profitable one than Cowpea and Sesame, and the total returns were 632.8 SDG.

Table (7): Average cultivated areas (feddan), production (kg), productivity (kg/feddan), value of production (SDG), labour (man days) and total cost of production

Crop	dura	Sesame	cowpea	Maize	Okra
Area	1.39	0.57	0.65	0.8o	0.25
Production	460.7	113.15	168	171.75	90
Productivity	331.4	197.1	258	213	355.5
Mean production (SDG)	297.6	137.2	159.9	114.9	248.7
Labor man days	19.66	11.89	14.07	12.92	12.75
Production Cost (SDG)	83	31.87	34.19	16.6	25
GM (SDG)	214.6	105.3	125.7	98.3	223.7

Where, GM = Gross margin, SDG= Sudanese Genih.

Table (8): Regression results

Explanatory variables	B	standardized coefficients (Beta)	T-value	Level of Significance
(Constant)	3.87		7.813	0.000
Land (feddan)		0.285	2.452	0.018
Labour (man days)		0.291	2.925	0.006
Capital (SDG)		0.052	4.559	0.000

(R^2 = 63%) R square F= 23.9 Sample size (50)

Table (9): Linear programming results

Row name	Dura (feddan)	Sesame (feddan)	Cowpea (feddan)	Maize (feddan)	Okra (feddan)	Right hands
Objective function (SDG)	214.6	105.3	125.7	98.3	223.7	Maximize
Land (feddan)	1.39	0.57	o.65	0.8	0.25	≤ 3.66
Labour (man days)	19.66	11.89	14.07	12.92	12.75	≤ 71.29
Capital (SDG)	83	31.87	34.19	16.6	25	≤ 190.66

Sample size (50)

Table (10): Optimal solution

Crop variety	Dura	sesame	cowpea	okra	maize
Optimal solution	214.6	0	125.7	223	0

CONCLUSIONS

The conclusions of this study were summarized in the following points:

1. The regression results showed that the explanatory power (R square) were high coefficients and explained variations in the yield of all activities. The F-test indicates its overall significance. From The analysis of linear programming revealed that among five varieties three crops were entered as the optimal solution.
2. Pests and diseases highly affected production in Nuba Mountain.
3. The study found that extension services, protection services, conflict between farmers and cattle tenders. To solve these problems, government could provide agricultural extension services to all farmer's and make relationship and contact between farmers and extension agent more cordial and suitable as a way of solving all this problems.

REFERENCE

Annual report. (2007). Ministry of Agriculture and forests Southern Kordofan State

Ahmed, AE, (1996). Productivity and resources allocation efficiency of major field crops in the Gezira scheme, MSc thesis department of rural economy faculty of agriculture university Khartoum, sudan.

World Bank. (2001). Engendering Development Through Gender Equality in Rights, Resources, and Voice, World Bank Policy Research Report, World Bank and Oxford University.

Eaton J, Dekle R and Kortum S, (2007). Agricultural research system in the world.

Siddig RA, (1999). The Economics of Crop Production Under The Different Land Tenure System in Merowe Province, M.Sc Thesis, Department of Agricultural Economic, Faculty of agriculture, University of Khartoum, Sudan.

Cite this Article: Murakah AMM, Eldukheri IA and Elnour EB, 2014. Description and Optimization of Sedentary Production System (Jubraka) in Nuba Mountains, Western Sudan. Greener Journal of Agricultural Sciences. 4(4):130-135, http://dx.doi.org/10.15580/GJAS.2014.4.012714070.