Gross Margin Analysis, Constraints, Resource Allocation and competitiveness of Millet production and Food security situation for Small Holders Farming System in Semi-desert area in North kordofan State, Sudan

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Abstract: The current study was conducted in North Kordofan State, covering two consecutive cropping seasons (2009/10 and 2010/11). The study area covers the northern parts of Sodari and Gabrat elsheikh localities, and located between latitude 15:00 – 16:00 north. This area is characterized by migratory farming system and occupied by nomadic tribes, Livestock production consist of camels (74% from the total), sheep (29%) and goats (6%). Millet considered as major food crop. The main objectives were to address the food security situation for the small farmers, to find out the Gross Margin GM, resource use and the comparative advantages of millet grown in the area. The primary data were collected via structured questionnaire. A multi-stage random sampling technique was employed to select 100 householders. Gross Margin analysis GM, Robust Regression RR, Household Economy Approach (HEA) and policy analysis matrix (PAM) as empirical approaches were used. Results of GM gave small positive returns of millet with GM of SDG 177.15**.** The daily energy received per person per day was equal to 1243 k.cal. Which is blow than the recommended amount due to, this area is severely food insecure. Resource use indicated that, land, labor and capital were positive and significant coefficient at one percent level. Thus farm potentiality increased by 97%. Results obtained by PAM revealed that, The DRC and CIC results obtained in such respect revealed that millet production in the area has an acceptable comparative advantage and a satisfactory level of international competitiveness since the DRC ratio is far less than one (SDG 0.42) and the CIC is also less than one (SDG 0.87), the CIC expresses that only SDG 0.87 is invested to gain one US$. The study findings concluded that food security in the area can be realized by the concentration on livestock production in such marginal areas by depending on broadcast of range seeds and hence the productivity of these areas will increase gradually.

Key words: Gross Margin, Food security, Resource Allocation, Competitiveness

INTRODUCTION

North Kordofan State lies between latitudes 110 15" – 160 45" north and longitudes 270 50" – 320 15" east. The State occupies an area about 242,000 square kilometres or about 59 million feddan(0.42 ha.). The study area, like most of drought stricken areas in Kordofan region, is jeopardized by environmental, socio-economical and political problems. These exhibit themselves in terms of resource degradation, shortage of potable water, lack of services and fluctuation in agricultural output. They collectively deteriorate standard of living and increase poverty incidence among the population. FAO (2012) stated that Africa is still most seriously affected by food shortages, this situation is more critical in East Africa and famine conditions are emerging in several parts of the Horn of Africa. The food-security situation in North Kordofan reflected chronic poverty rather than a transitory situation. It seemed to improve gradually from the north towards the south, with northern households having much-less-favorable consumption indicators. This appeared to be due to the generally drier conditions in the north, which limited the livelihood options of the people in the area (*ANLA - WFP Sudan - 2007*).In a study on food security,Olayemi (1998) gave the thresholds for food security as the ability of a household to meet 2260 k.cal .Olayide (1982) gave daily consumption of 2470 kcal of energy. In the views of Joseph and Ajayi (2002),the recommended minimum nutrient requirements to be consumed per day per capita is 2191.Stephen (2006), reported that the optimum energy need per person per day is 2100 kcal. According to Squire *et al*, (1979) in the household production, profit maximization can be answered by comparing the estimated increase in output accompanying an increase in factor input with the factor price. It is well-known result of the theory of the firm that, if a firm is making optimum use of productive inputs (Land, Labor and Capital) output will be carried to the point at which the costs of additional inputs are equal to the value of additional output. Partial budgeting is a method of organizing experimental data and information about the cost and benefits of the various alternative treatments *(Cimmyt, 1988)*. Cafiero, (2003) stated that, PAM is best organized in terms of commodity systems, which are defined as the vertically integrated chains of production activities that go from the farm production to the retail market for consumption, including any processing and marketing activity that may exist in between. Robust regression provides an alternative to least squares regression that works with less restrictive assumptions. Specifically, it provides much better regression coefficient estimates when outliers are present in the data (*Hamilton, 1991*).

METHODOLOGY

Questionnaires households' survey regarding crop production activities was conducted to collect primary data through direct interviewing with farmers. A form of multistage random sampling technique of 100 respondents was selected. Secondary sources of data were also used. Gross Margin analysis (GM), households food security approach, robust regression and policy analysis matrix were applied.

Gross Margin Analysis (GM)

Descriptive statistical tools were used to analyze data generated on socio-economic characteristics of the respondents while GM and net income analysis were used to analyze the data on profitability of production.

GM is the excess of sales revenue over purchases or profit above variable cost (Okoh, Ugwumba and Elue, 2008) while net farm income is the difference between gross margin and total fixed cost.

The average prevailing market prices of inputs and output was used to derive the relevant monetary values of inputs and output. These are mathematically represented as:

GM = TR – TVC
NFI = GM-TFC or TR-TC
NROI = NFI/TC
Where:
GM = Gross Margin
TR = Total Revenue
TVC = Total Variable Cost
NFI = Net Farm Income
TFC = Total Fixed Cost
TC = Total Cost
NROI = Net Return on Investment

Food security situation for the households

Household's income

The aim of this section is to state sources of household income (crop production, animal product and by product, and off –farm activities) and its relations to farmers food security.

Households' expenditure

The food needed by households classified into three categories which are the food consumed in summer, autumn and winter as it is expected that people consumed different quantities of food among the different seasons. When the quantities of food consumed by households in the different seasons summed together and the average is calculated.

Robust Regression (RR)

Robust regression techniques are iterative procedures that seek to identify the outliers and minimize their impact on the coefficient estimates. The amount of weighting assigned to each observation in robust regression is controlled by a special curve called an influence function. There are three influence functions available.

Policy analysis matrix (PAM)

The aim of PAM is to ascertain whether these products are efficient in terms of international competitiveness and comparative advantage, and whether these products deserve continuing government support. The coefficients of the PAM models that measure the economic efficiency and policy distortions are:

1. Nominal Protection Coefficient on Output (NPCo).
2. Effective Protection Coefficient on Input (NPCi).
3. Profitability Coefficient (PC).
4. Subsidy ratio to producer (SRP).
5. Domestic Resource Costs (DRC).

According to Mahmoud (2004) there are two main activities in a constructing a PAM database:

1. Establishing the production system budget at private prices.
2. Social valuation of inputs and outputs.

RESULTS AND DISCUSSIONS

The Gross margin analysis showed that millet GM was only SDG 177.15, Table 1. Such result can be used to make tentative recommendations, which is due to shortage and uneven distribution of rains (66%) and the use of local varieties (20%), poor soil fertility in semi-desert (10%) and pest and diseases (4%).This result agrees with Babeiker (2003) who reported that, the production constraints of millet are uncertain and uneven distribution of rain, and the use of local traditional varieties, Table 2.

The daily energy received per person per day was equal to 1243 k.cal. Which is blow than that of Olayemi(1998), Olayide (1982), Joseph and Ajayi (2002) and Stephen (2006), due to, this area is severely food insecure. This result gives indication to the unbalanced food intake by households in terms of energy need and in term of net income, Table 3.

Resource efficiency indicated that, land, labor and capital were positive and significant coefficient at one percent level. Thus farm potentiality increased by 97%, Table 4.

Results obtained by PAM revealed that, The DRC and CIC results obtained in such respect revealed that millet production in the cluster has an acceptable comparative advantage and a satisfactory level of international competitiveness since the DRC ratio is far less than one (SDG 0.42) and the CIC is also less (SDG 0.87), the CIC expresses that only SDG 0.87 is invested to gain one US$, Table 5.

Table (1): Gross Margin for Millet Grown in Rain-fed (Semi-desert) by kg and SDG/Feddan in N. K. S.

Cultural practices	**Millet/SDG.**
Seeds	10
Sowing	20
Ist weeding	20
2nd weeding	15
Harvesting	10
Threshing	5
Packing	3
Loading	3
Total variable costs	86
Yield	52.63
Field price	5
Gross Output	263.15
Gross Margin	**177.15**

Source: field survey (2011)

Table (2): Production Constraints of Millet Grown in Rain-fed in Semi-desert in North Kordofan State

Constraints	Frequency	Percent
Shortage and uneven distribution of rain	66	66
Pest and diseases	04	04
Use of local and traditional varieties	20	20
Poor Soil fertility in semi-desert	10	10
Total	100	100

Table (3): Household Weekly Food Need and the equivalent K.cal

		Summer		Autumn		Winter	
Food item	Kcal/kg	qt.kg	Total Kcal	qt.kg	total kcal	Qt.kg	total Kcal
Sorghum	3350	0.89	26800	7.00	23450	9.00	30150
Millet	3350	5.78	0	0	0	0	0
Wheat	3320	0	7370.4	2.22	7370.4	2.22	7370.4
Meat	2020	0.73	6060	3.00	6060	3.00	6060
Milk	660	3.28	2164.8	4.00	2640	5.00	3300
Sugar	4000	2.00	13120	3.98	13120	3.98	13120
Tea	1080	0.18	194.4	0.22	237.6	0.22	237.6
Coffee	685	0.14	95.9	0.22	150.7	0.22	150.7
Dry okra	350	0.22	325.5	0.66	231	0.93	325.5
Onion	410	1.78	1328.4	3.24	1328.4	3.22	1320.2
Sauce	210	4.80	279.3	1.33	279.3	1.33	279.3
Salt	710	0.11	78.1	0.11	78.1	0.44	312.4
Oil	8840	1.60	11757.2	1.33	11757.2	1.33	11757.2
Total			69,205.6		66,005.3		73,682.6
Per person/day(8)							1243

Source: Field survey, 2011

Table (4): Millet Results and Resource use of Estimates of Robust Regression

Coefficients	**Area**
	Semi-desert
Intercept	2.2***(0.4)
Land (x1)	0.69***(0.17)
Family labor(x2)	0.42***(0.17)
Hired labor(x3)	
Capital (x4)	-
Adj. R squire	0.97
F value	195.8***

Source: Field Survey (2011). *** Significant at 1%

Table (5): PAM indicators for Rain-fed (semi-desert) Millet by kg and SDG/feddan

Contents of PAM Variables	Revenue (SDG)	Tradable inputs (SDG)	Cost of domestic resources (SDG)	Profitability (SDG)
Financial prices	70.00	28.50	57.50	-16.00
Economic prices	118.82	20.30	40.95	57.56
Transfers	-48.82	8.20	16.55	-73.56

PAM Indicators/feddan):

FP in SDG/feddan =	-16.00
EP in SDG/feddan =	57.56
PC=	-0.28
NPC=	0.59
EPC	0.42
DRC=	0.42
CIC in SDG=	0.87

Source: Field Survey (2011).

CONCLUSION

North Kordofan is bestowing with several cash crops in which the state is having comparative advantages and high national and international competitiveness. Each zone of the state, in turn, is characterized by producing specific cash crop/crops. The current study is attempting to figure out the Gross Margin of millet for smallholder farmers in semi-desert area of North Kordofan State. the results showed low positive gross margin for millet production in the area.The constraints facing millet production in the area were Shortage and uneven distribution of rain, Pest and diseases, Use of local and traditional varieties and Poor Soil fertility in semi-desert. Also, the daily energy received per person per day was only 1243 K.cal it was below than that amount of Stephen (2006), due to; this area is severely food insecure. When taking resource use under consideration; robust regression was used for millet production; the highest measure of fit (R^2) was estimated to be 97%. These results indicate that the resources were used efficiently. Results obtained by PAM revealed that, The DRC and CIC results obtained in such respect revealed that millet production in the area has an acceptable comparative advantage and a satisfactory level of international competitiveness. Since this area is a semi-desert area the study doesn't recommend any crop cultivation and due consideration should be given to rehabilitations of Range lands and livestock production, mainly desert sheep and camel.

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