

Food Security Nature and Land Use for Sustainable Production of Pearl Millet in Dry Land areas of North Kordofan State, Sudan

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ABSTRACT

The current study was conducted during 2013 season in Elnuhud locality of North Kordofan, Sudan. Pearl millet is the key crop in North Kordofan State, being major sources of food for households' farmers. Despite its importance the productivity deteriorated due to crop pest diseases, uncertainty of rains, poor genetic resources, poor agronomic practices and institutional constraints leading to low yields. The overall objectives of the study were to assess the socio-economic characteristic of the households, and the food security availability and situation in the area. The study applied cluster random sampling technique where a total sample of 150 households was selected randomly. The results of socio-economic characteristics indicated that the majority of the sampled households had some sort of education (57.9%), while the rest were illiterate (42.1%). It was found that 97.7% of the sample households growing millet, only 3.56 hectare allotted for millet production hence the productivity kg/ha was only 72.4. The estimated coefficient of linear regression was positive and statistically significant percent from zero level (ranging from 10%, 5% and 1%). It was found out (74.7%) of pearl millet utilized and consumed at home, sold (14.1%), (8.1%) saved while 3.03% used for other purpose. Regarding food security and availability households stated that shortage (87.5%) and not enough production is (11.4%). Similarly the main sources of income in this locality were devoted mostly from crops and livestock (93.7%), fire wood (4.2%) and sale of dung cake for fuel (2.1%). For food security situation, the daily energy received per person was 1369.9 Kcal. This result gives indication to the unbalanced food intake by households in terms of energy needed and accordingly, the area is food insecure. The study concluded with some recommendation of increasing the availability of

important agricultural inputs and mechanization services to farmers through encouraging active private sector participation in agricultural services delivery.

Keywords: Land use, socio-economic, regression, food security, food availability

INTRODUCTION

North Kordofan state covers an area of 244, 700 square km meters, equivalent to 139 square miles and 58.8 million acres of land, the state is divided into four groups: land Al gayzan, Garduod sediment, valleys, mud-cracked, it is largely an undulating plain, with the Nuba Mountains in the southeast quarter. During the rainy season from June to September, the area is fertile, but in the dry season, it is virtually deserted with an estimated population according to the census in 2008 is 2,920,992 persons distributed among the various state and localities, characterized by heterogeneous population according to geographical diversity, environmental, lifestyle, rural, urban residents and returnees (NSDDRC NKS-SC/UNDP 2010). According to Maruod (2010), climatic zones in North kordofan state are classified into desert in the northern part to semi desert, arid and tropical in the southern part of the state. The desert, which is not suitable for cultivation, occupies 30% of the total area. The vast area of the state, excluding the desert is suitable for livestock grazing. The state is endowed with huge natural resources including land and water. However, poor management of these resources in the contingency of environmental stress and natural calamities mainly drought have rendered the country not being able to persistently maintain its food security. 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. The ASARECA meeting of June 2010 in Addis Ababa, Ethiopia endorsed pearl millet as the crop that is most suitable for the ASAL and stressed for the need to disseminate available technologies to increase farm productivity while putting emphasis in development

of new materials that can withstand the current and future a biotic stresses and meet end users quality requirements.

MATERIALS AND METHODS

Questionnaires households' survey regarding crop production activities was conducted to collect primary data through direct interviewing with households farmers. A form of cluster random sampling of 150 respondents was selected from six villages to represent the entire area. Secondary sources of data were also used. Descriptive measures and linear regression model and household economy approach were used.

2.1 linear regression models

Linear Regression estimates the coefficients of the linear equation, involving one or more independent variables that best predict the value of the dependent variable. To determine the relationship between socio-economic characteristics of respondents and their crop production (income), regression model was specified as:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, e)$$

Where:-

Y= denote for crop production (income)

B₀= constant

X₁= area (hectare)

X₂= Experience, (number)

X₃= Age, (number)

X₄= Households gender, dummy variable

X₅=Education level of households head, dummy variable

X₆= man days for family labor (number)

X₇= Plot distance to residence (number)

X₈= land ownership, dummy variable

X₉= Soil fertility, dummy variable

e= error term

2.2 Food security situation for the households

2.2.1 Households income

The main sources of income for household were agricultural production (crop production and animal production), added to off –farm activities.

2.2.2 Households expenditure

Food needed by households classified into three categories, the food consumed in summer, autumn and winter as it is expected that people consumed different quantities of food among different seasons. When the quantities of food consumed by households in the different seasons summed together and the average was calculated, then the daily energy received per person per day in K. cal. was calculated. According to Stephen, (2006) the ideal energy intake per person per day is 2100 K. cal.

RESULTS AND DISCUSSION

3.1 Education level

Exposure to education should increase a farmer's ability to obtain, process, and use information relevant to the crop production. The majority of the sampled households had some sort of education (51%), while the rest were illiterate (49%). This observation highlights that education is an important variable to take into in the study area. Where there are more illiterate segments, there is a need to enhance integration of extension and bottom up approaches within the area. This result agrees with Negash (2007) that the literacy level was argued to have positive impact on adoption of new technology, Table1.

Table 1: shows Education level in Dry Lands of North Kordofan, Sudan

| Education level | Frequency percent | Valid |
|-----------------------------|----------------------|------------|
| illiterate | 47 | 49.0 |
| Basic/can read and write | 20 | 20.8 |
| lower primary 1- 4 | 13 | 13.5 |
| upper primary 5- 7 | 9 | 9.4 |
| secondary 9-12 | 4 | 4.2 |
| high education 13-14 | 1 | 1.0 |
| college | 2 | 2.1 |
| Total | 96 | 100 |

Source: HHS survey 2013

3.2 Selected crops grown and productivity trend

Results showed 97.7% of the sample households growing millet, 60.45 for sorghum, 28.15% groundnut and only 3.15% specified for watermelon production. These estimations entail that households food security firstly depend on millet and secondly on sorghum, respectively. Elnuhud is famous in producing Groundnut and watermelon because anciently and historically productive, but recently productivity decreased due biophysical factors. Beside its source of income, watermelon used for human consumption and animal feed. Large allocated land of 5.1 hectare is grown by households' groundnut, 4.79 hectare for sorghum, 3.56 hectare for millet and only 0.73 ha for watermelon. Unfortunately the overall productivity of cereals in the entire locality is lower this might be attributed to insect pests damage, shortage of rains, quality of seed, shortage of labor and soil fertility. For the above mentioned results there is a need to raise productivity so as to improve farmers' livelihood and farmers' income, Table 2.

Table: 2 Crops grown and productivity trend in Dry Lands of North Kordofan, Sudan

| Crop grown | % of households growing the crop | *Area /ha | Productivity kg/ha |
|-------------|----------------------------------|-----------|--------------------|
| Millet | 97.9 | 3.56 | 72.4 |
| sorghum | 60.4 | 4.79 | 29.26 |
| G/nut | 28.1 | 5.1 | 273.5 |
| Water melon | 3.15 | 0.73 | 136.9 |

Source: HHS survey 2013, * = average land allocated for crop, ha=hectare

3.3 Impact of some socioeconomic indicators on pearl millet production

The estimated coefficient of linear regression related to all production function was positive and statistically significant percent from zero (ranging from 10%, 5% and 1%) level. This implies that the variables significantly influence the production of pearl millet. This finding coincides with Cameda Abdissa, Aboma Cirma, Verkuigi Hugo and Mwangi Wilfred (2001) that socio-economic indicators have significantly influenced the mean proportion of maize production, Table 3.

Table: 3 Socio-economic indicators across pearl millet production by locality in Dry Lands of North Kordofan, Sudan

| Explanatory variables | Constant | t. value | Sig. |
|----------------------------|----------|----------|----------|
| area | 209.36 | 4.353 | .0001*** |
| Experience | 247.58 | 4.494 | .0001*** |
| Age | 297.2 | 3.319 | .001** |
| Gender | 267.35 | 9.543 | .0001*** |
| Education level | 280.91 | 8.640 | .0001*** |
| Man days for family labor | 380.04 | 4.243 | .003** |
| Plot distance to residence | 202.59 | 5.428 | .0001*** |
| Land ownership | 270.74 | 6.328 | .0001*** |
| Soil fertility | 183.88 | 1.955 | .054* |

Source: HHs survey 2013

3.4 Pearl millet utilization

Results observed that only 3.03% of crop has other purposes use, 74.7% consumed, 8.1% saved and 14.1% sold. This results give sign that slightly small amount of millet sold so as to meet the households basic needs while the majority used for human consumption, Table 5.

Table: 4 Pearl millet utilization by locality in Dry Lands of North Kordofan

| Category | | | |
|----------------------|----|--------------|-------|
| | N | Sum | Mean |
| Harvest kg | 89 | 26236 | 386.7 |
| Amount sold | 75 | 962(14.1%) | 327.9 |
| Amount saved | 82 | 2277(8.1%) | 81.1 |
| Amount consumed | 86 | 20912(74.7%) | 230.6 |
| Other purpose amount | 30 | 849(3.03%) | 69.25 |
| Sum 3+4+5+8 | | 28000 | |

Source: HHs survey 2013

3.5 Households food security situation

3.5.1 Food availability

ASHmead *etal*, (2009) one of the more comprehensive and accepted definition of food security was developed at the United Nations world food summit in 1996. Food security exists when all people, at all time, have access to sufficient, safe and nutritious food to meet preferences for an active and healthy life style. Food availability refers to sufficient supply of food for all people. Regarding food security and availability households stated that shortage (87.5%) and not enough production is (11.4%). This result agrees with what had been said by Jumbe Charles and Botha Blessings (2008) only 14% of households reported to have their own food throughout the year. So intervention through provision of improved seed tends to raise productivity and ensure food security of farmers, Table 5.

Table 5: Food availability in Dry Lands of North Kordofan, Sudan

| Crop | Category | Frequency | |
|---------|----------|-----------|---------------|
| | | Frequency | Valid percent |
| Millet | plenty | 1 | 1.1 |
| | Enough | 10 | 11.4 |
| | Shortage | 77 | 87.5 |
| Sorghum | plenty | 2 | 3.7 |
| | Enough | 6 | 11.1 |
| | Shortage | 46 | 85.2 |

Source: HHS survey 2013

3.6 Households' livelihood security and assets

3.6.1 Sources of income

The farm income refers to the total annual earnings of the family from sale of agricultural produce such as sale of crop, livestock and livestock product after meeting family requirements. The study also reviewed that the main sources of income in this locality were devoted mostly from crops and livestock (93.7%), fire wood (4.2%) and sale of dung cake for fuel (2.1%). More to this millet is the main stable food crop and groundnut is the most predominant in the area as cash crop whereas estimated household incomes depend upon. A total of SDG of 21200 (equal 4240 \$ Us dollar) was computed as yearly net income in the locality. This result agrees with Amaniga Ruhanga Ivan and Iyanga Lucy (2010) the main sources of livelihood in the study area in eastern and North-eastern Uganda have connection with cultivation and livestock rearing. Figure 1.

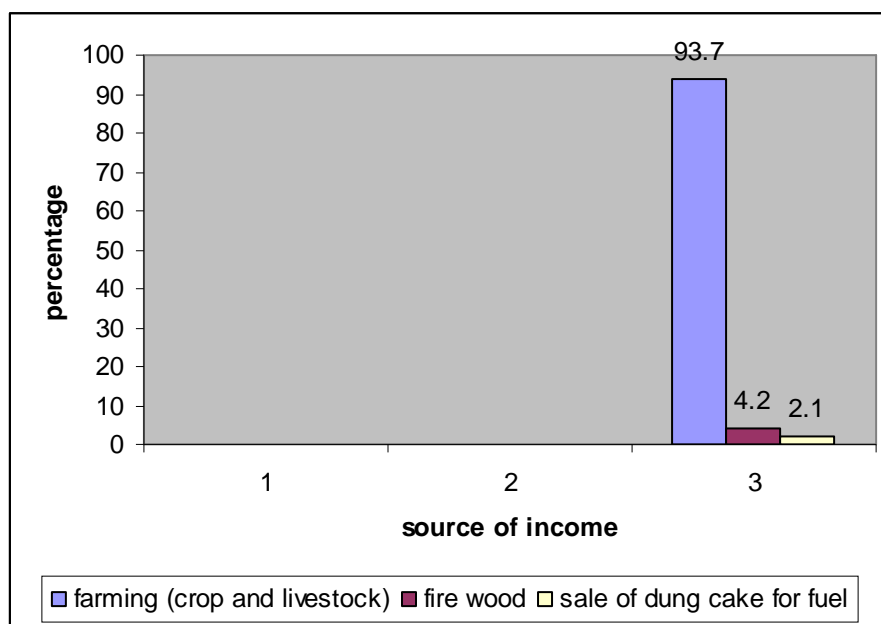


Figure: 1 Sources of income in Dry Lands of North Kordofan

3.6.2 Food security nature in the Area

According to food security situation and households' annual income and expenditure, food item costs were found to be negative and the daily energy received per person was 1369.9 Kcal. This result gives indication to the unbalanced food intake by households in terms of energy need and in term of net income and accordingly, the area is food insecure, Table 6.

Table (6): Household Weekly Food Need and the equivalent K.cal: in Dry Lands of North Kordofan State

| Food item | Kcal/kg | Summer | | Autumn | | Winter | |
|-----------|---------|--------|------------|--------|------------|--------|------------|
| | | qt.kg | Total Kcal | qt.kg | total kcal | Qt.kg | total Kcal |
| Sorghum | 3350 | 5.00 | 16750 | 3.50 | 11725 | 4.50 | 15075 |
| Millet | 3350 | 5.00 | 16750 | 3.50 | 11725 | 4.5 | 15075 |
| Wheat | 3320 | 0 | 0 | 0 | 0 | 0 | 0 |
| Meat | 2020 | 1.37 | 2,767.4 | 1.53 | 3,090.6 | 1.37 | 2,767.4 |
| Milk | 660 | 3.79 | 2,501.4 | 4.00 | 2640 | 3.00 | 1,980 |
| Sugar | 4000 | 2.50 | 10,000 | 2.00 | 8,000 | 2.5 | 10,000 |
| Tea | 1080 | 0.26 | 281 | 0.22 | 238 | 0.22 | 238 |
| Coffee | 685 | 0.24 | 164 | 0.22 | 151 | 0.22 | 151 |

| | | | | | | | |
|-------------------|------|------|----------|------|----------|------|---------------|
| Dry okra | 350 | 0.79 | 276.5 | 0.66 | 276.5 | 0.93 | 276.5 |
| Onion | 410 | 3.11 | 1275.1 | 3.24 | 1,275.1 | 3.22 | 1,357.1 |
| Sauce | 210 | 0.77 | 1,617 | 1.33 | 1,575 | 1.33 | 1,743 |
| Salt | 710 | 0.29 | 206 | 0.11 | 78 | 0.44 | 312 |
| Oil | 8840 | 1.16 | 10,254.4 | 1.33 | 10,873.2 | 1.33 | 10,519.6 |
| Vegetables | 9000 | 1.00 | 9,000 | 1.20 | 10,800 | 1.00 | 9,000 |
| Total | | | 71842.8 | | 61034.4 | | 68494.6 |
| Per person/day(7) | | | | | | | 1369.9 |

Source: Study Field survey, 2013

3.7 Physical capital and homestead number

Physical capital refers to human-made goods which are used in the production of other goods. These include machinery, tools and buildings. This section focused on the quality of the households' homesteads and on goods and equipment owned by the household. These are wealth indicators as they are associated with different wealth categories (Birachi, E and Ouma, E. 2007). Descriptive statistical showed that all household in the entire area have homestead number almost 3. It appears also most household have other building number, Table 6.

Table: 6 shows homestead number by locality in Dry Lands of North Kordofan, Sudan

| Category | N | Minimum | Maximum | Mean | Std. Deviation |
|-----------------------|----|---------|---------|------|----------------|
| Homestead number | 90 | 1 | 10.0 | 2.82 | 1.7519 |
| Other building number | 39 | 1 | 3.0 | 1.26 | 0.5486 |

Source: HHS survey 2012

CONCLUSION

The study concluded that education is important to be taken into account in the study area. Intervention needed to raise crop productivity so as to improve farmers' livelihood. The estimated coefficient related to production function was statically significant. The food availability situation is not enough and almost there is shortage all over the year. It was concluded that most sources of income were obtained from crop and livestock production. According to food security situation the daily energy received per person was 1369.9 Kcal. This result gives indication to the unbalanced food intake by households in terms of energy need and in term of net income and accordingly, the area is food insecure. Analysis also stated that all households have lesser homestead and building number.

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