



Full Length Research Article

CEREAL CROPS DIVERSIFICATION AND FOOD SECURITY IN CENTRAL DARFUR STATE – SUDAN

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ABSTRACT

This paper aims to study the impact of food crops diversity on food security at household level, with emphasis on cereal crops diversity in Central Darfur State. Respondents were selected and interviewed. A multiple linear regression model and descriptive analysis for socio-economic factors and population characteristics were used. Results revealed the vital role played by women for household food security. Farmers grow cereal cultivars, early maturing varieties, and late maturing varieties, and they make use of this diversity to help ensure food security. The average productivity of cereals was 336.5 kgs and 272.6 kgs per feddan for sorghum and millet respectively. Regression results indicated, that crop area, rain and crop price, were significant factors in explaining both millet and sorghum productivity variation in Central Darfur state.

Key words: Millet, Sorghum, Potential, Diversity, Central Darfur, Food security.

INTRODUCTION

The fight to achieve food security and end hunger is one of the greatest challenges facing the world in the coming decades (Crop Trust, 2015), therefore, recognizing, safeguarding and using the potential and diversity of nature are critical for food security and sustainable agriculture (FAO, 2004). A number of benefits can be obtained by the use of crop diversity, such as improved yield, reduced weed, diseases and pests (Borgen, 2015). Farmers can improve their ability to meet their food needs by growing a diversity of crop varieties, as different varieties may have different tastes, may ripen at different times or have different cooking qualities. Some grow well in sandy soils while others may need a great deal of water (CGDT, 2005). However, crop diversity is central to food security. It underpins today's production and provides the raw material needed for ensuring continuing supplies tomorrow, in the face of a rapidly changing world (Crop Trust, 2015), nevertheless, so far, little is done to improve diversity in cereal production in practice (Borgen, 2015) in order to achieve food security.

Cereal crops diversity

Agriculture is the main economic activity of the population in Central Darfur state, the majority of the population depend heavily on cereal crops production as a main source of

Livelihood and income; they make use of their local knowledge to achieve food security (EHA, 2014 and AbakerAdam Salih, 2006). People cultivate many varieties of cereal crops in Central Darfur state; some were indigenous, while others were introduced. However, they cultivate a variety of cultivars of cereals, ranging from early maturing to late maturing, some were introduced by some institutions such as JMRDP (p967083, *Gadamalhamam* and *Bayouda*) or Ministry of Agriculture (*Tabat and WadAhmed*), some were entered from neighboring countries like (*Subiansawa*), while others were indigenous (*Baladi, Faseikh, and Najjad*, Table (1). The local sorghum cultivars *Baladi* and *Faseikh* among others, are widely cultivated by the farmers in the area, as 52.5% of the farmers cultivate it in pure stand this can be attributed to the fact that, the soil in the study area is mainly of alluvial strata or flood plains (locally known as *Wadi*), where, the crop can exploit the available soil moisture reserved during the wet and dry seasons.

They are known to be late maturing cultivars. Other cultivars are usually grown in inter cropping system in most areas in marginal soils. *Bayouda, Darmassa* and *Baladi* are most millet cultivars cultivated by farmers, because they are known highly yielding varieties. Local maize known, as *Baladi* is the most prevailing cultivar together with the cultivar; *Americani*, the later is early maturing one. About 66% of the farmers grew local wheat cultivars known as *Jabali*, 33% cultivate the newly introduced cultivar; *Condor*, mainly in *Jebel Marra* highlands. About 75% of the farmer who grew rice cultivate the local cultivar; *Sudani*, while the rest cultivate the cultivar *Baladi* According to the Global Crop Diversity Trust (GCDDT), poor

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farmers are well aware of the relationship between the stability and sustainability of their production systems, and the diversity of crops, and crop varieties on their lands. Their management and use of a diverse range of plants has often helped them to survive under most difficult conditions. This diversity emphasizes that the farmer takes the advantage of cultivating different cultivars of cereals, as safeguard during adverse conditions, such as drought or invasion by pests, which is very common in the area (Abaker, Adam Salih, 2006).

After the outbreak of conflict in Sudan's Darfur region in 2003, cereal production plummeted (Buchanan-Smith *et al.*, 2014 and Lucy Hovil *et al.*, 2014). The conflict represents the impact of a fragile ecology/environment on economic, political and social relations. (UNICEF, 2003), and has drawn in a complex web of local, national, and transnational interests, (Young and Daniel Maxwell, 2009) consequently, mass displacement of population occurred and previous livelihood options were no longer available (Young and Abdal Monim Osman, 2006), stated that,

Table 1. Some of cereal crop varieties cultivated in the Zalingei

Sorghum	Millet	Maize	Wheat	Rice
Baladi	Bayouda	Baladi	Jabali	Sudani
Faseikh	Darmasa	Americani	Condor	Baladi
Dabar	Dimbi	Regan	Geeza	
Wadahmed	Baladi	Turkey		
P967083	Abusouf			
Gadamalhamam				
Subiansawa				
Tabat				
Dabar				
Gondoro				
Fetreita				
Gondiri				
Najjad				

Source: field survey 2005

Table 2. Socioeconomic characteristics of the respondents in the study area

Sex	frequency	percent	cumulative percent
female	25	62.5	62.5
male	15	37.5	100
Total	40	100	
age group			
20-29	2	5	5
30-39	17	42.5	47.5
40-49	15	37.5	85
50 and above	6	15	100
Total	40	100	
marital status			
single	3	7.5	7.5
married	32	80	87.5
divorced	3	7.5	95
widowed	2	5	100
Total	40	100	
Education level			
illiterate	17	42.5	42.5
khalwa	11	27.5	70
basic school	6	15	85
secondary school	6	15	100
University	0	0	100
Total	40	100	
occupation			
farmer	29	72.5	72.5
employee	7	17.5	90
merchant	1	2.5	92.5
livestock raising	3	7.5	100
Total	40	100	
cultivates sorghum			
Yes	35	87.5	87.5
No	5	12.5	100
Total	40	100	
cultivate millet			
Yes	38	95	95
No	2	5	100
Total	40	100	

Table 3. Millet regression equation (yield dependent variable)

Explanatory variables	Coeff	Std. errors	t-values	sig
(Constant)	243.751	28.144	8.661	***
X ₁	.073	.034	2.150	**
X ₂	-.018	.006	-3.062	***
X ₃	.0002	.000	4.444	***

*** = significant level at 0.01

** = significant level at 0.05

* = significant level at 0.1

Insecurity, with a variety of causes, has restricted the mobility of all groups and therefore seriously limited their core livelihood strategies, including cultivation of crops. In this context, cereal crop production was badly affected specially in early years of the conflict, humanitarian aid was the most available option of livelihoods, but people are now able to resume practicing cultivation and cereal crops production. The interest of this paper is to look for the impact of food crops diversity on food security in central Darfur state.

Table 4. Sorghum regression equation (yield dependent variable)

Explanatory variables	Coeff	Std. errors	t-values	sig
(Constant)	346.889	40.565	8.552	***
X ₁	.159	.077	2.068	**
X ₂	.000	.000	-1.812	*
X ₃	.054	.011	4.768	***

*** = significant level at 0.01

** = significant level at 0.05

* = significant level at 0.1

MATERIALS AND METHODS

Area of the study

The study was conducted in Zalingei, Central Darfur State. The State was created recently on 2012, and located in the center of Great Darfur in the west of Sudan. The population estimated at about 1123748 people, 80% of them live in the rural areas, where they depend upon rain fed farming and grazing for their livelihoods. They cultivate deferent crops mainly cereal crops; millet and sorghum the major staple food, while maize, wheat and rice are minor food crops cultivated in small scale. Furthermore, Darfur conflict, which erupted in 2003, has resulted in mass displacement internally or externally (Abaker, Adam Salih, 2006 and EHA, 2014).

Data collection

The random sampling technique was used; structured questionnaire, discussion groups and informal meeting with local leaders were means of primary data collection, while secondary data was collected from relevant sources.

Statistical analysis and Model Specification

Descriptive statistics were used for socio-economic factors and population characteristics, frequency tables were used to summarize the data to examine the socioeconomic characteristics of the respondents, depending on percentages, and means. A multiple linear regression model was used as a tool of analysis. The relationship between dependent variable and independent variables was depicted by the following general linear function:

$$Y = b_0 + b_1 X_1 + \dots + b_n X_n + e \text{ (Long, J. S. 1997).}$$

Where

X₁: Rain

X₂: Area

X₃: Price

$$MY = b_0 + b_1 R + b_2 MA + b_3 MPR$$

$$SY = b_0 + b_1 R + b_2 SA + b_3 SPR$$

Where

MY=millet yield MA=millet area

SY=sorghum yield SA=sorghum area

R =Rain MP=millet price

SP=sorghum price

DISCUSSION

About 37.5% of the respondents were males, while 62.5% of them were females (Table 2). Women's participation to production process is very significant in the study area; It is quite evident that illiteracy is wide spread among women (16 women completely uneducated)

The average age of respondents was 41 years, and 85% were in the range of 20-49 years and are engaged in agriculture which is the occupation for about 72.5%, of the respondents, but those who undertake other job also supplement it with agriculture, and about 80% of the respondents were married. Regression analysis to assess the main factor affecting cereal crops productivity in the study area, and their inter relationship. The relationship between millet yield and rain is positive indicating that as rainfall increases millet yield increases. The regression coefficient was (0.073), it is significant at 0.5 levels of significance, units. The regression coefficient for area cultivated by millet was negative (-0.018), the sign of the coefficient was appropriate, it is significant at 0.01 level of significance, which indicates that as area cultivated by millet increases by one unit, the yield of millet will decrease by 0.018 units. This may be because of the difficulty in managing large areas with limited financial ability; agricultural practices cannot be done efficiently leading to decrease in crop yield.

The coefficient of the area cultivated by sorghum is negative and significant at the 0.1 level of significance, which indicates that as area cultivated by sorghum increases, yield decreases, this could be justified by saying that, efficiency of agricultural practices decreases with increase in area cultivated by sorghum and hence yields decreases. The coefficient of sorghum price is positive (.054) and highly significant at 0.01 significance level, indicating the existence of positive relationship between sorghum yield and sorghum price. The coefficient of millet price is positive with appropriate sign (.0002) and significant at 0.01 level of significance, Table (3), indicating the existence of positive relationship between millet yield and millet price, as millet price rises by one unit, millet yield will rise by .0002 units, this because of the fact that, high prices of millet give incentives for the farmer to work hard and hence increase the yield, The results were in coincidence with the economic theories of supply and demand. For sorghum yield equation Table (4), the coefficient for rain fall is positive (.159), it is significant at the 0.5 level of significance, indicating that as rain fall increases by one unit, the yield of sorghum will increase by .159 units

Conclusion

The major food crops grown by the farmers include cereals, by growing a number of different crops; farmers have a better chance of having enough of the right kinds of crops to meet their various needs and those of their families.

These might include, for example, crops that mature at different times or that can be easily stored help to ensure a stable food supply throughout the year. Growing a range of crops may help farmers provide a nutritionally balanced diet for their family, exploit different environmental niches that exist on their land, or diversify their sources of their income to include, for example, medicines, fuel, textiles, building materials. Locally, millet is the most important crop in terms of its contribution to diet and value of production strategy (instrument) for food security. However, regression results indicated, that crop area, rain and crop price, were significant factors in explaining both millet and sorghum productivity variation in Central Darfur state.

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