Production and Marketing Constrains of Sorghum in Blue Nile State, Sudan

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Abstract

This paper isdirected to identify theconstraints of Sorghum production and marketing system in Blue Nile State, Sudan. The study depended on both secondary and primarydata. In primary data a well-suited survey was carried out during 2007/08 season byrandom cluster sampling technique.A sample size of 80 farmerswas randomly selected from four localities.The research methodology used was descriptive, cost- benefit, correlationand break-even analysis. The results showed thatbreak-even point is 3.4 sacks per feddan which is considered as a high productivity level not normally attained by farmers under rain fed conditions.The correlation coefficient was 0.3 for the yield andsignificant at level 95% while it was below 0.3 and notsignificantfor Sorghum's productionagainst mean annual rainfall. Constrains faced by producers were poor technical skills, meager marketing infrastructure and lack of finance which were two sources, viz, self-finance, and credit finance. Self-finance sources are, financing through selling of production and animals which represented by 53.7% and 20%, respectively. The main mode of credit finance is the Salam which practiced by 86%. (90%) of farmers realize a high effect of price fluctuation on production system and only (10%) state no effect.

Key words: -Blue Nile ,Sorghum ,Constrains ,Marketing ,Production

1. Introduction

Sudan area is about 1882000 km^2 and it is rich with natural resources. The economy of the Sudan depends on the agricultural sector, which contributed about 39.4% of the gross domestic product, about 7% of exports (Mohammad, 2008), about 70 and 75 percent of the population livelihood and labor force, respectively (Imam, 2008). Agricultural products include grain sorghum, sesame seeds, gum Arabic andCotton. Agricultural production faces many problems including the lack of marketing policies. The government has suggested the abolishment of export taxes in order to promote agricultural production and export in the future (http://wwwnationsencyclopedia.com). The Blue Nile State is considered as one of the most important states in agricultural production, particularly in mechanized and traditional rain-fed farming systems. The favorable environmental conditions i.e. temperature, humidity, amount of rainfall and length of the growing season make the area more suitable to agricultural production. It is also rich with animal wealth, horticultural crops and forestry products. Agriculture is the main profession of almost all people in the state. The main crops grown by farmers are cereals especially sorghum, Oil crops like sesame, sunflower and groundnuts are grown for local consumption and export. The extended fertile land and the considerable rainfall and the favorable conditions for investment encouraged companies and individual farmers to establish investment schemes in the state particularly after the settlement of peace in the southern parts. Sorghum, sesame and Cotton are the main crops grown in the Blue Nile State. Sorghum is ranked the first in terms of area cultivated and production; and it is ahead of all other crops in Sudan. Sorghum is an annual plant; it grows in different climate conditions. The cultivated areas and production were fluctuating annually affected by the amount and distribution of rainfall. Sorghum is grown in all parts of Sudan because of its wide genetic diversity (Investment Map for the Blue Nile state, 2004). Rapid population growth, especially in towns, with a fall in farm output has caused considerable deterioration in balance of supply and demands of sorghum and an increase in extreme poverty and malnutrition. Although a major part of working

population depend on farming for a living, production problems of a natural, human and political nature means that food requirements are difficult to be covered totally. Crop production in the rain fed traditional sub-sector is labor intensive. The use of mechanical implements is limited to small tools and all operations from land cleaning to threshing and bagging are carried out manually. The use of other inputs is limited to small amounts of pesticides and fungicides by very few farmers. Thus, it is the major cost component. On the other hand crop production in rain fed semi-mechanized sub-sector is carried out on commercial basis, and farmers have an access to vast amounts of land. Operational farm size during good weather or better price prospects is subject to machinery and labors constraints. Also the use of other inputs is not limited and proportional to the size of the farm. These problems and constraints of natural (in term of rainfall quantities and distribution), human and political nature (in term of agricultural production and marketing policies and facilities), have their impact on production instability and hence the production and marketing system will be affected by this instability, which will be reflected on the producing system and consumption requirements. So, the main objective of this research is to investigate the production and marketing constrains of sorghum in Blue Nile in order to identify the weak points in the system to set base line information for possible policy interventions and improvement.

2. Research Methodology

Both secondary and primary datawere used in study**.** The primary data collected by farm level an in-depth farm survey carried out during season 2007/08in both traditional and semi-mechanized rain fed areas of Blue Nile state. The sample farms for this study were selected in the Blue Nile state; within the state the sample farmers were selected randomly form the producing centers. This survey is multipurpose in nature; hence the sample design is to be made flexible enough to accommodate a number of different estimates all of which cannot be measured by the same precision. Considering these, cluster sampling of proportional size adopted in this study. This means that, 6 localities had been chosen. Unfortunately, the data collection covered four localities; these are Damazin, Roseris, Baw and Eltadamon localities. The other two localities (Gissan and Kurmuk) were excluded due to the difficulty of accessing them as there was instable security situation. A sample size of 80 farmers' sorghum growers in agricultural season

(2007/2008) was randomly selected from four localities proportional to the number of farmers in each locality. It included (26, 22, 18 and 14) farmers from Roseris, Damazin, Eltadamon, Baw and Roseris, respectively. Secondary data was provided by the Ministry of Agriculture, forest and Irrigation in The Blue Nile State. It includes the prices of all varieties of sorghum in the state (Tabat, Wad Ahmed and Feterieta) from 2002/03 to 2007/ 08, amount of annual rainfall from 2001 to 2008,the grown area along with the production and the productivity of sorghum crop for seasons 2002/03and 2007/08 and cost of production of the sorghum crop. The secondary data and socio-economic characteristics of surveyed producers have been analyzed using descriptive statistics such as frequencies & percentages. Break-even point analysis is used in the study because of the change in input output prices which locate the production break-even point at different levels to satisfy farmers profit. There are many ways to calculate break-even point, so there is no one standard formula that fits all situations. In other words, break-even point can be defined as number of units that must be produced in order to have a profit of zero (but will recover all associated costs). Thus, the break-even point is the point at which your product stops costing your money to produce and sell, and starts to generate a profit for your farm. However, the break-even point is found faster and more accurately with the following formula:

Q = FC / (UP - VC) …………………………………………………………. (1)

Where:

Q = Break-even Point, i.e., Units of production (Q),

FC = Fixed Costs

VC = Variable Costs per Unit

UP = Unit Price

Correlation between rainfall, production and yield of sorghum is applied to test how significant rainfall affecting the production in the area. The value of the correlation coefficient is best produced directly from SPSS spread sheet. The formula used to find the Pearson's Product Moment Correlation coefficient is:

$$r = \dfrac{n \left(\sum xy \right) - \left(\sum x \right) \left(\sum y \right)}{\sqrt{\left[n \sum x2 - \left(\sum x \right)2 \right]\left[n \sum y2 - \left(\sum y \right)2 \right]}}$$

………………………… (2)   Where:

r = Correlation coefficient

x = Rainfall

y= Production

$$r = \dfrac{n \left(\sum xy1 \right) - \left(\sum x \right) \left(\sum y1 \right)}{\sqrt{\left[n \sum x2 - \left(\sum x \right)2 \right]\left[n \sum y12 - \left(\sum y1 \right)2 \right]}}$$ ………........………………………………….(3)

Where:

r = Correlation coefficient

x = Rainfall

y_1= yield

3. Results and discussions

This is divided into three parts, part one contains analysis of secondary data, part two embraces analysis of socio-economic characteristics of surveyed producers and production factors of sorghum and the third part which includes benefit cost analysis (break-evenpoint and correlationanalysis).

3.1. General analysis of secondary data:

The secondary data topics include the analysis of rainfall distribution, planted and harvested areas, average yield, prices. The annual rainfall in Damazin has never been less than 600mm, which is the dependent amount of rainfall used for agricultural planning. It starts from mid- July to the end of September which suits various crops. The total rainfall in season (2008) showed a considerable increase (1000mm). It also recognized that the rainfall in Roseris was fluctuating but it was high in season 2008 (figure 3. 1). It is clear that the areas planted with sorghum were unstable mainly due to fluctuating of rain fall and other natural factors besides high costs of hand labor for cleaning the land. The harvested area always less than the planted area during the period 2003 to2008 this is because farmers are optimistic and planning for areas which are reduced due to rainfall

shortages and uneven rainfall distribution. Thus farmers lose some of their capital due to the lack of information about rainfall predictions and its distribution (Figure 3. 2).During the period 2003- 2008, the average productivity of sorghum per feddanhas been fluctuating because of the fluctuation in rainfall and the traditional production methods adopted in the Blue Nile State. The highest productivity level achieved was (4.5sacks/ feddan) in the season 2006/07 (Figure4.3).During the period 2003- 2008, the average productivity of sorghum per feddan has been fluctuating because of the fluctuation in rainfall and the traditional production methods adopted in the Blue Nile State. The highest productivity level achieved was (4.5sacks/ feddan) in the season 2006/07 (Figure3.3).However, where traditional agriculture predominates, average yields have ranged between 200 to 1500 kg/ ha, depending largely on moisture availability. This average has remained relatively flat over long periods of time. By contrast, in the United State of America (USA) yields ranged from 630-1260 kg/ ha, prior to hybridization and to 3775-4400 kg by the 1980's (Maunder, 1990). However, in the USA, there has been a decline in production in the 1992-94 periods; from 22.5 to 16.5 million metric tons. This is expected to change in 1995 because export demand is up by 40% over last year and, on average, production is projected to increase by 25 % over the next four years (Maunder, personal communication). Prior to the availability of hybrids in average rainy season yield was in the neighborhood of 515 kg/ ha, but this has increased during the 1986-90 period to 878 kg ha (Murty, 1992).There is considerable variation in yield, with some districts in India averaging over 2500kg/ ha. Of concern in much of the sorghum growing world has been the drop in increased sorghum production below population growth. During the period 1972-1992, the average annual per capita growth rate for sorghum production was1, 04%, 2.07%and 2.3% for sub-Saharan Africa, south Asia and Latin America respectively. The use of grain Sorghum as an animal feed has been an important stimulus lot the global use of sorghum (Dendy, 1995).Figure 3.4 shows that prices of the major types of sorghum were below 40 SDG /sack during seasons 2002, 2003, 2004 and 2007 which did not cover production cost. Prices of Feterieta and Wad Ahmed fluctuated depending on the success and failure of the season. In seasons 2005 and 2008, the prices of Feterieta and wad Ahmed increased above 56 SDG /sack, It is also observed that the prices of Tabat increased to SDG 80/sack in season 2005, then dropped down to 34 SDG

/sack in season 2007 and increased again to a high level of 104 SDG/sack.The taste of consumer is the major detrimental factor of the consumption, in addition to the traditions and norms, which makes a general trend towards a certain commodity. Nomads, for example consume milk and sorghum or millet. General speaking, a great portion of the rural production depends on sorghum as stable food crop. The quantity demanded varies directly with rural production number. The demand for sorghum is said to be inelastic, an increase or decrease in its price will not affect the quantity consumed, (Ahmed, 2002).The cost of sorghum production per feddan ranged from (60-70 SDG) during seasons 2002/03 to season 2004/05 which was almost stable, and started to increase steadily during the period 2005-2008 to reach 107 SDG /feddan which was very high compared to low productivity and low prices. It is also recognized that the cost of sesame was less than sorghum while the cost of cotton production was 170 SDG /feddan which was almost stable for three seasons before increasing to 287 SDG /feddan which is very high compared to sorghum and sesame (figure 3. 5).

Figure (3.1) Distribution of total rain fall (2002-08), Damazin, Roseirs and Buk
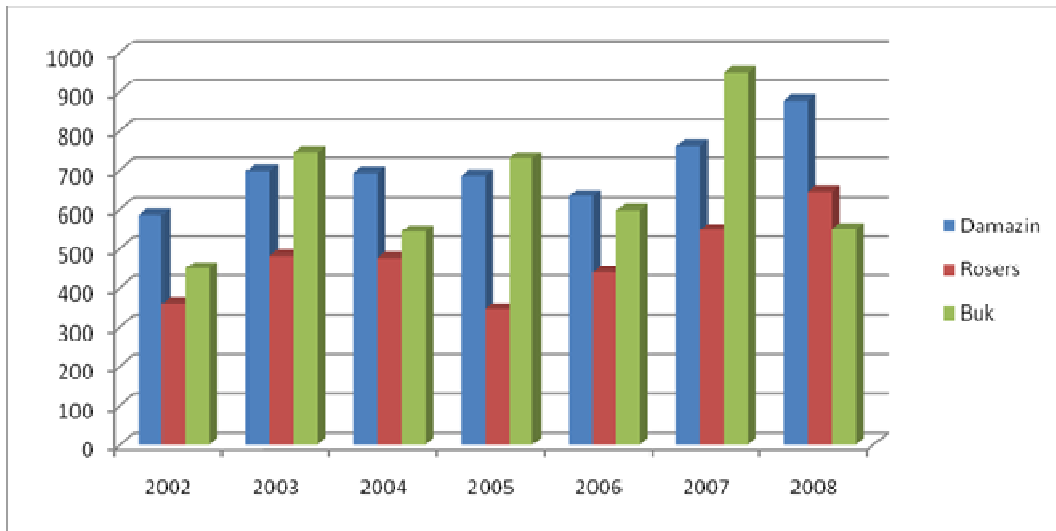
Source: Table (1.1), Appendix.1.

Figure (3. 2) Planted and harvested area of sorghum (2002/03-2006/07)
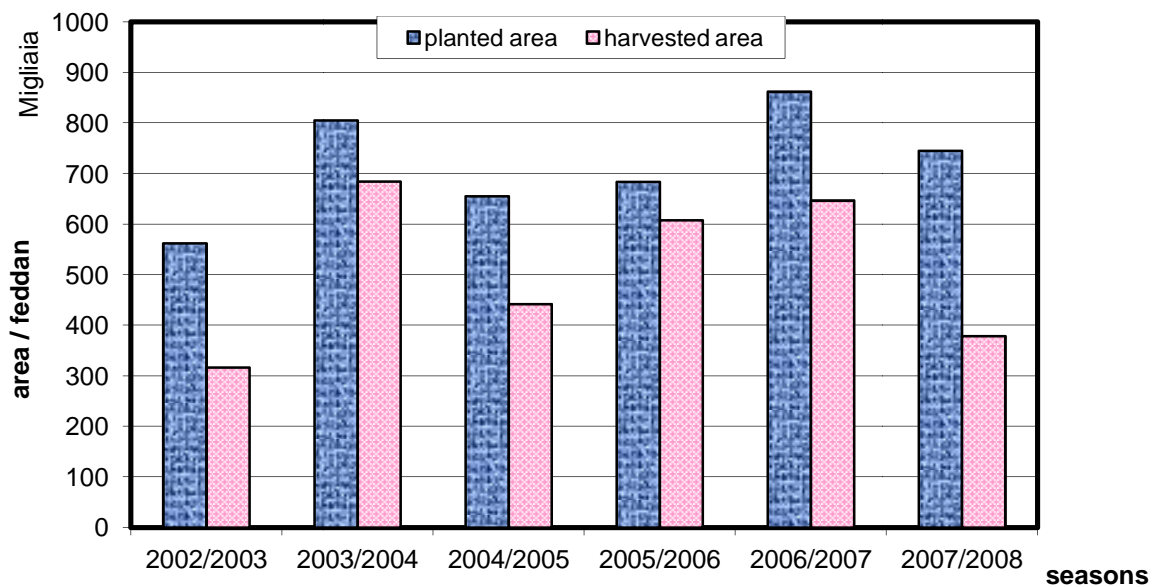
Source: Table (1.2), Appendix.1.

Figure (3.3) Average yield of sorghum during (2002/03- 2007/08)
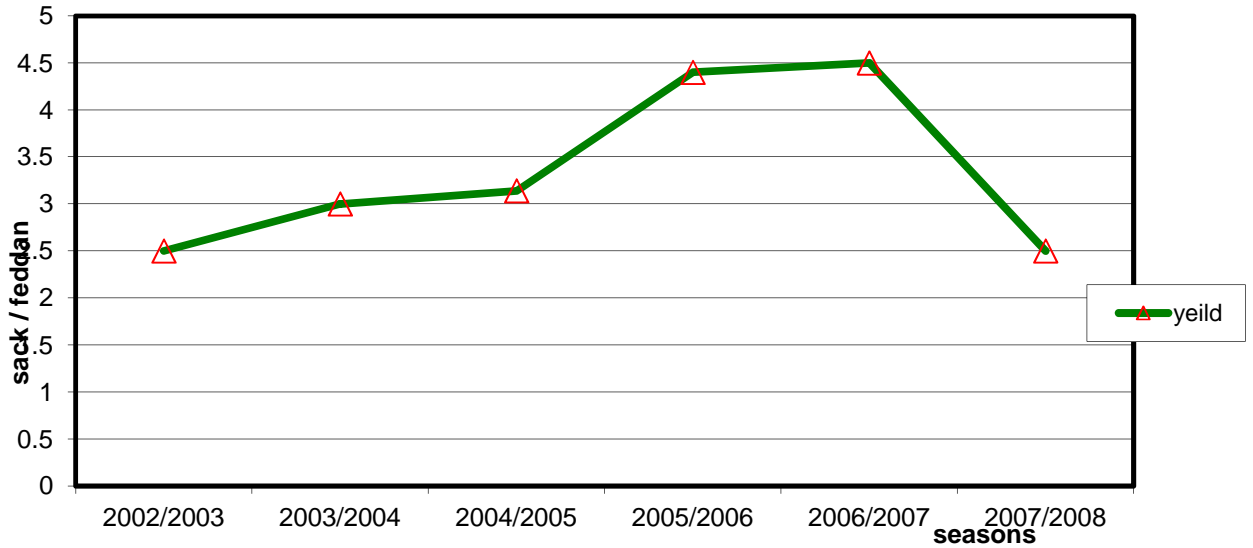
Source: Table (1.3), Appendix.1.

Figure (3.4) Deflated prices of sorghum varieties Feterieta, Wad Ahmed and Tabat (2002-2008).
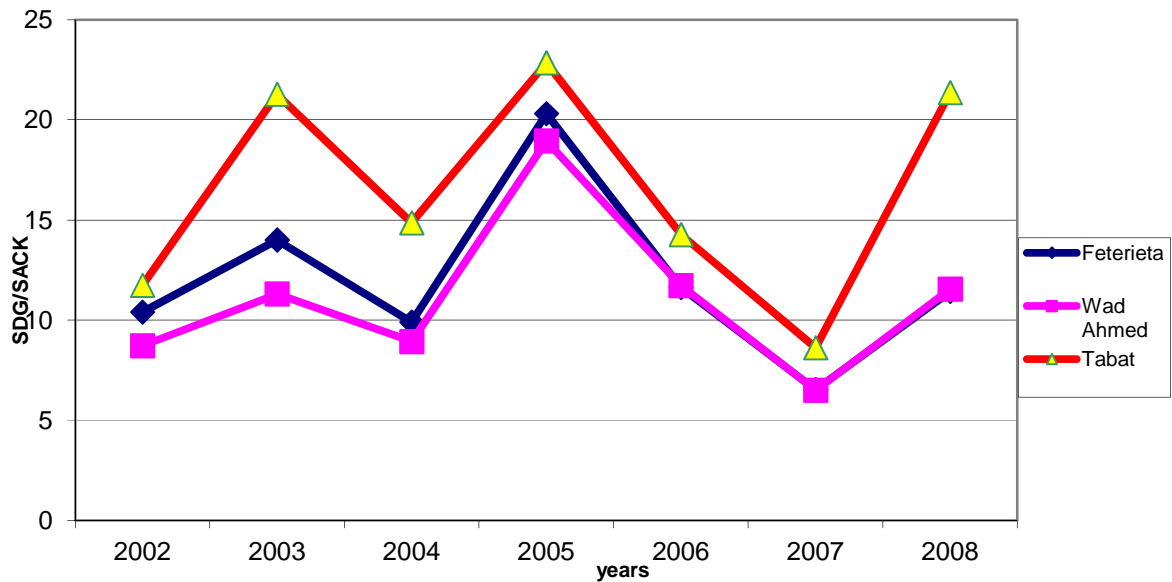
Source: Table (1. 4), Appendix.1.

Figure (4.5) Average production costs of sorghum (2002/03-2007/08)
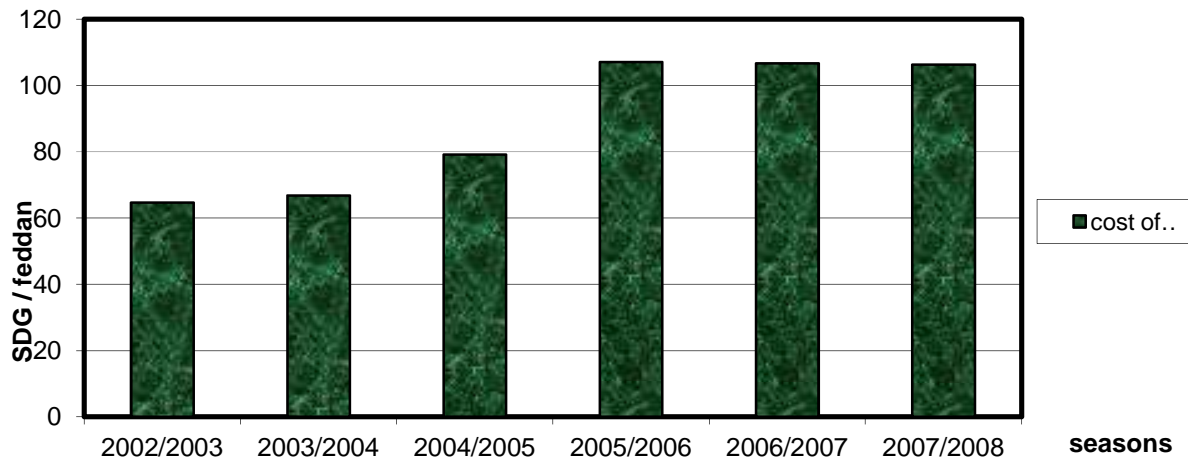
Source: Table (1. 5), Appendix.1.

3.2. Analysis of socio-economic characteristics of surveyed producers and production factors: - Theinformation of production, marketing andsocio-economic characteristics farmers (age and education level) of sorghum at study area have analyzed as follows:

3.2.1 Farmers' age

The data in table (3.2.1) shows that 45% of the respondents age is between 40 to 50 years, 23.8% of them are between 50 – 60 years, 15% between 30 – 40 years, 8.7% are between 60 – 70 years, only 5% are above 70 year, and 2.5% are between 20 – 30 years. This age structure explains that majority of the respondents (68.8 %) are based in the age limit of 40 – 60 years, this indicates that farmers within this age limit are mature enough to understand how to manage their farms via adopting new technologies to increase their productivity and production and hence their returns.

Table (3.2.1) Frequency Distribution of the surveyed farmers according to their age:

Age	Frequency	Percentage
20 -30	2	2.5
30 – 40	12	15
40 -50	36	45
50 – 60	19	23.8
60 – 70	7	8.7
Above 70	4	5
Total	80	100

Sources :-(Result from authors' survey, 2008)

3.2.2 Education level: -Table (3.2.2) shows that most of the surveyed farmers have attained sort of education and the illiterates among them were only 8.8% while those who have attained secondary and university education are over 48.8%. This indicates that farmers in the study area are most likely educated to deal with any technologies that might be delivered to the rain fed farming.

Table (3.2.2) Frequency distribution of farmers according to their education level:

Education level	Frequency	Percentage
Illiterate	7	8.7
Khalwa	13	16.3
Primary	18	22.5
Intermediate	3	3.7
Secondary	26	32.5
University	13	16.3
Total	80	100

Sources :-(Result from authors' survey, 2008).

3.2.3 Production characteristics:-

The production characteristics of the surveyed farmers provide information about total areas, the cultivated and harvested areas, cultivated areas with sorghum and other crops, weeding, limiting factors and activities other than farming run by the farmers

3.2.3.1Total area:-

Table (3.2.3) shows that 50 % of the respondents own areas less than 500 feddan; they are classified as small farmers. While, 12.5% of them own area size between 500 to 1000 feddan, but farmers tend to cultivate on large areas of more than one thousands feddan represent (37.5%) and aim at reducing production total costs.In Blue Nile State area and rain fed areas normally there is difference between total owned farmers areas, cultivated farmers areas and the harvested areas. Table (3.2.4) displays the average total area of the sampled farmers are estimated at 522 feddan, this indicates that more than 50 % of farmers has total cultivated area less than the average since 50% of the sampled farmers owned land area less than 500 feddan. While the average total cultivated area is estimated at 293 feddan, this indicates that 50% of farmers have total cultivated area less than the average but with degree less than that of total area. Regarding the average harvested area is estimated to be 228 feddan; this also indicates that more than 50% of farmers at study area have harvested area less than the average which is more than that of cultivated area and less than that of total area. The deference between the cultivated area and harvested area is attributed to losses caused by rainfall distribution.In table (3.2.4), the average total production is 374 sacks/feddan reflects that a significant percentage of farmers (more than 50%)have a production less than the average with some extreme production more than the average .

Table (3.2.3) Frequency distribution of the surveyed farmers according to their total area:

Total area in feddan	Frequency	Percentage
less than 500	40	50
500-1000	10	12.5
More than 1000	30	37.5
Total	80	100

Sources :-(Result from authors' survey, 2008).

Table (3.2.4) Average of area cultivated, harvested and total Yield:

Item	Average	Minimum	Maximum
Total area (Fed.)	522	5	4500
Cultivated area	293	5	1500
Harvested area	228	0	1500
Yield (kg/feddan	374	0	475

Sources :-(Result from authors' survey, 2008).

3.2.3.2 Sorghum and other crops:-

Table (3.2.5) explains that about 85% of the farmers are cultivating their land with sorghum as main crop a long side other crops, while only 15% cultivating their land with other crops rather than sorghum, which means that sorghum is the main crop in the Blue Nile state.On a world basis, sorghum represents 3.5% of total cereal production. While this figure is small, there are countries where it is of great importance: Burkina Faso (52.8%), Sudan (71.6%), Chad (1.0%), Cameroon (39.9%), Botswana (84.4%), and Rwanda (51.5%). In Africa as a whole, the proportion is 17.6% (Dendy, 1995).

Table (3.2.5) Frequency distribution of Sorghum and other crops:

Crop mix	Frequency	Percentage
Sorghum	68	85
Other crops	12	15
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.2.3.3 Limiting factors of area cultivated with sorghum:-

Table (3.2.6) demonstrates that the limiting factors to area devoted to sorghum as they have stated is mainly due to financial problems (45%) followed by cultivation of other crops beside sorghum (35%) while 16.3% refer the reason to the rain fall instability and 3.7% due to others reasons.

Table (3.2.6) Frequency Limiting factors to area sown by sorghum:

Factor	Frequency	Percentage
Financial problems	36	45
Other crops cultivated	28	35
Rainfall instability	13	16.3
Others	3	3.7
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.2.3.4 Number of weeding and its reasons:

Weeding is one of the crucial farm operations to get good harvest in rain fed areas in addition to its large portion in the cost of production because it is done manually in totally large areas.Most of farmers have conducted more than two weeding and above where 55% of the farmers did two weeding and 31.3% three weeding and only 2.5% were obliged to do more than three weeding, this is because of the heavy rains during the season. Ten of the farmers were managed to do one weeding because of the late finance and only one farmer did not conduct weeding because of its clean landas in tables (3.2.7) and (3.2.8).

Table (3.2.7) Frequency distribution of Number of weeding:

Item	Frequency	Percentage
One	8	10
Two	44	55
Three	25	31.3
Above	2	2.5
None	1	1.2
Total	80	100

Sources :- (Result from authors' survey, 2008).

Table (3.2.8) Frequency distribution of Reasons for number of weeding:

Item	Frequency	Percentage
land is clean	2	2.5
heavy rainfall	34	42.5
late finance	10	12.5
financial problems	10	12.5
heavy weeds	24	30
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.2.3.5 Activities other than farming:

Regarding economic activities in the sample area, 28.7% of the sampled farmers are restricted to farming only. While 31.3% runs animal production besides farming, whereas 20% of the farmers are engaged in trade and 20% runs other activities beside the farming activity as depicted in table (3.2.9).

Table (3.2.9) Frequency distribution of Off-farm:

Activity	Frequency	Percentage
animal production	25	31.3
Trade	16	20
Others	16	20
None	23	28.7
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.2.4 Finance:

The finance in the surveyed area covers information about type of finance, sources of finance, source of credit, methods of finance and finance activities. In the study area there are two sources of finance, these are self-finance, and credit finance. self-finance sources are, financing through selling of production represents 53.7% of the source of finance to the respondent farmers, followed by other sources (26.3%) and finally, selling of animal which represents about (20%) of the respondent farmers source of self-finance (see tables 3.2.10 and 3.2.11).Regarding sources of credit of finance, borrowing from banks is a main source for around 64% of the respondents, followed by borrowing from relative and friends (32%) and only 4% get their finance from other sources as displayed in table (3.2.12). The main mode of finance is the Salam which practiced by 86% of the farmers as shown in table (3.2.13). Weeding came on the first rank among the finance activities followed by crop establishment and harvesting, see table (3.2.14).

Table (3.2.10) Frequency distribution of Type of finance:

Item	Frequency	Percentage
Self-finance	72	62.1
Other (Bank, relatives, local merchant….etc)	44	37.9
Total	116	100

Sources :- (Result from authors' survey, 2008).

Table (3.2.11) Frequency distribution of sources of self-finance:

Item	Frequency	Percentage

Sell of production	43	53.7	
sell of animals	16	20	
Other	21	26.3	
Total	80	100	

Sources :- (Result from authors' survey, 2008).

Table (3.2.12) Frequency distribution of Other Sources of finance:

Item	Frequency	Percentage
Banks	39	81.3
borrowing from relatives and friends	8	16.7
Other	1	2.1
Total	48	100

Sources :- (Result from authors' survey, 2008).

Table (3.2.13) Frequency distribution of Mode of finance:

Item	Frequency	Percentage
Salam	38	90.5
Grantee	3	7.1
Partnership	1	2.4
Total	42	100

Sources :- (Result from authors' survey, 2008).

Table (3.2.14) Frequency distribution of financed activities:

Item	Frequency	Percentage
crop establishment	36	35
Harvesting	28	27.2
Weeding	27	26.2
packing &transport	12	11.7
Total	103	100

Sources :- (Result from authors' survey, 2008).

3.2.5 Marketing:

This section provides information about the marketing channels, transportation, transportation costs, taxes and marketing time and constraints of sorghum production in the Blue Nile state.Table (3.2.15) explains that the available marketing places are farm gate, local market, collection by middlemen and crop market at the Damzin. The most dominant channel is selling the product in the local market which comes on the first rank with 67% followed by farm gate (15.5%) and then come other marketing channels.

Table (3.2.15) Frequency distribution of marketing channels:

Item	Frequency	Percentage
farm gate	15	15.5
local market	65	67
Middlemen	7	7.2
crop market	6	6.2
Others	2	2.1
Total	97	100

Sources :- (Result from authors' survey, 2008).

3.2.5.1 Transportation:

Farmers using Lorries, trailers and caros (car boll of horse) to transport their production to the markets as shown in table (4.2.16). The dominant transportation method is by Lorries which is practiced by (75%) of the farmers and trailers (16.3%).

Most of the farmers (86.3%) took the responsibility of transporting their product to the markets; this indicates that farmers are taking part in the marketing functions beside their production process. Only 2.5% of the farmers levy the cost on traders and sell at the farm gate. In some cases (8.8%) of the farmers share the cost with traders according to a deal as depicted in table (3.2.17).

Table (4.2.16) Frequency distribution of Transportation:

Item	Frequency	Percentage
Lorries	60	75
Trailers	13	16.3
Car boll of Horse	5	6.2
Other	2	2.5
Total	80	100

Sources :- (Result from authors' survey, 2008).

Table (4.2.17) Frequency distribution of transportation cost:

Item	Frequency	Percentage
Farmer	69	86.3
Trader	2	2.5
Both	7	8.8
No transportation	2	2.5
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.2.5.2. Type of taxes:

Zakat,which is determined by Sharia laws and it amount to 10% of the volume of the marketed product, is paid by (46.4%) of the farmers, while (29.2%) of them have paid local taxes. About (18%) of the farmers who are transporting their product are exposed to pay road tax (Gebana) as illustrates in table (3.2.18). Regarding the selling time, about 50 % of the farmers sell their production during the first month after harvest and about 15% three months after harvest and 31.3% after two months after harvest this indicates that farmers tend to market their crop immediately after harvest to meet labors wages and Banks Obligations as displayed in table (3.2.19).

Table (3.2.18) Frequency distribution of Taxes, Zakat and fees:

Item	Frequency	Percentage
No taxes	2	1.2
Gebana	31	18.5
Zakat	78	46.4
local taxes	49	29.2
Others	8	4.8
Total	168	100

Sources :- (Result from authors' survey, 2008).

Table (3.2.19) Frequency distribution of Time of selling:

Item	Frequency	Percentage
1st month after harvest	40	50
2nd month	25	31.3
3rd month	12	15
No yeild	3	3.7
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.2.5.3 Marketing constraints:

Farmers were asked about main constraints they are facing in the marketing functions they practice on their sorghum crop. The main marketing functions are storage, transport, packing. They were also asked about finance and other problems that might be involved in sorghum marketing. Storage and finance are the most important constraints that are facing farmers in the marketing process. Thirty six percent of the farmers faced financial problems either insufficient or late finance. Also, 36 of the farmers are lacking storage

facilities. About 17 have faced problems in the packing process. Finally 17 have mentioned other problems including security and pest infestation. The structure of sorghum market is identified to be an oligopoly. The market is dominated by few farmers – traders who determine the prices in the market. They stated that producers of sorghum in the mechanized sub - system are also traders and speculators and may have oligopolistic control over the sorghum market. Their relative price - setting power is further enhanced by the country's size and segmentation of the sorghum market. Large sorghum merchants in Blue Nile state form price rings immediately after start of harvest to force producers to sell at low prices being aware of their needs for cash. At the retail level, there is high degree of concentration of sellers and buyers and the grain market resembles very much perfect competition. This should not be miss interpret, as what is important in the description of any commodity market is the whole apparatus that derives the movement and prices of that commodity, which in the case of the sorghum market is the setup and influence of the few big traders in the production areas of sorghum (Eldukheri, 2006).

Table (3.2.20) Frequency distribution of marketing constraints:

Item	Frequency	Percentage
Storage	36	31.6
Transport	17	14.9
Packing	5	4.4
Finance	36	31.6
Others	17	14.9
None	3	2.7
Total	114	100

Sources :- (Result from authors' survey, 2008).

3.2.6 Price fluctuation:

The sampled farmers were asked about the main sources of price fluctuations and to what extend would price levels affect the production of sorghum. Changes in supply and demands is the one of the main reasons that affects price stability this is reflected by opinion of (56.3%) of farmers in the study area. Rainfall instability is seen as a source of price instability by (21.2%) of the sampled farmers. High production costs was viewed by

(15%) of the farmers as a source of price fluctuations as shown in table (3.2.21). Table (3.2.22) reflects the farmers view on how prices could affect the farmers decision on sorghum production, (90%) of farmers see a high effect of price fluctuation on production system and only (10%) of farmers believe that they will continue to produce sorghum regardless of price level.Policies which have been taken by the government in the domestic production and marketing, or world marketing have an important impact on the price movement, because sorghum is strategic food crop for the most population. The government very carefully deal with the decreasing and increasing prices, specially before the liberalization policies which started in the early 1990s.The government intervene indirectly by subsiding the prices of agricultural inputs, or by forgiving the trade tax or by either decreasing tax fees or delaying tax collection, and by facilitating the financing of the crop .But something the government intervenes and directly affects the prices. In the case of surplus production, the price deteriorated to the minimum to the extent that it does not cover the production cost. This is due to nature of the inelastic demand for sorghum consumption i.e. in case of surplus production and low level of prices, the consumption remains the same. The opposite is true, when the price rises in the time of deficit, the consumption but less proportionally than increase in prices. This fluctuation will lead to a great instability in the production. No doubt that the farmers will increase their production when the prices rise. Increased production leads to surplus and price level in the coming season. As a result, the farmers will decrease their production, and consequently increasing the prices. Here the government intervenes to protect the consumer once the price rises and to protect the producer once the price falls (Shashoug, 2002).

Table (3.2.21) Frequency distribution of Price fluctuation sources:

Item	Frequency	Percentage
change in demand and supply	45	56.3
consumer taste	4	5
high cost of production	12	15
fluctuation of rainfall	17	21.2
No yield	2	2.5

Total	80	100

Sources :- (Result from authors' survey, 2008).

Table (3.2.22) Frequency distribution of Effect of price on production:

Item	Frequency	Percentage
no effect	8	10
high effect	72	90
Total	80	100

Sources :- (Result from authors' survey, 2008).

3.3. Costs, prices and Breakeven yield:-Table (4.3) shows total costs, total return, net return and breakeven point per feddans for sorghum production in the study area during the period 2002/2003 to 2007/2008. The cost of production is broke down to land preparation, crop establishment, harvesting and input costs. During the covered period 2002 to 2008 the cost of sorghum production showed upward trends it has reached SDG 117 per feddans in 2006 but it is slowed down to around SDG106 in 2007 and 2008 seasons respectively. During the same period the yield ranged between 2.5 to 4.5 sacks per feddan. The variation in productivity is mainly attributed to Prices has remarkably increased during the seasons 2003 to 2006 from SDG 26.18 per sack to SDG 74.83, but it showed a sharp decrease in 2007 and 2008 to reach SDG 47.44 and SDG 29.86 respectively, the fall down in prices was attributed to the surplus of sorghum production in these seasons. During the study period 2002 to 2008, farmers' returns normally exceed the total costs except in season 2008 where farmers incurred losses of SDG 32.25 per feddan which is due to the low prices during that season. Facing low prices in 2008 farmers have to produce 3.4 sacks per feddan to cover their variable costs as indicated by the breakeven point, which is considered as a high productivity level not normally attained by farmers under rain fed conditions. The required breakeven point to cover the variable cost of sorghum production during the period 2002 to 2008 ranged between 0.6 to 3.4 sacks per feddan.

3.4 Correlation between rainfall and agriculture variables in the Blue Nile Governorate

Pearson product moment correlation coefficientswere firstly calculated between agriculture and annual rainfall variables, using the years from 1980 to 2008 (Table (1.7)

Appendix.1). Means for the rainfall stations in the Damzin area were calculated and correlated with the total production and yield of sorghum in the Governorate. Time series for the production and yield of sorghum were plotted against mean annual rainfall. Correlation coefficients between the amount of annual rainfall and the production and yield of sorghum, Blue Nile state were calculated. The official rainfall statistics used in the study were obtained from the Sudan metrological authority, official agricultural statistics for sorghum, were used in the analysis. The production of sorghum is stated in M. Tons (metric tons, where one M.Ton equals 1000 kg), and yield of a certain crop is stated in kg/feddan (1 feddan is approximately 0·0042 km2). The correlation coefficient between sorghum production, yield and rainfall is shown in table (4.4). The correlation coefficient was 0.3 for the yield of sorghum against mean annual rainfall which is significant at level 95%. For sorghum production the correlation coefficient was below 0.3 and therefore, it is not significant. Sorghum production is dependent on other factors besides rain fall since the total area cultivated is mainly depends on the availability of finance. Sorghum yield is relatively more correlated to rain fall than production. Other factors that affect yield are weeding performance and rain distribution.

Table (3.3) Total costs, total return, net return and breakeven point per feddan for sorghum, 2002/2003 to 2007/2008.

Operation	Cost 2002/2003	Cost 2003/2004	Cost 2004/2005	Cost 2005/2006	Cost 2006/2007	Cost 2007/2008
Land preparation:						
Land rent	0.10	0.10	0.10	0.20	0.20	0.20

Land cleaning	1.10	1.64	1.64	10.04	1.98	.85
Ploughing	7.10	5.17	5.17	7.64	8.70	6.07
Building of camps	0.43	0.43	0.50	3.42	0.79	1.85
Crop						
Sowing	3.24	5.35	5.35	12.64	9.40	10.00
Resowing	6.74	9.52	10.52	10.20	11.00	11.70
Other	0,10	0.45	0.50	0	0	0
Harvesting operation						
Cutting	5.00	8.00	8.00	11.00	10.10	13.70
Collection	4.87	3.11	3.21	3.50	10.08	9.14
Harvesting	1.10	1.55	1.65	1.60	1.13	1.99
Carrying	1.03	0.93	0.93	2.70	2.29	1.25
Transportation	3.06	3.96	3.96	4.96	7.45	4.42
Other	2.65	1.90	2.90	4.86	2.17	3.91
Inputs / feddan						
Seeds	1.48	1.41	2.41	2.29	1.39	3.57
Petroleum	2.42	4.00	4.00	5.00	6.33	7.61
Empty sacks	5.88	4.11	7.11	15.40	9.23	9.00
Food	3.30	1.48	3.48	4.07	2.34	5.00
Administration	6.40	7.30	8.30	5.40	8.58	7.64
Zakat	8.75	6.40	9.40	12.10	13.50	9.00
Total cost	64.66	66.81	79.13	117.02	106.66	106.9
Average production (sack/fed)	2.5	3	3.14	4.4	4.5	2.5
Price (SDG/sack)	26.18	43.10	37.03	74.83	47.44	29.86
Total return(SDG/fed)	65.45	129.3	116.27	329.25	213.48	74.65
Net return (SDG/fed)	.79	62.49	37.14	212.23	106.82	-32.25
Breakeven (sack/fed)	2.4	0.6	1.04	0.4	0.8	3.4

Source: ministry of agriculture and forest and irrigation, Blue Nile State.

Table (4.4) Correlations

		Rainfall	Production	Yield
Rainfall	Pearson Correlation	1.000	0.22	0.30

	Sig. (2-tailed)	.	0.913	0.012
	N	28	28	28

** Correlation is significant at the 0.01 level (2-tailed).

N= number of observations.

4. Conclusion and recommendations

Sorghum production in the Blue Nile State is faced with many constraints. In this research analyzing of sorghum production system including socio-economic characteristics of farmers, production characteristics, financial methods and marketing system would help in future policy design and planning. The results concerning socio-economic characteristics of surveyed farmers explain that most of them in age limits and education level are mature enough to understand how to increase their productivity and production through adoption of new technologies. They owned large scale farms which could reach 4500 feddan with an average ownership of 522 feddans for each. The average yield of sorghum was 374 kg/feddan was achieved by more than 50% of them. In the study area there are two major source of finance, these are self-finance, and other than self-finance. On the other hand about more than half of them sell their production during the first month after harvest ,this indicates that the majority of farmers tend to market their production at harvest time at very low prices and this is mainly due to lack of financial ability to perform any marketing functions such as transport, storage, grading…etc. Moreover, there is a lack of market information system that capable to analyses, infer, and predict demand for sorghum to enable farmers to take well informed production decision. The most dominant marketing channel is selling the product in the local market which come on the first rank followed by farm gate and then come other marketing channels. This structure indicates the inability of farmers to market their harvest in main markets. Break-even point is changing according to input output prices. Facing low prices in 2008 farmers have to produce 3.4 sacks per feddan to cover their variable costs as indicated by the breakeven point, which is considered as a high productivity level not normally attained by farmers under rain fed conditions. The required breakeven point to cover the variable cost of sorghum production during the period 2002 to 2008 the point ranged between 0.6 to 3.4 sacks per feddan. Time series for the production and yield of sorghum covering the period (2002/03-2007/08) were plotted

against mean annual rainfall for the same period. The correlation coefficient was 0.3 for the yield of sorghum against mean annual rainfall which is significant at level 95%. For sorghum production the correlation coefficient was below 0.3 and therefore, it is not significant. We can conclude that the main constraints facing producers in the Blue Nile State could be summarized as poor skills and organizational capacities, meager marketing infrastructure and marketing practices, lack of finance and support services, unfavorable natural conditions and insecurity conditions. The study recommends that farmers should be supported with agricultural extension services to adopt new production technologies, marketing unit has to be established within the state ministry of agriculture to analyze sorghum value chain with the view of identifying the actors involved in the chain and establish win-win relationship between them, finance is to be made available in the right amount, at the right time and at reasonable terms through specialized banks, farmers are to be categorized into marketing associations to take collective decisions and during pumper seasons when farmers realize production surplus, the government buying intervention should take place. On the one hand the government builds up a buffer stock and on the other hand it protects the farmers from low prices.

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APPENDIX.1

Table (1.1):-Distribution of total Rain fall during (2002-2008) in Damazin,Buk and Roseirs

Seasons	Damazin	Roseris	Buk
2002	585.3	359.6	449
2003	696.7	480.6	746
2004	691.6	475.4	542
2005	684.1	343.5	729
2006	633.9	438.5	596
2007	762.3	546.2	950
2008	877	645.8	549

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue NileState,

Table (1.2):- Planted and harvested area of sorghum during (2002/03-2007/08)

Seasons	planted area	Harvested area
2002/03	561980	316793
2003/04	805167	684486
2004/05	655515	442472
2005/06	683864	607691
2006/07	861951	647000
2007/08	745000	379000

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue NileState,

Table (1.3):-Average yield of Sorghum during (2002/03- 2007/08)

Seasons	Yield
2002/03	2.5
2003/04	3
2004/05	3.14
2005/06	4.4
2006/07	4.5
2007/08	2.5

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue NileState,

Table (1.4):-Average prices of Feterieta, Wad Ahmed and Tabat during (2002-2008)

Years	Feterieta	Wad Ahmed	Tabat
2002	25.3	23.2	28.4

2003	37	35.6	56.6
2004	31.6	31.6	46.8
2005	71.9	71.4	80.9
2006	44.2	44.2	53.8
2007	26.5	26.4	35
2008	56.1	56.7	104.9

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue Nile State.

Table (1.5):-Deflated prices of Feterieta, Wad Ahmed and Tabat during (2002-2008)

Years	Feterieta	Wad Ahmed	Tabat	GDP defted
2002	10.4	8.72	11.74	242.50
2003	14	11.30	21.28	266.33
2004	9,9	8.93	14.86	315.30
2005	20,31	18.94	22.85	353.75
2006	11,63	11.72	14.27	376.61
2007	6.53	6.50	8.62	405.72
2008	11.43	11.55	21.36	490.98

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue Nile State.

Table (1.6):- Average production costs of sorghum per / SDG during (2002/03-2007/08)

Season	Cost of production
2003/2004	64.66
2003/2004	66.81
2004/2005	79.13
2005/2006	107.02
2006/2007	106.66
2007/2008	106.3

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue NileState,

Table (1.7):-Average of Rain fall during (1980-2008) in Damazin

Item	Years	Months								
		April	May	June	July	August	September	October	November	Total
1	1980	2.5	14	48	243.5	171	245	24.5	9.5	513
2	1981		100	101.5	158.5	159.5	100	11.5		631
3	1982		27	93	148.5	191	83.5	48.5		591.5
4	1983		26	180.5	193.5	275	71	4.5		650.5
5	1984		65.5	98	156	123	59.5	12		514
6	1985		73	76.5	180	53.5	111	24.2		518.2
7	1986			143.5	293.5	160.5	51.6	35		684.1
8	1987		137.9	65.6	66.4	145.1	84.6	53.5		557.1
9	1988		14	104.6	150	150.5	177.5	25		621.6
10	1989		58.5	184.5	226	133.6	58.3	36		696
11	1990		105	69.5	224.5	168	33	40.6		546.1
12	1991		98.5	52.5	227.5	242.5	19.5	40		687.5
13	1992		37.2	125.6	97.2	195	206	59		720
14	1993	8.2	100.5	99	245	139.5	108	75	25	800.2
15	1994		76	103	123	190	200.5	55		747.5
16	1995		52	108	91.8	210.2	123.6	4.5		633.1
17	1996		25	54.1	120.5	169.1	58	67		662.6
18	1997		49.5	114.1	162.8	97.3	201.5	39.9		665.1
19	1998		22	53.7	165.3	204	261	61.7		767.7
20	1999		75.7	165	230.7	129.8	213.1	62.2		876.5
21	2000		58.8	91.2	232.2	182	46	32		874.8
22	2001		97.9	121.6	195.9	232.2	89.3			942.2
23	2002		28.2	59	169.5	207.5	83.9	29.5		577.6
24	2003		33.6	37.3	250.8	177.3	174.6	37.9		673.6
25	2004		38.4	93.4	208	137.2	141.6	44		662.6
26	2005		66.8	105.9	239.7	198	70	14		694.4
27	2006		60.6	118.3	163.5	133.4	88	70.1		632.9
28	2007		18	115	210	229	106.5	87	-	765.5
29	2008	41.8	47.1	276.7	183	219.1	219.1	31.4	-	989.8
Average		1.8	57.04	107.2	175.3	168.5	123.7	40.4	0.9	689.8

Source: Ministry of Agriculture &Animal Resource& Forestry, Blue Nile State,

Appendix 1.7

Cultivated Area, Productive Area, Production and Productivity of Sorghum in Blue Nile State for Seasons 1980/1981 – 2007/2008

Item	Season	Cultivated Area 000Fed	Productive Area000Fed	Production 000 Tons	Productivity Kg/Fed
1	1980/1981	400	350	123	358
2	1981/1982	1095	824	350	420
3	1983/1982	477	382	178	215
4	1984/1983	431	371	96	259
5	1985/1984	393	362	40	110
6	1986/1985	891	820	287	350
7	1987/1986	1005	834	313	375
8	1988/1987	767	637	106	166
9	1989/1988	1352	1125	336	299
10	1990/1989	521	433	81	187
11	1991/1990	529	365	83	227
12	1992/1991	929	875	257	294
13	1993/1992	1298	1010	273	270
14	1994/1993	1117	740	126	170
15	1995/1994	937	647	132	204
16	1996/1995	745	671	151	225
17	1997/1996	854	760	201	264
18	1998/1997	800	720	227	315
19	1999/1998	650	480	151	315
20	2000/1999	270	190	42	221
21	2001/2000	320	240	70	292
22	2002/2001	523	482	235	488
23	2003/2002	560	364	87	239
24	2004/2003	655	560	145	259
25	2005/2004	522	369	107	290
26	2006/2005	684	607	244	402
27	2007/2006	732	647	258	399
28	2008/2007	376	289	694	216
Average		708.3	577	217.8	279.6

Source : Ministry of Agriculture &Animal Resource& Forestry, Blue Nile State;