

MINISTRY OF AGRICULTURE AND NATURAL RESOURCES (MANR),
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Trends and Changes in Sorghum Production in
the Sudan , 1961/62 to 1982/83

Prepared by
Abdul Latif Ijaimi
Mohamed M. Elhanan
Surjit S. Sidhu

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Abdul Latif Ijaimi is an Agricultural Economics Specialist and
Mohamed M. Elhanan is Head of the Production Economics and Farm
Management Section of DAES . Surjit S. Sidhu is a Production
Economist from USAID - CHECCHI assigned to PAEA .

Table of Contents

	<u>Page</u>
<u>I</u> Introduction	1
<u>II</u> Data Sources	9
<u>III</u> Sectoral Changes at the National Level	9
A. Changes in Production	9
B. Changes in Areas	12
C. Changes in Yields	14
<u>IV</u> Changes at the Regional Level	16
A. Changes in Production	16
B. Changes in Areas	19
C. Changes in Yields	20
<u>V</u> Yield Decline	23
<u>VI</u> Summary and Implications of the Results	27
Appendix	33

List of Tables

	<u>Page</u>
Table 1 . Shares of Individual Food Crops in Total Area and Production of Food Crops, Average of 1961/62 to 1971/72 and 1972/73 to 1982/83, Sudan	2
Table 2 . Average Production, Area and Yield of Sorghum 1961/62-1971/72 and 1972/73-1982/83, Sudan ..	3
Table 3 . Average Yearly Production of Sorghum, Sudan 1979/80-1983/84.....	4
Table 4 . Compound Annual Growth Rates of Production , Area and Yield of Sorghum ,1961/62-1982/83 , Sudan	6
Table 5 . Average Production, Area and Yield of Sorghum , 1961/62 - 1982/83 , Sudan	7
Table 6 . Changes in Compound Annual Growth Rates of Production, Area and Yield of Sorghum, 1961/62 - 1971/72 to 1972/73- 1982/83 , Sudan	11
Table 7 . Changes in Coefficient of Variation of Production , Area and Yield of Sorghum , 1961/62 - 1971/72 to 1982/83 , Sudan.....	13
Table 8 . Distribution by Province and Crop Sector of Average sorghum, Production in (000MT) , 1972/73 to 1982/83, Sudan.....	17
Table 9 . Average Area , Production and Yield of Sorghum by Province and bu Sector 1961/62 - 1971/72 and 1972/73 - 1982/83 , Sudan.....	18
Table 10 . Changes in Compound Annual Growth Rates of Areas , Production and Yield of Sorghum by Province and by Sector 1961/62 - 1971/72 to 1972/73 - 1982/83 , Sudan.....	21
Table 11 . Changes in Coefficient of Variation of Area , Production and Yield of Sorghum by Province and by Sector 1961/62 - 1971/72 to 1972/73 - 1982/83 , Sudan.....	22
Table 12 . Growth Rates for Sorghum Yield and Area by region and by sector, 1961/62 - 1971/72 and 1972/73 - 1982/83 , Sudan.....	25

<u>Appendix</u>	33
Table 13 . Sorghum, Area, Production and Yield 1961/62 - 1983/84 Rainfed Sector, Sudan	34
Table 14 . Sorghum , Area, Production and Yield by Province 1961/62 ~ 1983/84 , Sudan.....	35
Table 15 . Sorghum Area , Production and Yields in Blue Nile Province 1961/62 - 1982/83 (Irrigated , mechanized and traditional Sectors) , Sudan	36
Table 16 . Sorghum, Area , Production and Yield in Kassala Province 1961/62 - 1982/83 (Irrigated , mechanized and traditional Sectors) , Sudan	37
Table 17 . Sorghum, Area, Production in Kordofan Province 1961/62 - 1983/84 (Mechnaized and traditional Sectors) Sudan.....	38
Table 18 . Sorghum , Area , Production and Yield in Darfur Province 1961/62 - 1983/84 (Mechnaized and traditional sectors), Sudan	39

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Trends and Changes in Sorghum Production in the Sudan, 1961/62 to 1982/83.

Introduction

Sorghum is the most important food crop in the Sudan. As shown in Table 1, the average share of sorghum in total food production in the Sudan during the 11-year period 1972/73 to 1982/83 was approximately 56 percent and the corresponding share in total area under food production was about 47 percent. In comparison shares during the 11-year period 1961/62 to 1971/72 were higher; 60 percent and 50 percent respectively. In spite of this small decline in the relative position of sorghum in total food production, the average yearly production of sorghum increased from 1324 thousand metric tons MT during 1961/62 - 1971/72 to 1974 thousand (MT) during 1972/73 - 1982/83 (Table 2), which represents an increase of 49.1 percent.

Sorghum production in the Sudan consists of three sectors, irrigated, rainfed mechanized and rainfed traditional (non-mechanized). As shown in Table 3, average yearly production of sorghum in the Sudan during the 5 years (1979/80 to 1983/84) was 2111.8 thousand MT. Of this total 11 percent was irrigated, 61 percent rainfed mechanized and 28 percent rainfed traditional. Thus, the rainfed sector as a whole produced 69 percent of the total yearly output of sorghum of which 69 percent was in the rainfed mechanized sector and 31 percent in the rainfed traditional sector. The rainfed mechanized sector is the

Table 1 . Shares of Individual Food Crops in Total Area and Production of Food Crops, Averages of 1961/62 to 1971/72 and 1972/73 to 1982/83, -Sudan

Crop	Production		Area	
	1961/62 to 1971/72	1972/73 to 1982/83	1961/62 to 1971/72	1972/73 to 1982/83
	(Percent)			
Sorghum	59.7	55.8	50.0	46.9
Wheat	3.7	6.2	2.4	3.3
Millet	14.9	11.8	19.1	19.3
Sesame	8.8	6.7	16.6	15.6
Groundnuts	12.9	19.5	11.9	14.9

Table 2 . Average Production , Area and Yield of Sorghum_1961/62 -
1971/72 and 1972/73 -- 1982/83 Sudan

Crop Sector	1961/62 - 1971/72	1972/73 - 1982/83	Change (percent)
	Average Production (000 MT)		
All Sudan	1324	1974	49.1
Irrigated	216	224	3.7
Flooded	23	19	-17.4
Rainfed (Mechanized)	324	1063	228.1
Rainfed (Traditional)	761	668	-12.2
Rainfed (Total)	1085	1730	59.4
	Average Area (000 Feddans)		
All Sudan	3732	6621	77.4
Irrigated	440	474	7.7
Flooded	53	56	5.7
Rainfed (Mechanized)	984	3434	249.0
Rainfed (Traditional)	2254	2657	17.9
Rainfed (Total)	3238	6091	88.1
	Average Yield (kilograms/Fed.)		
All Sudan	353	298	-15.6
Irrigated	495	473	-4.4
Flooded	437	320	-26.8
Rainfed (Mechanized)	334	307	-8.1
Rainfed (Traditional)	334	254	-24.0
Rainfed (Total)	332	292	-12.0

Table 3 . Average Yearly Production of Sorghum, Sudan, 1979/80 -
1983/84 .

Crop Sector	(000 M.T)	Percent	Percent
Irrigated	232.0	11.0	-
Rainfed -(mechanized)	1291.0	61.1	68.7
Rainfed -(traditional)	588.8	27.9	31.3
Sub - total - rainfed	(1879.8)	(89.0)	(100.0)
Total	2111.8	100.0	-

5

dominant sorghum producing sector in the Sudan, accounting for a share of over 61 percent in the total

During the past 22 years sorghum production in the Sudan has recorded significant growth. As shown in Table 4, log-trend regressions fitted to the twenty two years' data from 1961/62 to 1982/83 yield annual growth rates of 3.5 percent and 5.11 percent for total sorghum production and area in the Sudan, respectively. Growth rates of this size are high compared to the production records of both the developed and the developing countries. During the corresponding period, the Green Revolution countries of Asia actually recorded lower growth rates. During this period Sudan was a net exporter of sorghum at an average of 112,000 MT tons per year. It is also well known that in the Sudan some sorghum is used as animal feed and that some unrecorded exports of sorghum take place to the neighboring countries. It is, therefore, safe to conclude that, on the whole, Sudan produced enough sorghum to meet its food consumption requirements during the period 1961/62 to 1982/83.

However this rapid increase in sorghum production has been accompanied by (1) a considerable amount of instability in production, and (2) a decline in the national average yield. The coefficient of variation of yearly national production for the 22-year period 1961/62 to 1982/83 was 32.6 percent (Table 5) and the average yield declined at an annual rate of -1.34 percent (Table 4)

Table 4. Compound Annual Growth Rates of Production, Area and Yield of Sorghum, 1961/62-1982/83, Sudan

Crop Situation	Growth Rates of		
	Production	Area	Yield
All Sudan	3.50	5.11	-1.54
Irrigated	-0.39*	0.96	-1.32
Flooded	-2.94	-0.38*	-2.72
Rainfed (Mechanized)	11.93	12.83	-0.79
Rainfed (Traditional)	-0.92	1.44	-2.32
Rainfed (Total)	4.23	5.60	-1.27

* The regression coefficients from which these growth rates are calculated are not significantly different from zero at 10 percent level of significance.

Table 5. Average Production, Area and Yield of Sorghum, 1961-82
1961-82, Sudan

Production in 1000 Hl.
Area in 1000 Feddans
Yield in Hilo grams/Fed.

Crop Situation	Average	Production	Area	Yield	Coefficient of Variation (%)
All Sudan	1649	851 (66/67)	3277 (81/82)	32.2	
Irrigated	229	118 (58/69)	327 (72/73)	25.0	
Flooded	54	4 (79/80)	40 (70/71)	50.0	
Rainfed (Mechanized)	673	113 (66/67)	2150 (81/82)	72.2	
Rainfed (Traditional)	714	490 (68/69)	1377 (67/68)	28.4	
Rainfed (Total)	1405	627 (66/67)	3500 (81/82)	37.5	
All Sudan	5176	2823 (68/69)	9231 (81/82)	35.7	
Irrigated	457	305 (74/75)	562 (75/76)	13.4	
Flooded	54	20 (79/80)	109 (70/71)	46.1	
Rainfed (Mechanized)	2209	410 (63/64)	5532 (81/82)	69.2	
Rainfed (Traditional)	2456	1509 (68/69)	3417 (67/68)	19.0	
Rainfed (Total)	4665	2361 (68/69)	8652 (81/82)	39.1	
All Sudan	326	224 (82/83)	412 (63/64)	15.3	
Irrigated	484	268 (68/69)	747 (72/73)	24.5	
Flooded	379	200 (76/77), (79/80)	524 (68/69)	26.7	
Rainfed (Mechanized)	320	222 (66/67)	434 (62/63)	18.4	
Rainfed (Traditional)	294	187 (76/77), (82/83)	403 (67/68)	22.1	
Rainfed (Total)	312	221 (82/83)	404 (67/68)	16.2	

Note: Figures in parentheses indicate the year.

Sorghum in Sudan is a staple food . Instability of it's yearly production, therefore, is of natural concern . The severity of the recent drought and the concomitant food shortages have further raised the level of this concern . The large shortfall in production during the 1984/85 season and indications of a bumper 1985/86 crop have brought to the fore the questions concerning food stabilization policy . This paper, therefore, aims at documenting the trends and changes in sorghum production, area and yields at the national and regional levels and by sector by using the time series data from 1961/62 to 1982/83 .

The purpose is primarily to describe Sorghum production trends and patterns of change over the 22-year period. In so doing we hope to develop some increased understanding of the nature and magnitude of production risks as measured by variability , sources of growth in sorghum production, and patterns of yield decline and compare the performance of Irrigated, rainfed mechanized and rainfed traditional sectors .

The 22-year period of 1961/62 to 1982/83 is divided into two time periods of 11-years each; the first period from 1961/62 to 1971/72 and the second period from 1972/73 to 1982/83 . Such a division allows comparisons of various trends and variability in production between the two periods and to comment upon the magnitudes and variability of production risks between the two periods, across crop sectors and regions .

SP-1

11 Data Sources

The Department of Agricultural Economics (DAES), Ministry of Agriculture and Natural Resources (MANR) Sudan, regularly reports area, yield and output data for sorghum (and other crops) by province . Most of the sorghum crop (89 %) is grown under rainfed conditions . The data for irrigated and rainfed sectors are reported separately . Also the data pertaining to the rainfed areas are separately reported for rainfed mechanized and rainfed traditional (non-mechanized) sectors .

Most MANR area and yield statistics for sorghum crop have been subjective estimates . These estimates for the past some years have been supplemented by crop-cutting surveys in major sorghum producing areas of Gedarif and Damazine . Most statistics for the irrigated crops, however, are actual data .

In the ensuing analysis, area, output and yield data for irrigated , rainfed mechanized and rainfed traditional sectors are used for the period 1961/62 to 1982/83, as reported by MANR in various issues of the Bulletin of Agricultural Statistics, Yearbook of Agricultural Statistics, Current Agricultural Statistics, and the Bulletin No. 2 from the Mechanized Farming Corporation .

111 Sectoral Changes at the National Level

A/ Changes in Production

1. Average yearly production of sorghum for the Sudan

as a whole increased by 650 thousand MT, that is, by 49.1 percent between the two 11-year periods, (Table 2) . The entire increase, except for a small fraction in the irrigated sector (3.7 percent), occurred in the rainfed mechanized sector which experienced an increase of 228.1 percent . The rainfed traditional sector actually produced 12.2 percent (93 thousand MT) less sorghum per year during the second period than during the first period .

2. The overall growth rate in sorghum production in the country increased by 2.91 percentage points from 1.44 percent during the first period to 4.35 percent during the second period (Table 6) . However, because of a small base , sorghum production in the rainfed mechanized sector had higher growth rate of 11.04 percent during the first period than a growth rate of 9.18 percent during the second period. This implies that the yearly level of production in the mechanized sector was more stable during the second period .

3. The overall variability (instability) of sorghum production in Sudan, as measured by the coefficient of variation in the yearly production, increased slightly from 25.0 percent during the first period to 26.5 percent during the second period . This was primarily due to increased variability in production in the irrigated and flooded sectors . However, the instability of production in the rainfed sector decreased considerably; by 34.3 percent, from 61.8 to 40.6 in the rainfed mechanized sector, and by 30.8 percent, from 32.1 to 22.2 in the rainfed traditional

Table 6 . Changes in Compound Annual Growth Rates of Production, Area and Yield of Sorghum, 1961/62 - 1971/72 to 1972/73 - 1982/83, Sudan .

Crop Situation	Growth Rate 1961/62 - 1971/72	Growth Rate 1972/73 - 1982/83	Change
	<u>Production</u>		
All Sudan	1.44	4.35	2.91
Irrigated	-1.76	-2.95	-1.19
Flooded	1.61*	-10.33	-11.94
Rainfed (Mechanized)	11.84	9.18	-2.66
Rainfed (Traditional)	-2.18	1.03*	3.21
Rainfed (Total)	2.13*	5.83	3.70
	<u>Area</u>		
All Sudan	3.27	5.86	2.59
Irrigated	2.31	1.78	-0.53
Flooded	0.84*	-6.70	-7.54
Rainfed (Mechanized)	14.77	8.49	-6.28
Rainfed (Traditional)	-1.33*	3.53	4.86
Rainfed (Total)	3.42	6.34	2.92
	<u>Yield</u>		
All Sudan	-1.77	-1.43	0.34
Irrigated	-3.97	-4.59	-0.62
Flooded	0.77*	-4.23	-5.00
Rainfed (Mechanized)	-2.57	0.64*	3.21
Rainfed (Traditional)	-0.85*	-2.41	-1.86
Rainfed (Total)	-1.24	-1.57	-0.33

* The regression coefficients from which these growth rates are calculated are not significantly different from zero .

sector (Table 7). This means that the production risk in rainfed mechanized as well as rainfed traditional sectors (of sorghum production) at the national level decreased considerably between the two periods, but the level of risk as measured by the coefficient of variation is still quite high. It is interesting to note that this risk is lower in the rainfed traditional sector than the irrigated and rainfed mechanized sectors.

B/ Changes in Area

1. For all Sudan average area planted to sorghum increased by 77.4 percent from 3732 thousand feddans during the first period to 6621 thousand feddans during the second period (Table 2). Except for a small increase in the irrigated sector, most of this increase took place in the rainfed sector especially rainfed mechanized sector where the average area planted (to sorghum) increased by 249 percent from 984 thousand feddans in the first period to 3434 thousand feddans in the second period. The average area in the rainfed traditional sector increased approximately 18 percent from 2254 thousand to 2657 thousand feddans.

2. The increase in average area planted to sorghum at the national level from the first to the second period was accompanied by an acceleration of the growth rate of area planted to sorghum which increased by 2.59 percentage points from 3.27 percent in the first period to 5.86 percent during the second period. But it is important to note that this increase in the growth rate of area planted took place

Table 7. Changes in Coefficient of Variation of Production, Area and Yield of Sorghum, 1961/62 - 1971/72 to 1972/73 - 1982/83, Sudan

Crop Situation	Coefficient of Variation (percent)		Change percent
	1961/62-1971/72	1972/73-1982/83	
	<u>Production</u>		
All Sudan	25.0	26.5	6.1
Irrigated	23.6	27.4	16.1
Flooded	45.4	58.5	28.9
Rainfed (Mechanized)	61.8	40.6	-34.3
Rainfed (Traditional)	32.1	22.2	-30.8
Rainfed (Total)	28.1	30.3	7.8
	<u>Area</u>		
All Sudan	19.4	22.1	13.7
Irrigated	15.3	15.0	-1.9
Flooded	48.8	45.6	-7.8
Rainfed (Mechanized)	62.5	32.4	-48.2
Rainfed (traditional)	21.1	15.6	-26.1
Rainfed (Total)	21.0	23.4	11.4
	<u>Yield</u>		
All Sudan	13.4	12.1	-9.7
Irrigated	25.9	24.1	-6.9
Flooded	16.1	29.8	85.1
Rainfed (Mechanized)	19.6	16.6	-15.5
Rainfed (Traditional)	14.9	21.0	41.1
Rainfed (Total)	13.9	16.6	19.4

entirely in the rainfed traditional sector where the growth rate increased by 4.86 percentage points from -1.33 to 3.53 . In other sectors the growth rate actually declined with a substantial decline of 6.28 percentage points from 14.77 percent to 8.49 percent in the rainfed mechanized sector .

3. The variability in total area planted to sorghum at the national level, as measured by the coefficient of variation increased by 2.7 percentage points from 19.4 percent in the first period to 22.1 percent in the second period . However, within each individual sector the variability decreased with the largest decline from 62.5 percent to 32.4 percent in the rainfed mechanized sector followed by a decline from 21.1 percent to 15.6 percent in the rainfed traditional sector . In other words the yearly areas planted to sorghum in the two important sectors of rainfed mechanized and rainfed traditional became considerably more stable during the second period compared to the first period

C. Changes in Yields

1. The national average yield of sorghum declined by 13.6 percent from 353 kilograms per feddan in the first period to 298 kilograms per feddan during the second period . The average yields declined in all sectors . The smallest decrease of 4.4 percent from 495 kilograms per feddan to 473 kilograms per feddan was in the irrigated sector . The yields in the rainfed mechanized sector decreased by 8.1 percent from 334 kilograms to 307 kilograms, but there was a substantial decline of 24 percent from 334 kilograms to 254 kilograms in the rainfed traditional sector .

2. For all Sudan growth rate in sorghum yields improved by 0.34 percentage points from -1.77 percent in the period to -1.43 in the second period (Table 6). However, this improvement at the national level, was entirely due to an improvement of 3.21 percentage points in the rainfed mechanized sector where the growth rate increased from -2.57 percent to 0.64 percent. Thus, only in the rainfed mechanized sector there was no yield decline during the second 11-year period. In all other sectors there was further decline during the second period in the growth rates of yields which were already negative.

3. The instability of sorghum yields for the country as a whole was less during the second period than during the first period. The coefficient of variability declined by 9.7 percent between the two periods from 13.4 percent to 12.1 percent (Table 7). This improvement in the stability of sorghum yields occurred basically in the irrigated and rainfed mechanized sectors. The coefficient of variation of yields declined by 6.9 percent from 25.9 percent to 24.1 percent in the irrigated sector and by 15.5 percent from 19.6 to 16.6 in the rainfed mechanized sector. The yields of sorghum, however, became more variable in the rainfed traditional sector where the coefficient of variation increased by 41.1 percent from 1.49 to 21.0.

IV Changes at the Regional Level

A. Changes in Production

1. Yearly average production of sorghum during the 11-year period 1972/73 to 1982/83 was the highest (711 thousand MT) in the Blue Nile region (Table 8) . It formed 36.02 percent of the national yearly average production of 1974 thousand MT . In the Blue Nile, irrigated , rainfed mechanized and rainfed traditional sectors , accounted for 28 percent, 38 percent and 34 percent of the total, respectively . Another approximately 32 percent of the yearly average production of sorghum in the Sudan was produced in Kassala region . Most of it (96 percent) was produced in the rainfed mechanized sector and the remaining 4 percent with river flood waters . The shares of Kordofan , Darfur and Southern regions were 13.81 percent, 4.80 percent and 12.57 percent , respectively . It should be noted that the western regions of Kordofan and Darfur together produced less than 19 percent of the national yearly average production . The share of the rainfed mechanized sector in Kordofan was 54 percent . Northern and Khartoum provinces produced less than one percent each .

2. From first to the second period yearly average production of sorghum increased in all regions and all sectors within each region except rainfed traditional sector in the Blue Nile , Kordofan, Kassala and Northern regions (Table 9) . The largest decline of production in the traditional sector was in the Kassala region where a yearly production of 117

Table 8 . Distribution by Province and Crop Sector of Average Sorghum Production (in 000 MT), 1972/73 to 1982/83. Sudan

Province/Region	Irrigated	Flooded	Rainfed Mechanized	Rainfed Traditional	Total Dura	Share (%)
Northern	19.27	-	-	-	19.27	0.98
Kassala	-	25.00	601.00	-	626.00	31.71
Khartoum	2.18	-	-	-	2.18	0.11
Blue Nile	201.73	-	269.84	239.39	710.96	35.02
Kordofan	-	-	148.38	124.35	272.73	13.81
Darfur	-	-	*	94.82	94.82	4.80
Southern	-	-	*	248.09	248.09	12.57
Total	223.18	25.00	1019.22	706.65	1974.05	100
Share (%)	11.30	1.27	51.63	35.80	100	

* Sorghum produced in rainfed mechanized areas in these two regions during some years is included in rainfed traditional sector

Table 9 . Average Area , Production and Yield of Sorghum by Province and by Sector , 1961/62 - 1971/72 and 1972/73 - 1982/83 , Sudan

Region/Drop sector	Area (000 FD)			Production (000 MT)			Yield (kg/FD)		
	1961/62 1971/72	1972/73 1982/83	Change (%)	1961/62 1971/72	1972/73 1982/83	Change (%)	1961/62 1971/72	1972/73 1982/83	Change (%)
1/ <u>Blue-Nile</u>	1321	2142	62.1	544	711	30.70	408	326	-20.1
Irrigated	337	421	24.9	169	202	19.53	317	475	-8.1
Mechanized	161	849	427.3	62	270	335.48	379	325	-14.0
Traditional	823	872	6.0	313	239	-23.64	375	274	-26.9
2/ <u>Kassala</u>	1149	1951	69.6	375	626	66.93	328	312	-4.9
Irrigated (Flooded)	34	70	105.9	14	25	78.57	407	347	-14.7
Mechanized	789	1881	138.4	244	601	146.31	319	310	-2.8
Traditional	326	0	-100	117	0	-100	232	-	-
3/ <u>Kordofan</u>	599	1096	83.0	178	273	53.37	300	247	-17.7
Mechanized	23**	474	1960	10**	148	1380	230	316	37.4
Traditional	576	622	8.0	168	125	-25.59	299	196	-34.4
4/ <u>Darfur</u>	243	342*	40.7	85	95	11.76	362	283	-21.8
5/ <u>Southern</u> (i)	324	1033	218.8	101	248	145.54	301	272	-9.6
6/ <u>Northern</u>	91*	43	-52.7	43*	19	-55.81	491*	455	-7.3
7/ <u>Khartoum</u>	10*	14	40.0	1.5*	2.2	46.67	173	160	-7.5

Note : (i) Average area for 1972/73 - 1982/83 includes mechanized areas in the upper Nile .

(ii) Irrigated and flooded areas are shown together under "Irrigated" .

* 10 years average (1961/62 - 1970/71) .

** 4- year average (1968/69 - 1971/72) .

thousand MT during the first period disappeared altogether. On the other hand the largest absolute increase of 357 thousand MT in the yearly average production in the rainfed mechanized sector also occurred in Kassala region. The second largest increase of 208 thousand MT (335.40 percent) in the yearly average production in the mechanized sector occurred in the Blue Nile region. Southern region as a whole also experienced considerable increase where yearly average production increased from 101 thousand MT to 248 thousand MT. A large part of this increase, however, was in the mechanized sector in the Upper Nile province.

3. From first to the second period annual growth rates in sorghum production declined in most sectors within regions, except traditional sectors of Kordofan and Darfur regions (Table 10).

4. Instability in sorghum production, as measured by the coefficient of variation (Table 11), decreased from first to the second period in most sectors within regions, except traditional sector in the Kordofan and Northern regions.

B/ Changes in Areas

1. From first to the second period average areas planted to sorghum per year increased in all sectors within regions, except the traditional sector in Kassala region. During the first period an average of 326 thousand feddans were planted to sorghum in the traditional sector in Kassala region each year. But during the second

period no such areas are reported . On the other hand largest increase of 1092 thousand feddans in areas planted annually in the mechnaized sector also took place in this region . It was followed by an increase of 688 thousand feddans in the Blue Nile region and 451 thousand feddans in the Kordofan region.

2. Annual growth rates in areas planted to sorghum increased from first to the second period in Darfur and Southern regions and in traditional sector of the Blue Nile region , but declined elsewhere (Table 10) .

3. Instability of areas planted to sorghum as measured by the coefficient of variation increased from first to the second period only in Southern and Northern regions and the mechanized sector of the Blue Nile region but it decreased in all other sectors (Table 11) .

C/ Changes in Yields

1. Average yields of sorghum declined from first to the second period in all sectors in all regions , except in the mechanized sector of Kordofan where they increased from 230 kilograms per feddan in the first period¹ to 316 kilograms during the second period (Table 9) . However the decline in mechanized areas of Kassala was quite small (2.8 percent .

2. In irrigated areas of Blue Nile region the annual growth rate of yields improved very slightly by 0.54 percentage points from -5.50 percent to -4.96 percent .

1. The first period in this case was only four years from 1968/69 to 1971/72 .

Table 10. Changes in Compound Annual Growth Rates of Areas, Production and Yield of Sorghum by Province and by Sector 1961/62 - 1971/72 to 1972/73 - 1982/83, Sudan

Region/Crop sector	Growth Rates of :								
	Area			Production			Yield		
	1961/62 1971/72	1972/73 1982/83	Change	1961/62 1971/72	1972/73 1982/83	Change	1961/62 1971/72	1972/73 1982/83	Change
1/ <u>Blue Nile</u>									
Irrigated	3.54	0.84	-2.7	-2.18	-4.16	-1.98	-5.50	-4.96	0.54
Mechanized	12.81	7.87	-4.94	11.25	6.32	-4.93	-1.37	-1.44	-0.07
Traditional	-0.48	4.33	4.81	0.22	2.10	1.88	0.71	-2.14	-2.85
2/ <u>Kassala</u>									
Irrigated (Flooded)	-4.92	10.86	15.78	-1.92	8.53	10.45	3.16	-2.10	-5.26
Mechanized	14.30	6.16	-8.14	10.58	9.4	-1.18	-3.24	3.06	6.30
Traditional	-	-	-	-	-	-	-	-	-
3/ <u>Kordofan</u>									
Mechanized	-	-1.77	-	-	-3.12	-	-	-1.36	-
Traditional	7.55	2.24	-5.31	3.16	8.32	5.16	-4.07	5.93	10.00
4/ <u>Darfur</u>									
Traditional	-6.43	10.97	17.40	-4.48	7.83	12.31	2.10	-2.81	-4.91
5/ <u>Southern</u>									
Traditional	1.26	8.57	7.31	5.2	4.33	-0.87	3.79	-3.91	-7.70

Table 11. Changes in Coefficient of Variation of Area, Production and Yield of Sorghum by Province and by Sector, 1961/62 - 1971/72 to 1972/73 - 1982/83, Sudan

Province/crop situation	Coefficient of variation (percent)								
	Area			Production			Yield		
	1961/62 1971/72	1972/73 1982/83	Change (%)	1961/62 1971/72	1972/73 1982/83	Change (%)	1961/62 1971/72	1972/73 1982/83	Change (%)
1/ <u>Blue Nile</u>	23.18	25.55	10.22	32.63	31.07	-4.78	13.18	20.84	56.12
Irrigated	19.79	13.63	-30.87	28.36	30.45	7.37	34.45	25.84	-24.99
Mechanized	49.70	52.21	5.05	59.44	59.41	-0.05	22.43	20.20	-9.94
Traditional	29.20	20.10	-31.16	42.47	36.62	-13.77	17.92	27.53	53.63
2/ <u>Kassala</u>	35.51	25.28	-28.81	43.55	39.73	-8.77	20.56	17.36	-15.56
Irrigated (Flooded)	66.85	37.34	-44.14	68.33	43.52	-36.31	24.82	22.66	-8.70
Mechanized	61.02	25.42	-58.34	55.32	40.69	-26.45	21.66	18.73	-13.53
Traditional	100.89	-	-	107.74	-	-	83.09	-	-
3/ <u>Kordofan</u>	37.46	12.01	-67.94	36.06	25.01	-30.64	18.47	17.98	-2.65
Mechanized	155.57**	27.50	-82.32	149.57	33.03	-77.92	35.56	18.73	-47.33
Traditional	35.31	27.43	-22.32	34.81	43.63	25.34	19.17	29.64	54.62
4/ <u>Darfur</u>	52.10	32.41*	-37.79	54.82	36.46	-29.84	32.83	21.46	-34.63
5/ <u>Southern</u>	15.18	28.06	77.48	48.22*	27.95	-42.04	34.84	17.27	-50.43
6/ <u>Northern</u>	37.70*	61.62	63.45	39.62	67.66	70.77	30.65*	22.89	-25.32
7/ <u>Khartoum</u>	118.29*	53.27	-54.97	118.43	53.52	-54.81	54.08	52.38	-3.14

Note : * Calculated for 10 years period (1961/62 - 1970/71)

** Calculated for 4 years period (1968/69 - 1971/72)

et.

A negative growth rate in yield of this order in irrigated areas should, however, be of very serious concern. In mechanized areas of the Blue Nile region there was no appreciable change in the annual average yields between the two periods. In the mechanized areas of Kordofan, however, the growth rate increased by 6.30 percentage points from -3.24 in the first period to 3.06 in the second period. In the traditional sector the yield growth rate increased by 10.00 percentage points in Kordofan region but decreased by 2.85, 4.91 and 7.70 percentage points in the Blue Nile, Darfur and Southern regions, respectively.

3. Except for traditional sector in the Blue Nile and Kordofan sorghum yield were more stable during the second period than during the first period in all other sectors and regions.

V Yield Decline

The national average yields of sorghum in the Sudan have been declining for the past about two and a half decades. As shown in Table 4 the national average yields declined at an annual rate of -1.54 percent during the 22-year period from 1961/62 to 1982/83. As discussed in the previous section the average yields have declined almost in every sector in all provinces from the period 1961/62 - 1971/72 to 1972/73 - 1982/83 (Table 9). At the same time the areas planted to sorghum increased in every sector but the growth rates of area expansion slowed down from first to the second period. Also, the yields during

the second period generally became more stable than during the first period .

Yield decline from first to the second period was much smaller in the mechanized sector than in the traditional sector . Even for the total 22-year period annual rate of decline in yields in the mechanized sector was quite small (-0.79 percent) . During the second 11-year period there was actually a slightly positive (0.64 percent) rate of growth in yields in this sector .

During rapid area expansion phase of agricultural development the land frontier is expected to move to marginally less productive lands . Without simultaneous improvements in biochemical technology the average yields per unit of land area are expected to fall. This, however, need not mean that the existing seed technology is deteriorating or that the lands previously under production are becoming less productive . The data presented in this report indicate that the areas planted to sorghum in the Sudan during the 22-year period have expanded quite rapidly . This has been particularly so in the rainfed mechanized sector which in all likelihood pushed traditional farmers to more marginal areas . Consequently, the yield decline in the traditional areas has been more rapid . These arguments suggest that the rate of expansion of areas planted to sorghum in various parts of the country in various sectors should influence the rate of yield decline. Accordingly , to test this hypothesis the following regression was estimated .

$$(1) \quad Y = 1.9410 - 0.3082X_1 - 2.5821 X_2 + 0.5107 X_3$$

$$\quad \quad \quad (-2.276) \quad \quad \quad (-1.385) \quad \quad \quad (0.284)$$

$$R^2 = 0.24, \quad n = 17$$

The figures in the parentheses are the t-values .

Y = The annual rate of growth (decline) in sorghum yields in a particular sector in a given region .

X₁ = The annual rate of growth in area planted to sorghum in the corresponding sector and region .

X₂ = One for the irrigated sector 0 otherwise .

X₃ = One for the rainfed mechanized sector 0 otherwise .

The data matrix for this regression is presented in Table 12 .

Based on the regression (1) results presented above we make the following comments .

1. Holding constant the influence of irrigation and mechanization the rate of decline of sorghum yields has been strongly influenced by the rate of expansion of areas planted to sorghum .

2. Holding constant the influence of the rate of area expansion and mechanization the decline of sorghum yields has been more in the irrigated areas than in the rainfed areas. This result should be of very serious concern .

3. Holding constant the influence of area expansion and irrigation , mechanization as such did not influence the decline rate of sorghum yields .

Table 12. Growth Rates for Sorghum Yield and Area by region and by sector 1961/62 - 1971/72 and 1972/73 - 1982/83, Sudan.

Region	Sector	Y	X ¹	X ²	X ³
		1961/62 - 1971/72			
Kassala	Irrigated (Flooded)	3.16	-4.92	1	0
Kassala	Mechanized	-3.24	14.30	0	1
Blue Nile	Irrigated	-5.50	3.54	1	0
Blue Nile	Mechanized	-1.37	12.81	0	1
Blue Nile	Traditional	0.71	-0.48	0	0
Darfur	Rainfed	2.10	-6.43	0	
Southern	Rainfed	3.79	1.26	0	
Kordofan	Traditional	-4.07	7.55	0	
		1972/73 - 1982/83			
Kassala	Irrigated (Flooded)	-2.10	10.86	1	0
Kassala	Mechanized	3.06	6.16	0	1
Blue Nile	Irrigated	-4.96	0.84	1	0
Blue Nile	Mechanized	-1.44	7.87	0	1
Blue Nile	Traditional	-2.14	4.33	0	0
Darfur	Rainfed	-2.81	10.97	0	0
Southern	Rainfed	-3.91	8.57	0	0
Kordofan	Traditional	5.93	2.24	0	0
Kordofan	Mechanized	-1.36	-1.77	0	1

Y = Growth rate of yield .

X₁ = Growth rate of area .

X₂¹ = One for irrigated sector , 0 otherwise .

X₃² = One for mechanized sector , 0 otherwise .

VI Summary and Implications of the Results

1. The purposes of this paper are (1) to describe sorghum production trends and patterns of change in the Sudan at the national and regional levels by sector¹, over the 22-year period from 1961/62 to 1982/83, (2) to examine if the production of sorghum had become more unstable overtime, (3) to examine the sources of growth of sorghum production, (4) to examine the patterns and causes of yield decline, and (5) to compare irrigated, rainfed mechanized and rainfed traditional sectors. For comparative purposes the 22-year period was divided into two equal time periods of 11-year each; the first period from 1961/62 to 10/1/72 and the second period from 1972/73 to 1982/83.

2. The time series data used in the analysis are as reported by the Ministry of Agriculture and Natural Resources in various issues of the Bulletin of Agricultural Statistics, Year book of Agricultural Statistics, Current Agricultural Statistics, and the Bulletin No. 2 from the Mechanized Farming Corporation.

3. For the 22-year period sorghum production in the Sudan increased at an annual compound rate of growth of 3.5 percent. This is quite an impressive performance in sorghum production. During the corresponding period, the Green Revolution countries of Asia actually recorded lower growth

1. Sorghum production is divided into 3 main sectors; Irrigated, rainfed mechanized and rainfed traditional (non-mechanized).

rates . The yearly average production increased between the two periods by 650 thousand MT from 1324 thousand MT in the first period to 1974 thousand MT during the second period . The source of this growth has been rainfed mechanized sector which contributed 114 percent to the yearly average increase between the two periods and experienced an over-all annual rate of growth of approximately 12 percent . Irrigated and traditional sectors experienced slightly negative growth in sorghum production .

4. At the national level the variability of production increased in the irrigated and flooded sectors which produce approximately 11 percent of total output of sorghum . This caused a slight increase in the overall variability of sorghum production in the Sudan from 25.0 percent during the first period to 26.5 percent during the second period even though in the rainfed sector which produces about 89 percent of the sorghum output, production became much more stable. The coefficients of variation decreased from 61.8 percent to 40.6 in the rainfed mechanized sector and from 32.1 percent to 22.2 percent in the rainfed traditional sector . At the regional level also production in most cases became more stable during the second period . At the same time sorghum yields also became more stable in all sectors and regions except the traditional sector in the Blue Nile and Kordofan regions .

However, in spite of a general decline in instability of sorghum production in the Sudan , the magnitude of

instability is still quite high . Five times during the 11-year period 1972/73 to 1982/83 , annual sorghum production fell below the mean . The absolute level of production risk (in terms of the standard deviation) was 523 thousand MT and the relative risk as measured by the coefficient of variation was 26.5 percent . In the rainfed mechanized sector which produces about 61 percent of the total sorghum output the coefficients of variation were even higher ; 59.4 percent in the Blue Nile , 40.7 percent in Kassala and 33.0 percent in Kordofan . These instability magnitudes are rather high and seem to lend some tentative support to the intuitive arguments and concerns for a more serious consideration of the food security policy for the Sudan .

On a long term basis Sudan has been a surplus producer of sorghum . On the other hand the data discussed above indicate that annual output of sorghum could quite often be inadequate to meet domestic demand . For such lean years a system of storage and distribution consistent with local shortages is necessary . Except during the year 1984/85 which suffered an unusually high loss of crops because of a very severe drought, Sudan in the past has been successfully meeting its annual food deficits (annual production - annual consumption) through storage and distribution activities primarily undertaken by the private trade . However, this does not mean that in periods of acute shortages, there may not have been hardships to the population in various parts of the country . Large scale population movements, for which

Sudan is well known, are a response to such hardships . Yet the public authorities in the Sudan have refrained from indulging into any large scale food procurement, storage and distribution activities . This could be because of the prohibitive costs of such activities in view of the sparse distribution of population and the very large distances involved . It could also be because of the cultural traditions of food sharing during the periods of hardships . In any case, this response of the public authorities , is symptomatic of the belief that Sudan, at least until now, did not need a public food procurement and distribution system .

A public food procurement and distribution system whether directly undertaken by public authorities or on their behalf by the international food aid agencies , shall in part , be a replacement of similar activities currently being undertaken by the private trade, and consequently would entail considerable social costs . In view of the results discussed above that there has been some decline in the instability of sorghum production in the Sudan aside from the 1984/85 drought, the past attitude of the public authorities towards a food distribution system, and the possibility of increase in the social costs involved, it seems prudent that the desirability of a food security system should be very carefully studied .

5. During the 22-year period of our analysis area planted to sorghum and total sorghum continued to expand but sorghum yields per unit of land declined in all sectors

... irrigated, rainfed mechanized and rainfed traditional ... at the national as well as regional levels . The national average yield declined by 15.6 percent from 353 kilograms per feddan during the first 11-year period to 298 kilograms per feddan during the second 11-year period . The annual rate of decline for the entire period was -1.54 percent . Our analysis indicates that this yield decline was basically due to a rapid rate of expansion of area planted to sorghum which pushed cultivation in the rainfed mechanized sector but more so in the rainfed traditional sector, to the marginal lands, and that mechanization as such did not influence the decline rate of sorghum yields . In addition, the decline in national yield was also due to a decline in yields in the irrigated sector which holding constant the influence of expansion of areas . This is not what one would ordinarily expect and should indeed be a matter of serious concern .

The rate of yield decline in the rainfed mechanized sector, for the 22-year period, was the lowest compared to the other sectors. In fact during the second 11-year period, the growth rate of yields in this sector was positive and at the same time growth rate of area expansion had become much slower . That is, the yields in this sector, during the second period were actually increasing .

The implications of these results are that since the rate of expansion of area in the rainfed mechanized sector which has been the key source of growth in sorghum output

32

has been slowing down production increases in the future from expansion of area would be relatively more difficult and that such increases would have to be supplemented (1) by hastening the adoption of yield increasing biochemical technology , and (2) by a rapid diffusion of the pre-planting tillage technology currently being demonstrated by the Canadian International Development Agency at SIM SIM .

Appendix

Table 13. Sorghum, Area, Production and Yields, 1961/62-1983/84, Rainfed Sector, Sudan.
Area in 000 feddans - Production 000 MT - Yield in Kgs/feddan

Season	Rainfed (Mechanized)			Rainfed (Traditional)			Rainfed (Total)		
	Area	Prod	Av. Yld	Area	Prod	Av. Yld	Area	Prod	Av. Yld
61/62	974	394	405	2059	742	360	3033	1136	375
62/63	412	179	434	2665	922	346	3077	1101	358
63/64	410	144	352	2377	871	366	2787	1015	364
64/65	543	187	344	2148	703	327	2691	890	330
65/66	683	196	285	2101	679	323	2784	875	314
66/67	508	113	221	2225	514	231	2733	627	229
67/68	792	325	410	3417	1377	403	4209	1702	404
68/69	852	251	295	1509	490	325	2361	741	314
69/70	1592	419	263	2045	788	385	3639	1207	332
70/71	2041	670	328	2224	592	266	4265	1262	296
71/72	2018	681	337	2026	695	343	4044	1376	340
72/73	1751	442	253	1838	496	270	3589	938	261
73/74	2413	823	341	2488	576	232	4901	1299	386
74/75	2952	751	254	2223	759	341	5175	1510	291
75/76	3362	1032	307	2507	827	330	5869	1859	317
76/77	3368	1047	311	2802	523	187	6170	1569	254
77/78	3452	1203	348	3165	695	220	6617	1898	287
78/79	3397	1066	314	2927	881	301	6314	1947	308
79/80	2814	779	276	2359	516	219	5173	1293	250
80/81	3434	1214	354	3020	700	232	6454	1914	297
81/82	5532	2150	390	3120	851	273	8652	3001	347
82/83	5305	1185	223	2780	520	187	8085	1705	291
83/84	5502	1129	205	2839	357	127	8341	1486	178

Table 14. Sorghum Area, Production and Yield by Province 1961/62 - 1983/84, Sudan.
Area in 000 feddans - Production in 000 MT - Yield in Kgs/FD

Season	Northern			Khartoum			Blue Nile			Kassala			Kordofan			Darfur			Upper Nile			Bahr Eljazel			Equatoria			Total		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1961/62	100	73	730	34	6	176	1183	541	455	1349	537	398	418	158	378	110	35	318	221	50	226	45	16	356	50	18	360	3516	1434	408
1962/63	93	63	430	15	1	67	1316	462	351	712	289	406	481	171	356	518	129	365	197	42	213	135	59	437	50	14	290	3517	1267	360
1963/64	97	61	629	6	2	333	1256	626	498	777	237	305	529	184	348	290	139	496	175	43	246	133	48	361	24	9	375	3277	1349	412
1964/65	138	54	391	30	2	67	1081	434	401	772	291	377	86	158	325	348	110	316	140	31	221	146	53	363	15	4	250	3157	1137	360
1965/66	46	23	500	2	0.3	150	1199	509	425	865	271	313	502	153	305	340	71	209	145	27	186	96	40	417	5	1	200	3200	1099	342
1966/67	43	31	721	1	0.2	200	1034	371	359	1108	250	226	289	82	211	310	71	229	206	30	146	90	16	178	2	0.4	200	3183	852	268
1967/68	122	38	311	7	2	236	2041	929	425	1676	709	423	468	145	310	142	51	359	115	20	174	125	25	200	4	1	250	4700	1980	421
1968/69	46	19	413	1	0.1	100	1025	403	393	793	227	268	484	113	233	159	42	264	186	24	129	120	40	333	8	1	125	2822	869	308
1969/70	116	51	440	3	0.3	100	1373	490	357	1301	372	286	923	310	336	146	84	575	166	29	175	197	114	597	6	1	167	4231	1451	343
1970/71	109	38	349	4	1	250	1517	556	367	1780	471	265	936	234	250	172	88	512	166	29	175	211	121	602	9	1	111	4894	1539	314
1971/72	41	22	537	0	0	0	1503	602	401	1506	470	312	968	244	252	148	50	338	170	79	465	200	118	500	20	5	250	4556	1590	349
1972/73	30	16	533	0	0	0	1436	692	482	1136	234	206	1048	200	191	118	45	381	182	78	429	85	20	235	60	15	250	4095	1300	317
1973/74	26	7	269	20	1	50	1862	688	369	1456	472	324	1204	240	199	175	57	325	353	137	388	180	39	216	170	51	300	5446	1692	311
1974/75	87	38	437	24	3	125	1613	493	305	1718	592	344	978	263	268	306	76	248	436	123	294	196	31	158	219	57	260	5577	1681	301
1975/76	96	49	510	20	3	150	2188	809	370	2078	727	350	968	225	253	311	78	251	517	178	344	200	32	160	210	59	281	6503	2160	332
1976/77	44	17	386	10	2	200	2298	625	272	1933	527	272	1130	307	260	350	95	272	433	114	363	225	45	200	230	58	252	6703	1790	257
1977/78	26	11	423	17	2	118	2250	674	300	1908	576	302	1249	359	287	433	169	390	264	122	132	596	209	351	134	38	284	7137	2140	303
1978/79	50	19	380	18	4	222	2065	780	378	2138	558	251	1218	394	323	455	130	268	427	169	396	425	108	254	109	30	275	6905	2192	317
1979/80	40	19	475	10	2	200	1654	501	303	1707	477	279	901	156	173	341	67	196	400	128	320	448	92	205	110	20	182	5611	1462	261
1980/81	45	18	400	15	3	200	2083	626	301	2265	803	355	1078	269	250	405	89	220	1065	260	244	-	-	-	-	-	-	6956	2068	297
1981/82	23	12	522	10	3	300	3354	1309	390	3068	1221	398	1081	294	272	415	112	270	1280	221	251	-	-	-	-	-	-	9231	3272	354
1982/83	9	6	667	5	1	200	2763	624	226	2054	700	341	1232	292	237	452	125	277	1049	190	181	-	-	-	-	-	-	7564	1938	256
1983/84	17	10	588	0	0	0	2864	685	239	3078	621	202	1311	167	127	442	56	127	1170	210	179	-	-	-	-	-	-	8882	1749	197

35

Table 15. Sorghum area, production and yields in Blue Nile province
1961/62 - 1982/83 (irrigated, mechanized and traditional
sectors) Sudan .

Area in 000 feddans - Production in 000 MT - Yield in Kgs/FD

season	Irrigated			Mechanized			Traditional		
	Area	Prod.	Av. Yld.	Area	Prod.	Av. Yld.	Area	Prod.	Av. Yld.
61/62	356280	230420	645	100015	40638	406	732145	269751	368
62/63	339680	123060	362	98410	52160	530	877930	286570	326
63/64	254683	219027	860	94000	41960	446	907667	365283	402
64/65	273570	164940	603	110500	32270	292	696550	236970	340
65/66	253109	165020	652	116920	42335	362	828565	301209	364
66/67	283280	149280	527	126465	33317	263	624121	188299	302
67/68	381920	229152	600	179368	67313	375	1479871	692095	468
68/69	306542	66399	217	145300	39064	269	573543	297402	519
69/70	408458	168354	412	187001	63998	342	777042	258115	332
70/71	421000	169242	402	271885	128316	472	824115	258442	314
71/72	428064	173786	406	341939	135281	396	732762	292700	399
72/73	421254	320506	761	400131	133673	334	614590	237541	387
73/74	452413	260896	577	651022	242790	373	758218	184524	243
74/75	283562	129050	455	744250	206175	277	585070	158023	270
75/76	464779	230634	496	838381	272670	325	885841	305616	345
76/77	467132	198363	425	921800	293950	319	909483	132184	145
77/78	435136	228534	525	902000	237000	263	912679	208388	228
78/79	446000	184000	413	476000	207000	435	1143000	389000	340
79/80	353000	140000	386	419000	132000	315	872000	229000	263
80/81	383000	108000	282	680000	230000	338	1020000	288000	282
81/82	446000	221000	496	1828000	725000	397	1080000	363000	336
82/83	477000	198000	415	1476000	288000	195	810000	138000	170

Table 16. Sorghum area, production and yields in Kassala province 1961/62 - 1982/83 (irrigated, mechanized and traditional sectors) Sudan .

Area in 000 feddans - Production in 000 MT - Yield in Kgs/FD

season	Irrigated			Mechanized			Traditional		
	Area	Prod.	Av. Yld.	Area	Prod.	Av. Yld.	Area	Prod.	Av. Yld.
61/62	44790	13700	306	874345	353508	404	430155	170172	396
62/63	12270	5570	454	313060	126590	404	386940	156440	404
63/64	11260	3500	311	316000	102210	323	449600	131290	292
64/65	25675	9090	354	432865	154322	357	313395	127738	408
65/66	16315	3784	232	565695	152172	269	283365	115460	407
66/67	24780	10853	438	381660	79195	208	701265	159607	228
67/68	41581	20155	485	612295	257330	420	1022200	431511	422
68/69	17090	10140	593	776330	217268	280	0	0	0
69/70	56647	24505	433	1243988	347889	280	0	0	0
70/71	86261	34271	397	1693742	436624	258	0	0	0
71/72	37588	17855	475	1467970	451991	308	0	0	0
72/73	53290	25631	481	1082935	208021	192	0	0	0
73/74	65800	24000	365	1390500	447500	322	0	0	0
74/75	83000	30530	368	1635000	561000	343	0	0	0
75/76	78000	20956	269	2000000	706000	353	0	0	0
76/77	23000	4600	200	1910000	522000	273	0	0	0
77/78	60000	22000	367	1848000	554000	300	0	0	0
78/79	95000	42000	442	2043000	516000	253	0	0	0
79/80	35000	10000	286	1672000	467000	279	0	0	0
80/81	74000	28000	378	2191000	775000	354	0	0	0
81/82	110000	38000	345	2958000	1183000	400	0	0	0
82/83	93000	29000	312	1961000	671000	342	0	0	0

Table 17. Sorghum area, production and yield in Kordofan province
1961/62 - 1983/84. (Mechanized and traditional sector),
Sudan .

Area in 000 feddans - Production in 000 MT - Yield in Kgs/FD

Season	Mechanized			Traditional		
	Area	Prod.	Av. Yld	Area	Prod.	Av. Yld
61/62	-	-	-	418000	158000	378
62/63	-	-	-	481000	171000	356
63/64	-	-	-	529000	184000	348
64/65	-	-	-	486000	158000	325
65/66	-	-	-	502000	153000	305
66/67	-	-	-	389000	82000	211
67/68	-	-	-	468000	145000	310
68/69	200	144	720	483800	112865	233
96/70	685	623	909	922315	309377	335
70/71	15714	7498	477	920280	226502	246
71/72	76510	32461	424	891490	211539	237
72/73	316384	100321	317	731831	100029	137
73/74	453978	138605	305	750000	101790	136
74/75	551404	195320	354	427000	68050	159
75/76	558791	170944	306	328869	53960	164
76/77	549000	216000	393	631000	91000	144
77/78	599000	179000	299	650000	180000	277
78/79	618000	214000	346	600000	180000	300
79/80	515000	91000	177	386000	65000	168
80/81	278000	104000	374	800000	165000	206
81/82	256000	88000	344	825000	206000	250
82/83	514000	135000	263	718000	157000	219

Table 18. Sorghum area, production and yield in Darfur province
1961/62 - 1983/84. (Mechanized and traditional sector),
Sudan.

Area in 000 feddans - Production 000 in MT - Yield in Kgs/ED

Season	Mechanized			Traditional		
	Area	Prod.	Av. Yld	Area	Prod.	Av. Yld
61/62	-	-	-	110,000	35,000	318
62/63	-	-	-	518,000	189,000	365
63/64	-	-	-	280,000	139,000	469
64/65	-	-	-	348,000	110,000	316
65/66	-	-	-	340,000	71,000	209
66/67	-	-	-	310,000	71,000	229
67/68	-	-	-	142,000	51,000	359
68/69	-	-	-	159,000	42,000	264
69/70	-	-	-	146,000	84,000	575
70/71	-	-	-	172,000	88,000	512
71/72	-	-	-	148,000	50,000	338
72/73	-	-	-	118,000	45,000	381
73/74	1400	140	100	174,966	56,500	323
74/75	4470	800	179	302,000	75,000	248
75/76	5700	695	122	304,500	77,316	254
76/77	7000	800	114	343,356	94,500	275
77/78	6000	2000	333	427,208	167,000	390
78/79	3000	200	66	452,000	130,000	288
79/80	-	-	-	341,000	66,886	196
80/81	-	-	-	405,000	89,000	220
81/82	-	-	-	415,000	112,000	270
82/83	-	-	-	452,000	125,000	277