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PLANNING AND AGRICULTURAL ECONOMICS ADMINISTRATION (PAEA),
DEPARTMENT OF AGRICULTURAL ECONOMICS AND STATISTICS (DAES)

January 1986

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

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PS - RR - 2 - 1986

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Trends and Changes in Groundnuts Production in the Sudan, 1961/62 - 1982/83

I. Introduction

Groundnuts is an important oilseed crop in the Sudan. On an average for the 11-year period 1972/73-1982/83, it occupied about 15 percent of the area devoted to 5 major food crops¹ and contributed 19.5 percent to their output (Table 1). During the period 1961/62-1971/72 these percentages were approximately 12 percent and 13 percent, respectively. More recently during the 5-year period 1979/80-1983/84, they were 14 percent and 18.6 percent (Table 2). Thus, the relative position of groundnuts in the total food production in the Sudan increased from 13 percent during the first 11-year period to 19.5 percent during the second period and has been holding at 18.6 percent for the more recent period. At the same time average yearly area planted to groundnuts increased by 138.6 percent from 883500 FD during the first 11-year period to 2108000 FD during the second 11-year period and average yearly production of groundnuts increased by approximately 265 percent from 285000MT to 754600 MT. Accordingly the national average yield of groundnuts per feddan increased by about 11 percent from 322 Kgs to 358 Kgs (Table 3).

During the 22-year period 1961/62 to 1982/83 production of groundnuts in the Sudan has shown remarkable growth.

1. Sorghum, wheat, millet, sesame and groundnuts.

Table 1 . Shares of Individual Food Crops in Total Area and Production
 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 . 5-Year Average Production and Area of Food Crops, 1979/80 to 1983/84, Sudan

	Production (000 MT)	Area (000 FD)
Sorghum	2118 (59.4) (78.7)	7863 (52.1) (71.8)
Millet	392 (11.0) (14.6)	2730 (18.1) (24.9)
Wheat	180 (5.1) (6.7)	360 (2.4) (3.3)
Total-cereals	2690 (75.5) (100)	10953 (72.5) (100)
Sesame	211 (5.9) (24.1)	2040 (13.5) (49.1)
Groundnuts	663 (18.6) (75.9)	2111 (14.0) (50.9)
Total-oilseeds	874 (24.5) (100)	4151 (27.5) (100)
Total-foodcrops	3564 (100) -	15104 (100) -

Note : Figures in the parentheses are percentages .

Table 3 . Average Production, Area and Yield of Groundnuts, 1961/62 to 1971/72 and 1972/73 to 1982/83, Sudan

	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
<u>Average Production (000 MT)</u>			
All Sudan	285.0	754.6	264.7
Irrigated	74.5	303.2	307.0
Rainfed	210.5	450.2	113.9
<u>Average Area (000 FD)</u>			
All Sudan	883.5	2108.0	138.6
Irrigated	118.9	342.6	188.1
Rainfed	764.5	1761.1	130.4
<u>Average Yield (Kgs/FD)</u>			
All Sudan	322.7	358.0	10.9
Irrigated	627.0	885.0	41.2
Rainfed	275.3	256.0	-7.0

The compound annual rates of growth of production, area and yield computed from log-trend regression were 7.9 percent, 7.3 percent and 0.4 percent respectively² (Table 4). This is quite an impressive performance record especially because output growth has been accompanied by yield increase inspite of a very rapid rate of expansion of area planted to groundnuts.

Groundnuts in the Sudan is produced as irrigated and rainfed (non-mechanized) crops. As shown in Table 5, average yearly production of groundnuts in the Sudan for the period 1979/80 to 1983/84 was 663000 MT of which 36.3 percent was irrigated and 63.7 percent rainfed. It is an important export crop. On an average for the 4 years 1980-1983 Sudan exported 17744 MT of groundnuts in shell, 46599 MT of groundnuts shelled and 16957 MT of groundnuts oil and earned LS 37.5 million per year.

The rapid increase in the production of groundnuts has been accompanied by large instability of production. The yearly production for the 22-year period varied from a low of 148000 MT to a high of 103000 MT with a coefficient of variation of 52.2 percent and a mean of 520000 MT (Table 6).

Groundnuts being an important foreign exchange earning crop, the high instability of its production is of a natural concern. This paper, therefore, aims at documenting the trends and changes in sorghum production, area and yields at the national and regional levels for the irrigated and rainfed crops of groundnuts by using the time series

2. Groundnuts is the only major crop in the Sudan which experinced a positive growth rate in yields during this period.

4

Table 4 . Compound Annual Growth Rates of Production, Area and Yield of Groundnuts, 1961/62 to 1982/83, sudan

Growth Rates

	Production	Area	Yield
All Sudan	7.9	7.3	0.4
Irrigated	11.8	9.9	1.8
Rainfed	6.3	7.2	-0.9

Note : Growth rates are calculated from log-trend regression .

Table 5 . Average Yearly Production of Groundnuts, 1979/80 to 1983/84, Sudan

Situation	(000 MT)	Percent
Irrigated	241	36.3
Rainfed	422	63.7
Total	663	100

Table 6 . Average Production, Area and Yield of Groundnuts, 1961/62 to 1982/83, Sudan

	Average	Minimum	Maximum	Coefficient of variation (%)
		<u>Production (000 MT)</u>		
All Sudan	520	148(1962/63)	1030(1977/78)	52.2
Irrigated	189	31(1962/63)	455(1977/78)	73.4
Rainfed	330	115(1961/62)	605(1976/77)	45.7
		<u>Area (000 FD)</u>		
All Sudan	1495	472(1961/62)	2668(1977/78)	46.2
Irrigated	230	65(1961/62)	530(1975/76)	59.9
Rainfed	1263	407(1961/62)	2300(1976/77)	45.3
		<u>Yield (Kgs/FD)</u>		
All Sudan	347	219(1965/66)	518(1974/75)	18.1
Irrigated	822	508(1961/62)	1155(1976/77)	24.6
Rainfed	261	191(1982/83)	336(1974/75)	18.2

Note: Figures in parentheses indicate the year .

data from 1961/62 to 1982/83 . In describing the trends and patterns of change in the production of groundnuts we hope to increase our understanding of the nature and magnitude of instability of production, sources of growth in production and yields and compare irrigated and rainfed 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 1983/83 . Such a division allows comparisons of various trends and variability in production between the two periods and to comment upon changes in their magnitudes between the two periods, across regions and irrigated and rainfed sectors .

II Data Sources

The Department of Agricultural Economics and Statistics (DAES), Ministry of Agriculture and Natural Resources (MANR) Sudan, regularly reports area, yield and output data for groundnuts (and other crops) by provinces . Most of the sorghum crop (63.7 %) is grown under rainfed conditions .The data for irrigated and rainfed sectors are reported separately .

Most MANR area and yield statistics for groundnuts crop have been subjective estimates . As yet there are no crop-cutting surveys for this crop . Most statistics for the irrigated crop, however, are actual data .

In the ensuing analysis, area, output and yield data for irrigated and rainfed 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 and Current Agricultural Statistics .

III Changes at the National Level

A. Changes in Production

1. For the country as a whole average yearly production of groundnuts increased by 469600 MT from 285000 MT in the first period to 754600 MT in the second period . That is, average production between the two 11-year periods increased by 264.7 percent (Table 3) . Approximately 49 percent of this increase occurred in the irrigated sector and 51 percent in the rainfed sector . As a result the irrigated sector on an average, produced 40.2 of the total output of groundnuts during the second period as compared to 26.1 percent during the first period . As shown in Table 5, however, this share of the irrigated sector during the more recent period of 1979/80 to 1983/84 was 36.3 percent .

2. As shown in Table 4, the average annual growth rate of production of groundnuts for the entire 22-year period was considerably higher for the irrigated sector (11.8 percent) than in the rainfed sector (6.3 percent) . However, from first to the second period the growth rate in the irrigated sector declined from 14.3 percent to -4.6 percent, whereas it increased marginally from 3.4 percent to 3.6 percent in the rainfed sector (Table 7) . From first to the second period growth rate of production for all Sudan slowed

Table 7 . Changes in Compound Growth Rates of Production, Area and Yield of Groundnuts, 1961/62 to 1971/72 and 1972/73 to 1982/83, Sudan

	1961/62 to 1971/72	1972/73 to 1982/83	Change
<u>Production</u>			
All Sudan	5.7	0.4	-5.2
Irrigated	14.3	-4.6	-18.9
Rainfed	3.4	3.6	0.2
<u>Area</u>			
All Sudan	6.9	2.5	-4.4
Irrigated	15.2	-1.9	-17.1
Rainfed	5.6	3.2	-2.7
<u>Yield</u>			
All Sudan	-1.2*	-2.0	-0.8
Irrigated	-0.8*	-2.7	-1.9
Rainfed	-2.4	0.4*	2.8

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

down considerably but still remained positive . It declined by 5.3 percentage points from 5.7 percent to 0.4 percent .

3. For the whole 22-year period taken together production of groundnuts was more stable in the rainfed sector than in the irrigated sector . As shown in Table 6, the coefficient of variation was 45.7 percent in the rainfed sector and 73.4 percent in the irrigated sector . Stability of groundnuts production improved considerably from first to second period at the national level, as well as within the irrigated and rainfed sectors . The coefficient declined by 36.4 percent from 52.2 percent in the first period to 32.2 percent in the second period in the irrigated sector, and by 2.7 percent from 26.3 percent to 25.6 percent in the rainfed sector . For all Sudan it declined by 20.4 percent from 27.5 percent to 21.9 percent (Table 8) .

B. Changes in Area

1 . Average yearly area planted to groundnuts in the Sudan increased by 138.6 percent from 883500 FD in the first period to 2108000 FD in the second period . On an average, the irrigated area increased by 223700 FD and rainfed area increased by 996600 FD . That is approximately 82 percent of the increase in average yearly area planted to groundnuts in the Sudan occurred in the rainfed sector and the remaining 18 percent in the irrigated sector . However, the percentage increase from first to the second period in the irrigated sector was 188.1 compared to 130.4 in the rainfed sector .

Table 8 . Changes in Coefficient of Variation of Production, Area and Yield of Groundnuts, 1961/62-1971/72 to 1972/73-1982/83, Sudan

Coefficient of Variation

	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
	<u>Production</u>		
All Sudan	27.5	21.9	-20.4
Irrigated	52.2	33.2	-36.4
Rainfed	26.3	25.6	-2.7
	<u>Area</u>		
All Sudan	29.5	15.8	-46.4
Irrigated	51.3	27.5	-46.4
Rainfed	29.6	17.0	-42.6
	<u>Yield</u>		
All Sudan	17.6	17.5	-0.6
Irrigated	16.	19.0	18.8
Rainfed	17.5	18.4	5.1

2 This rapid increase in the average area planted to groundnuts at the national level, however, was accompanied by a slowing down of the growth rate of area from first to the second period. During the first period total area planted to groundnuts in the Sudan increased at an annual rate of 6.9 percent. The rate declined to 2.5 percent during the second period. In the irrigated sector area during the first period increased at a very rapid rate of 15.2 percent. But during the second period the rate actually became negative (-1.9 percent). In the rainfed sector the rate declined from 5.6 percent to 3.2 percent. Thus, the areas planted to groundnuts in the Sudan continued to expand throughout the second period. But during this period all of this increase occurred in the rainfed sector, whereas the irrigated sector experienced a negative growth rate in area planted to groundnuts.

3. Alongwith the generally declining growth rates of areas planted to groundnuts, annual areas planted became considerably more stable. The coefficient of variation of areas annually planted to groundnuts in the Sudan declined from 29.5 percent in the first period to 15.8 percent during the second period. It declined from 51.3 percent to 27.5 percent in the irrigated sector and from 29.6 percent to 17 percent in the rainfed sector. In other words the yearly areas planted to groundnuts within the irrigated and rainfed sectors and the country as a whole became considerably more stable from first to the second period.

C.Changes in Yields

1 . As shown in Table 6, the national average yield of groundnuts for the 22-year period 1961/62 to 1982/83 was 347 Kgs/FD . It varied from a low of 219 Kgs/FD during 1965/66 to a high of 518 Kgs/FD during 1974/75 . The average yield for the irrigated sector was 822 Kgs/FD, with a low of 508 Kgs/FD and a high of 1155 Kgs/FD . In the rainfed sector the average yield was 261 Kgs/FD with the lowest and highest yields being 191 Kgs/FD and 336 Kgs/FD respectively .

Between the two periods the national average yield of groundnuts increased by about 11 percent, from 322.7 Kgs/FD during the first period to 358 Kgs/FD during the second period . However, the yield increase occurred only in the irrigated sector where the average yield increased by 41.2 percent from 627 Kgs/FD in the first period to 885 Kgs/FD during the second period . In the rainfed sector yield actually declined by 7 percent from 275 Kgs/FD to 256 Kgs/FD .

2 . The growth rate of groundnuts yield for all Sudan declined from -1.2 percent¹ in the first period to -2.0 percent in the second period . Similarly in the irrigated sector the growth rate declined from -0.8 percent¹ to -2.7 percent . However, in the rainfed sector it improved from -2.4 percent to 0.4 percent¹ .

3 . For the country as a whole, there was no change from first to the second period, in the stability of the

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

groundnuts yield, as measured by the coefficient of variation. However, the coefficient of variation increased from 16 percent to 19 percent in the irrigated sector and from 17.5 percent to 18.4 percent in the rainfed sector .

IV Changes at the Regional Level

A. Changes in Production

1 . Except the Northern region production of groundnuts increased in all other five regions of Kassala, Blue Nile, Kordofan, Darfur and Southern (Table 9) . During the first period the Northern region on an average produced 1.15 percent (4300 MT) of the 11-year average national output of groundnuts . But during the second period small amounts were produced only during the years 1974/75, 1975/76 and 1975/77 . This region produced only irrigated crop.

Kassala region also produces groundnuts only in the irrigated sector . Average yearly production in this region increased from 5700 MT during the first period to 37000 MT during the second period, that is, by 549 percent . Consequently Kassala's share in the national annual average production increased from 2 percent in the first period to about 5 percent during the second period .

The Blue Nile region produces groundnuts in both the irrigated as well as the rainfed sectors, but most of the irrigated crop in Sudan is produced in this region . During the first 11-year period it produced on an average over 75 percent of its yearly output of 86900 MT in the irrigated sector which contributed approximately 23 percent to the

Table 9 . Average Production of Groundnuts in Important Producing Areas, 1961/62 to 1971/72 and 1972/73 to 1982/83, Sudan

Region/ Sector	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
	<u>Average Production (000 MT)</u>		
Northern Irrigated	4.3(1.51)	a	
Kassala Irrigated	5.7(b)(2.0)	37.0(4.96)	549.1
Blue Nile Irrigated	65.5(22.98)	239.0(31.67)	264.9
Rainfed	21.4(c)(7.51)	56.4(7.47)	163.5
Total	86.9(30.49)	297.0(39.36)	242.0
Kordofan Rainfed	71.0(24.91)	185.7(24.61)	161.6
Darfur Rainfed	89.7(31.47)	183.0(24.25)	104.0
Southern Rainfed	26.5(9.30)	51.8(6.86)	95.5
All Sudan	285.0(100)	754.6(100)	266.7

Note : a. Production continued only during the seasons 1974/75, 1975/76 and 1976/77 .
 b. There was no production for the first four years .
 c. There was no production during the first two years .

average yearly output of Sudan . During the second period it produced on an average over 80 percent of the yearly output of 297000 MT in the irrigated sector and contributed approximately 32 percent to the average yearly output of Sudan . Average yearly production in the irrigated sector increased by 265 percent from 65000 MT in the first period to 239000 MT in the second period . Rainfed production of groundnuts in this region also expanded substantially . The average yearly production increased by 163.5 percent from 21400 MT in the first period to 56400 MT during the second period . The share of the Blue Nile region taking irrigated and rainfed production together in the average yearly production of groundnuts in the Sudan increased from 30.4 percent in the first period to 39.4 percent during the second period .

Average yearly production in Kordofan and Darfur, the other two major groundnuts producing regions, also increased substantially . In the Kordofan it increased by 161.6 percent from 71000 MT to 185700 MT and in Darfur it increased by 104 percent from 89700 MT to 138000 MT . During the first period Kordofan and Darfur contributed 25 percent and 31.5 percent, respectively to the average yearly production of all Sudan, but during the second period the share of Kordofan was slightly larger . From first to the second period production of groundnuts increased in the Southern region as well . It increased from 26500 MT to

51800 MT. but the contribution of this region to the average yearly production of Sudan declined from 9.3 percent to 6.9 percent .

2 . From first to the second period annual growth rates of production of groundnuts declined in all regions and both sectors, except the rainfed sector of Kordofan region where the growth rate increased by 3.6 percentage points from -0.9 percent to 2.7 percent (Table 10) .

3 . From first to the second period stability of production as measured by the coefficient of variation improved in all regions and both sectors, except the rainfed sector of Blue Nile and Kordofan regions where the coefficient increased by 24 percent and 82.4 percent respectively (Table 11) .

B. Changes in Areas

1 . As shown in Table 12, the average yearly areas planted to groundnuts increased from first to the second period in all regions and both (irrigated and rainfed) sectors, except that during the second period production of the irrigated crop in the Northern region was carried out only during 1974/75, 1975/76 and 1976/77 and thereafter disappeared altogether . During the first period average yearly area planted as irrigated crop of groundnuts in this region was 6800 FD which was less than one percent of the national average .

In percentage terms the largest increase of 442.2 percent from first to the second period occurred in the

Table 10 . Changes in Compound Annual Growth Rates of Production of Groundnuts for Important Producing Areas, 1961/62-1971/72 to 1972/73-1982/83, Sudan

	1961/62 to 1971/72	1972/73 to 1982/83	Change
	<u>Growth Rates</u>		
Northern Irrigated	-12.5	a	
Kassala Irrigated	31.9 (b)	-1.4	-33.3
Blue Nile Irrigated	16.7	-4.9	-21.6
Rainfed	1.0 (c)	-4.7	-5.7
Total	18.0	-4.3	-22.3
Kordofan Rainfed	-0.9	2.7	3.6
Darfur Rainfed	5.4	4.7	-0.7
Southern Rainfed	5.7	3.0	-0.7
All Sudan	5.7	0.4	-5.3

Note : a. Production continued only during the seasons 1974/75, 1975/76 and 1976/77 .
 b. Average for seven years .
 c. Average for nine years .

Table 11 Changes in Coefficient of Variation of Production of Groundnuts 1961/62-1971/72 to 1972/73-1982/83, by Region and by Sector, Sudan

Region/Sector	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
<u>Coefficient of Variation (%)</u>			
Kassala Irrigated	70.0	47.8	-31.7
Blue Nile Irrigated	55.0	31.0	-43.6
Rainfed	47.5	58.9	24.0
Total	52.9	30.4	-42.5
Kordofan Rainfed	22.1	40.3	82.4
Darfur Rainfed	34.9	26.6	-23.8
Southern Rainfed	60.5	16.0	-73.6
All Sudan	27.5	21.9	-20.4

Table 12 . Average Area of Groundnuts in Important Producing Areas, 1961/62 to 1971/72 and 1972/73 to 1982/83, Sudan

	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
<u>Average Area (000 FD)</u>			
Northern Irrigated	6.8(0.77)	a	
Kassala Irrigated	8.3(b)(1.47)	45.0(2.13)	442.2
Blue Nile Irrigated	103.5(11.66)	259.5(12.31)	150.7
Rainfed	74.5(c)(8.43)	120.0(5.69)	61.1
Total	178.0(20.09)	379.6(18.01)	113.3
Kordofan Rainfed	318.2(36.02)	809.6(38.41)	154.4
Darfur Rainfed	297.3(33.65)	673.6(31.95)	126.6
Southern Rainfed	66.4(7.52)	197.7(9.38)	197.7
All Sudan	883.5(100)	2108.0(100)	138.6

Note : a. Production continued only during the seasons 1974/75, 1975/76 and 1976/77 .
 b. There was no production for the first four years .
 c. There was no production for the first two years .

irrigated crop in the Kassala region where the areas planted increased from 8300 FD to 45000 FD . In absolute terms, however, the largest increase of 491400 FD occurred in the rainfed crop in the Kordofan region where the area planted increased from 318200 FD to 809600 FD . It was followed by rainfed crop in the Darfur region where the areas planted increased by 376300 FD from 297300 FD to 673600 FD . During the second period Kordofan and Darfur together had a share of over 70 percent in the average yearly area planted to groundnuts in the Sudan . From first to the second period the share of Kordofan increased from 36.02 percent to 38.41 percent and that of Darfur declined from 33.65 percent to 31.95 percent

Inspite of a substantial increase in the area planted to groundnuts especially in the irrigated sector, the share of Blue Nile region in the average yearly area planted in the Sudan, declined from 20.09 percent in the first period to 18.01 percent in the second period . However, the share of irrigated crop increased from 11.66 percent to 12.31 percent . Areas in the Southern region increased from 66400 FD to 197700 FD and its' share from 7.52 percent to 9.38 percent .

2 . From first to the second period growth rates of area planted to groundnuts increased only in the rainfed areas of Darfur and Southern region . Elsewhere they declined and were negative during the second period (Table 13)

3 . Annual areas planted to groundnuts became

Table 13 . Changes in Compound Annual Growth Rates of Area of Groundnuts for Important Producing Areas, 1961/62-1971/72 to 1972/73-1982/83, Sudan

	1961/62 to 1971/72	1972/73 to 1982/83	Change
	<u>Growth Rates</u>		
Northern Irrigated	-3.9	a	
Kassala Irrigated	24.5 (b)	-3.9	-28.4
Blue Nile Irrigated	15.6	-0.8	-16.4
Rainfed	6.6 (c)	-4.6	-11.2
Total	19.2	-1.7	-20.9
Kordofan Rainfed	8.1	-2.0	-10.1
Darfur Rainfed	4.5	10.7	6.2
Southern Rainfed	-4.1	9.2	13.8
All Sudan	6.9	2.5	-4.4

Note : a. Production continued only during the seasons 1974/75, 1975/76 and 1976/77 .
 b. Average for seven years .
 c. Average for nine years .

considerably more stable in all regions, (except Darfur) and in both sectors . In Darfur the coefficient of variation increased by 24 percent from 28.7 percent to 35.5 percent (Table 14) .

C. Changes in Yields

1 . Except the rainfed crop in Darfur and Southern regions, groundnuts yields increased in all other regions (Table 15) . Even in the Kordofan region the average yield of rainfed crop increased by 2.7 percent from 223 Kgs/FD during the first 11-year period to 229 Kgs/FD during the second 11-year period . In Kassala region the yield of irrigated crop increased by 78.7 percent from 438 Kgs/FD to 822 Kgs/FD. In the Blue Nile the combined yield of irrigated and rainfed crops increased by 60.5 percent from 488 Kgs/FD to 783 Kgs/FD, the yield of irrigated crop increased by 45.5 percent from 633 Kgs/FD to 921 Kgs/FD, and that of the rainfed crop increased by 63.8 percent from 287 Kgs/FD to 470 Kgs/FD . These are obviously very substantial yield increases .

2 . Growth rates of yields of groundnuts generally declined from first to the second period except in the Kordofan region where the growth rate increased by 13.1 percentage points from -8.5 percent to 4.6 percent and the rainfed crop of the Blue Nile region where it increased from -5.3 percent to -0.1 percent (Table 16) .

3 . As mentioned earlier there was no appreciable change in the stability of yields of groundnuts at the

Table 14 . Changes in Coefficient of Variation of Area of Groundnuts 1961/62-1971/72 to 1972/73-1982/83, by Region and by Sector, Sudan

Region/Sector	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
	<u>Coefficient of Variation (%)</u>		
Kassala Irrigated	90.0	27.3	-70.0
Blue Nile Irrigated	50.1	28.7	-42.7
Rainfed	37.1	30.9	-16.7
Total	52.5	24.7	-53.0
Kordofan Rainfed	62.0	18.0	-71.0
Darfur Rainfed	28.7	35.5	24.0
Southern Rainfed	43.1	28.4	-34.1
All Sudan	29.5	15.8	-46.4

Table 15 . Average Yield of Groundnuts for Important Producing Areas, 1961/62 - 1971/72 and 1972/73 - 1982/83, Sudan

	1961/62- 1971/72	1972/73- 1982/83	change (%)
	<u>Yield in (Kg/Fed)</u>		
Northern			
Irrigated	632		
Kassala			
Irrigated	438	822	78.7
Blue Nile			
Irrigated	633	921	45.5
Rainfed	287	470	63.8
Total	488	783	60.5
Kordofan			
Rainfed	223	229	2.7
Darfur			
Rainfed	302	272	-9.9
Southern			
Rainfed	399	262	-34.3
All Sudan	322.7	358.0	10.9

Table 16 Changes in Compound Annual Growth Rates (decline) in Yield of Groundnuts for Important Producing Areas, 1961/62-1971/72 to 1972/73-1982/83, Sudan

	1961/62 to 1971/72	1972/73 to 1982/83	Change
<u>Growth Rates</u>			
Northern Irrigated	-9.0	a	
Kassala Irrigated	6.0 (b)	2.6	-3.4
Blue Nile Irrigated	0.9	-4.1	-5.0
Rainfed	-5.3 (c)	-0.1	5.2
Total	-1.0	-2.6	-2.3
Kordofan Rainfed	-8.5	4.6	13.1
Darfur Rainfed	0.9	-5.5	-6.4
Southern Rainfed	10.2	-5.7	-6.4
All Sudan	-1.2	-2.0	-0.8

Note : a. Production continued only during the seasons 1974/75, 1975/76 and 1976/77 .
 b. Average for seven years ; no production in the first four years .
 c. Average for nine years since there was no production for the first two years

national level, as measured by the coefficient of variation, from the first to the second period. However, for major producing areas of Kordofan and Darfur, and within the irrigated and rainfed sectors of Blue Nile, the coefficient of variation increased from first to the second period (Table 17)

Y Groundnuts Yields and Stability of Production

As mentioned in the previous sections production of groundnuts continued to spread in the Sudan throughout the 22-year period of this study. The crop area increased at an annual compound rate of 7.3 percent. In the irrigated sector it increased even at a faster rate of 9.9 percent. During periods of such rapid growth of crop areas, production continues to move to marginally inferior lands and ordinarily one expects crop yield per unit of land area to decline. This is, for example, the case of sorghum. In the case of groundnuts, however, even though small (0.4 percent) but a positive growth rate, is recorded for the national average yield per unit of area during the period of 22-years. The yield increases occurred all over the country where groundnuts are grown but they were especially large in the irrigated areas. Only in Darfur and the Southern regions there was a slight yield decline. In this section the results of two regressions which are estimated (1) to study the impact of growth in crop areas, of irrigation and of change in time periods on growth in yields, and (2) to study if the yearly variations of crop areas and yields, irrigation and change of time periods influenced the stability of production of groundnuts, are presented.

Table 17. Changes in Coefficient of Variation of Yield of Groundnuts 1961/62-1971/72 to 1972/73-1982/83, by Region and by Sector, Sudan

Region/Sector	1961/62 to 1971/72	1972/73 to 1982/83	Change (%)
<u>Coefficient of Variation (%)</u>			
Kassala Irrigated	30.8	27.0	-12.3
Blue Nile Irrigated	19.0	25.2	32.6
Rainfed	28.2	31.7	12.4
Total	18.0	17.8	-1.1
Kordofan Rainfed	29.7	40.8	37.4
Darfur Rainfed	20.0	20.6	3.0
Southern Rainfed	48.5	31.9	-34.2
All Sudan	17.6	17.5	-0.6

$$(1) \quad GY = 1.849 - 0.268 GA + 3.944 DI - 1.4147 DT$$

(1.156)	(1.043)	(1.085)
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$$R^2 = 0.216, \quad n = 12$$

The figures in the parentheses are the absolute t-values.

GY = The annual rate of growth in groundnuts yield in a particular sector (irrigated or rainfed) in a given region for the 11-year period .

GA = The annual rate of growth in area planted to groundnuts in a particular sector in the given region for the 11-year period .

DI = One for the irrigated sector zero otherwise .

DT = Zero for the period 1961/62-1971/72 and one for the period 1972/73-1982/83 .

The data for regression (1) are presented in Table 18 .

$$(2) \quad CVP = 26.143 - 0.029CVA + 0.630CVY + 15.630 DI - 10.893 DT$$

(0.075)	(1.021)	(1.267)	(0.825)
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$$R^2 = 0.368, \quad n = 12$$

The figures in the parentheses are the absolute t-values.

CVP = The coefficient of variation of yearly production of groundnuts for the 11-year period in a particular sector (irrigated or rainfed) in a given region .

CVA = The coefficient of variation of yearly areas planted to groundnuts for the 11-year period in a particular sector in the given region .

CVY = The coefficient of variation of average yields of groundnuts for the 11-year period in a particular sector in the given region .

Table 18 . Growth Rates for Groundnuts Yield and Area, 1961/62-1971/72 and 1972/71-1982/83, Sudan

	GY	GA	DI	DT
<u>First period = 1961/62 - 1971/72</u>				
Kassaka (I)	6.00	24.50	1.00	0.00
Blue Nile (I)	0.90	15.60	1.00	0.00
(RF)	-5.30	6.60	0.00	0.00
Kordofan (RF)	-8.50	8.10	0.00	0.00
Darfur (RF)	0.90	4.50	0.00	0.00
Southern (RF)	10.20	4.10	0.00	0.00
<u>Second period = 1972/73 - 1982/83</u>				
Kassala (I)	2.60	-3.90	1.00	1.00
Blue Nile (I)	-4.10	-0.80	1.00	1.00
(RF)	-0.10	-4.60	0.00	1.00
Kordofan (RF)	4.60	-2.00	0.00	1.00
Darfur (RF)	-5.50	10.70	0.00	1.00
Southern (RF)	-5.70	9.20	0.00	1.00

Notes : I = Irrigated; RF = Rainfed;
 GY = Growth rate of of yield ; GA = Growth rate of area
 DI = Dummy variable, one for irrigated areas;
 DT = Dummy variable, one for the period 1972/73-1982/83.

Table 19 . Coefficient of Variation of Production, Area and Yields of Groundnuts, 1961/62-1971/72 and 1972/71-1982/83, Sudan

	CVP	CVA	CVY	DI	DT
<u>First period = 1961/62 - 1971/72</u>					
Kassaka (I)	70.00	90.90	30.80	1.00	.00
Blue Nile (I)	55.00	50.10	19.00	1.00	.00
(RF)	47.50	37.10	28.20	.00	.00
Kordofan (RF)	22.10	62.00	29.70	.00	.00
Darfur (RF)	34.90	28.70	20.00	.00	.00
Southern (RF)	60.50	43.10	48.50	.00	.00
<u>Second period = 1972/73 - 1982/83</u>					
Kassala (I)	47.80	27.30	27.00	1.00	1.00
Blue Nile (I)	31.00	28.70	25.20	1.00	1.00
(RF)	53.90	30.90	31.70	.00	1.00
Kordofan (RF)	40.30	18.00	17.80	.00	1.00
Darfur (RF)	26.60	35.50	40.80	.00	1.00
Southern (RF)	16.00	28.40	20.60	.00	1.00

Notes : I, RF, DI and DT as in Table 18 above and CVP, CVA and CVY are coefficient of variation of production, area and yield, respectively .

DI and DT = As defined above under equation (1).

The data for regression (2) are presented in Table 19 .

The results of the regressions (1) and (2) presented above are summarized as follows :

1. The increase in yields of groundnuts, holding constant the influence of irrigation and expansion of areas planted to groundnuts, occurred at a faster rate during the first 11-year period (1960s) than during the second 11-year period (1970s) .

2. Holding constant the influence due to change of time period and expansion of areas planted to groundnuts, the rate of increase of yields was faster in the irrigated areas than in the rainfed areas . This may be the result of improvements in seed technology or management and cultivation practices (or both) which may have been adopted at a faster rate in the irrigated areas than in the rainfed areas .

3. The rate of expansion of areas planted to groundnuts, holding constant the influence of change in time period and irrigation, negatively influenced the rate of yield increase .

4. Holding constant the influence of expansion of areas, irrigation and change in time period, there was a positive growth in the yields (in the rainfed areas) .

5. The results stated above are not very strong, but, at least qualitatively are quite reasonable and non-trivial.

6. The variability of production of groundnuts, holding constant the influence due to variability in yields, the influence of irrigation and change in time periods, is unrelated to (is not affected by) the expansion of areas planted to groundnuts. In other words, expansion of areas planted to groundnuts as such did not influence the stability in production of groundnuts.

7. However, the variability of yields, holding constant the variability of areas planted, irrigation and change of time periods, increases the variability of production.

8. Similarly, the variability of production is more in the irrigated production than in the rainfed production holding constant the variability in areas planted and yields and the influence of change of time periods.

9. The variability of production was less (i. e., production was more stable) during the second period, than during the first period, holding constant the impact of other variables included in the regression.

VI Summary of the Results

1. The purposes of this paper are (1) to describe trends and patterns of change in the production of groundnuts in the Sudan at the national and regional levels for irrigated and rainfed crops, over than 22-year period from 1961/62 to 1982/83, (2) to examine changes in the overtime stability of production, (3) to examine sources of growth of production of groundnuts, (4) to examine the patterns and causes of yield changes, and (5) to compare irrigated and rainfed sectors . For comparative purpose the 22-year period is divided into two equal time periods of 11-years ; the first period from 1961/62 to 1971/72 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, Yearbook of Agricultural Statistics and Current Agricultural Statistics .

3. For the 22-year period area planted to groundnuts in the Sudan increased at an annual compound rate of growth of 7.3 percent and production of groundnuts increased at the rate of 7.9 percent . These rates were considerably faster in the irrigated sector than in the rainfed sector . As a result the irrigated sector on an average, produced 40.2 percent of the total output of groundnuts during the second 11-year period as compared to 26.1 percent during the first 11-year period . During the more recent period of 1979/80 to

1983/84 the share of the irrigated sector was 36.3 percent . However, from first to the second period the rate of growth in production of groundnuts in the irrigated sector declined from 14.3 percent to -4.6 percent, whereas in the rainfed sector it marginally increased from 3.4 percent to 3.6 percent . The shares of groundnuts in the total output and area planted to five major crops (sorghum, wheat, millet, sesame and groundnuts) increased from 13 percent and 12 percent, respectively, in the first period to 20 and 15 percent during the second period .

4. Being an important export earning crop, the variations in its yearly production cause variations in export earnings for the Sudan and, thus, are a serious matter. Our analysis shows that (1) the yearly production is more stable in the rainfed sector than in the irrigated sector, and that (2) the stability of production and areas planted to groundnuts has improved overtime at the national as well as sectoral (irrigated, rainfed) levels.

5. At the national level the average yield of groundnuts increased by 11 percent from 323 Kgs/FD in the first period to 358 Kgs/FD in the second period . For the 22-year period the annual growth rate of yields was 0.4 percent . However, the growth in yields occurred primarily in the irrigated sector where the yield between the two periods increased by 41.2 percent from 627 Kgs/FD to 885 Kgs/FD, and in rainfed areas of Blue Nile and Kordofan regions where the increase was 63.8 percent and 2.7 percent;

respectively . In Darfur and Southern regions there was some decline in yields due to rapid expansion of area .

The improvements in yield of groundnuts were faster during the 1960s and slowed down during the 1970s . The instability in yearly production in the case of groundnuts is due to variations in yield and not due to variations in areas planted to groundnuts, and is more in the irrigated areas than in the rainfed areas . However, production of groundnuts overtime has become more stable .

Appendix

Table 20. Area, Production and Average Yield of Groundnuts by Region, 1961/62-1982/83, Sudan

A : Area in (000 FD)
P : Production in (000 MT)
Y : Yield in Kgs/FD .

	NORTHERN			KASSALA			BLUE NILE						BLUE NILE TOTAL			KORDOFAN			DARFUR			SOUTHERN		
	A	P	Y	A	P	Y	Irrig.		Rainfed		A	P	Y	A	P	Y	Rainfed			Rainfed				
							A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1961/62	7	9	128	0	0	0	58	24	414	0	0	0	58	24	414	221	64	305	100	27	270	95	25	263
1962/63	10	9	900	0	0	0	34	21	617	0	0	0	34	21	617	232	64	358	215	69	321	105	25	258
1963/64	8	6	750	0	0	0	39	30	769	52	21	404	91	51	650	246	79	321	400	126	315	102	28	275
1964/65	6	5	833	0	0	0	60	45	750	66	22	333	126	67	532	243	81	335	338	100	297	65	26	400
1965/66	8	6	750	9	2	222	114	80	702	57	16	281	171	96	561	313	70	224	387	115	297	47	15	319
1966/67	9	9	1000	6	4	667	162	115	710	126	35	278	288	150	521	250	59	235	356	87	294	17	4	235
1967/68	4	3	750	4	2	500	104	52	500	128	47	367	232	99	427	228	65	285	347	120	346	31	9	290
1968/69	4	2	500	2	1	500	87	45	517	86	10	116	173	55	318	214	46	215	273	44	161	54	15	278
1969/70	5	3	600	35	12	343	179	96	536	145	42	290	324	138	426	366	90	246	283	99	350	61	42	689
1970/71	7	2	225	25	12	480	154	112	727	75	19	253	229	131	572	290	50	172	294	93	316	68	50	735
1971/72	7	4	571	13	7	528	147	101	687	65	23	271	232	124	534	897	95	234	278	107	385	85	53	624
1972/73	4	2	500	41	28	683	225	248	1021	135	41	391	330	288	878	958	87	191	330	120	364	60	42	525
1973/74	1	1	533	45	30	667	216	216	1000	100	32	320	316	248	755	965	125	137	282	99	351	117	40	342
1974/75	2	1	500	68	78	1150	221	260	1250	100	42	323	371	402	1028	796	231	237	445	165	371	210	49	233
1975/76	1	1	500	53	31	585	1424	225	757	144	69	479	1568	394	694	988	143	245	538	167	316	167	46	275
1976/77	4	4	500	38	26	681	2250	190	708	151	76	505	1401	266	663	856	166	239	726	225	310	151	50	276
1977/78				52	39	652	1264	300	1250	157	84	535	1421	414	983	955	243	234	1024	250	244	219	35	297
1978/79				33	17	315	1217	139	871	135	63	467	1352	252	716	642	236	233	875	237	271	239	63	264
1979/80				43	52	1209	1267	350	936	174	132	759	1441	382	866	907	182	236	815	193	237	247	49	198
1980/81				35	30	857	1164	129	787	65	33	388	1249	162	651	800	240	213	800	225	231	245	55	224
1981/82				46	41	691	1365	237	649	90	36	400	1455	293	644	830	314	378	800	150	189	245	60	245
1982/83				29	25	693	1202	156	772	50	12	240	1252	168	667	562	66	113	775	183	236	225	50	222

Table 21. Area, Production and Average Yield of Groundnuts 1961/62 - 1982/83, Sudan

	Total Sudan						Total Sudan		
	Irrig.			Rainfed			A	P	Y
	A	P	Y	A	P	Y			
1961/62	65	53	508	407	115	283	472	148	314
1962/63	45	31	689	650	197	303	695	228	371
1963/64	47	35	745	800	254	318	847	239	341
1964/65	66	50	758	713	230	323	779	280	359
1965/66	131	89	679	804	216	269	935	205	226
1966/67	177	128	723	749	185	247	926	313	338
1967/68	113	57	504	734	241	328	847	298	352
1968/69	93	49	537	626	115	184	719	164	228
1969/70	218	111	509	855	274	320	1073	385	359
1970/71	186	126	677	728	213	293	914	339	371
1971/72	167	111	665	1344	276	205	1512	387	256
1972/73	270	278	1030	1372	290	211	1642	568	346
1973/74	296	262	884	1452	292	201	1748	554	317
1974/75	384	456	1186	1408	472	335	1792	928	518
1975/76	529	393	743	1784	389	218	2313	782	338
1976/77	347	260	751	1556	474	305	1903	734	386
1977/78	382	426	1117	2300	605	263	2682	1031	385
1978/79	313	247	789	2028	559	276	2341	806	344
1979/80	408	405	993	1945	452	232	2353	857	365
1980/81	199	159	799	1980	553	279	2179	712	327
1981/82	411	278	676	1965	560	285	2376	838	353
1982/83	230	181	787	1632	311	191	1862	492	264