RESULTS AND DISCUSSION

1. Effect of Sowing Date on the Growth, Yield and Chemical Composition of Sorghum.

A. Effect on growth characters:

1. Plant height:

The data present in Tables(5 and 6)demonstrate the effect of the sowing date on the plant height of sorghum at different cuts.

Sowing date showed a significant effect on plant height of sorghum at different cuts in the two successive seasons. Plant height decreased significantly by delaying the time of sowing after 16 th June and 17 th May in the first and second seasons, respectively. The superiority in the plant height of earling sowing might be attributed to the favorable climatic condition prevailing during the growth of sorghum plants or the photoperiod(Tables 2 and 3) Similar results were obtained by Fergany (1967), Minor (1971) and Ebrahim (1982). They reported that plant height decreased with delay sowing in forage sorghum.

2. Stem diameter:

The data present in Tables(5 and 6)indicate that sowing dates had a significant effect on stem diameter in the both seasons. Stem diameter of sorghum plants significantly decreased with delaying sowing date in the two season. The last sowing date at July 1, produced significantly

Table 5 : Effect of sowing date on the growth characters of sorghum plants in 1981 season.

Sowing date	Plant height (cm)	Stem diameter(mm)	Number of stems /m^2	Number of leaves/plant	Leaf area index	Dry weight of plant organs (g)			Leaf : stem ratio
						Leaves	Stems	Whole plant	
a. First cutting (60 days after sowing)									
17 th May	271.20 a	12.41 a	22.49a	9.50a	8.62a	11.33a	39.77a	51.10a	0.211 b
1 st June	262.00 a	11.22 b	20.39a	9.04a	7.33b	10.55ab	37.51ab	48.06a	0.223 b
16 th June	233.87ab	10.94bc	17.56ab	8.23ab	5.43c	10.04b	35.85b	45.89ab	0.237ab
1 st July	212.07b	10.16c	15.30b	7.73b	4.38c	9.12b	33.07b	42.19b	0.264 a
b. Second cutting (45 days after first cut)									
17 th May	196.14a	11.15a	30.97a	8.32a	4.91a	8.79a	32.21a	41.00a	0.298 b
1 st June	168.38a	10.70ab	25.88b	7.72b	3.41b	8.50a	26.59b	35.09b	0.314 b
16 th June	157.62bc	10.38b	18.65c	6.47c	3.12b	7.83a	18.16c	25.99c	0.328ab
1 st July	143.25c	9.09c	16.21d	6.06c	2.06c	5.94b	12.98d	18.92d	0.394 a

Table 6 : Effect of sowing date on the growth characters of sorghum plants in 1982 season.

Sowing date	Plant height (cm)	Stem diameter (mm)	Number of stems / m^2	Number of leaves/ plant	Leaf area index	Dry weight of plant organs (g)			Leaf: stem ratio
						Leaves	Stems	Whole plant	
a. First cutting (60 days after sowing)									
17 th May	276.17a	11.15a	29.24a	8.82a	9.41a	11.30a	41.20a	52.50a	0.217b
1 st June	261.23a	10.42b	27.20a	8.85ab	7.27b	10.67b	40.53a	51.20a	0.241b
16 th June	246.35ab	10.10b	24.77ab	8.24ab	5.64c	10.22c	37.84b	48.06b	0.247ab
1 st July	231.44b	9.87b	17.07b	7.63b	4.32d	9.22d	33.25c	42.47c	0.288a
b. Second cutting (45 days after first cut)									
17 th May	201.46a	10.75a	34.14a	7.30a	4.71a	8.54a	23.47a	32.01a	0.331b
1 st June	146.41b	9.80b	29.16b	6.98b	3.23b	7.90a	20.30a	28.20b	0.357b
16 th June	141.57bc	9.58bc	27.45bc	6.33c	2.79bc	6.72b	15.11b	21.83c	0.382ab
1 st July	123.80c	9.33c	23.41c	5.76d	2.35c	5.57c	10.76c	16.33d	0.426a

thinner stalks than the other planting dates. Such result was obtained by Fergany (1967) and Ebrahim (1982). They reported that stem diameter decreased as planting date was delayed from April 15 to June 1.

3. Number of stems/m^2:

Sowing dates had a significant effect on number of stems/m^2 in the two successive seasons (Tables 5 and 6). Generally, there was a downward trend for the number of stems/m^2 as sowing date was dalyed. Lower number of stems/m^2 was obtained from later sowing of July 1 in the both seasons. On the other hand the early sowing date increased significantly the number of stems/m^2 in the two seasons. These results may be attributed to the good growth characters at the early sowing date. These findings are in harmony with those of Stickler and Pauli (1961), Blum (1972) and Ebrahim (1982).

4. Number of leaves/plant:

Sowing dates had a significant effect on the number of leaves of sorghum plants in the two successive seasons. The present data in Tables (5 and 6) indicate that there was a significant effect on the number of leaves per plant with delaying the sowing date. Early sowing of May 17 produced higher number of leaves/plant as compared with other dates of sowing, while the sowing at July, gave

the lowest number of leaves per plant. These results could be attributed to the relatively higher temperature during the growth season, resulting in early maturity and subsequently the number of leaves decrease. Similar conclusion was confirmed by Ebrahim (1982).

5. Leaf area index (LAI):

Differences between sowing dates in LAI were significant in the two successive seasons. The date at May 17th sowing gave significantly higher LAI than the other sowing dates Tables(5 and 6). The increase in leaf area may be due to favourable temperature and day length prevailing in early sowings than later ones. These factors produced greater vegetative growth of sorghum plants during the early sowing. These results are in harmony with those obtained by Stickler and Pauli (1961) and Ebrahim (1982) who concluded that leaf area tended to be larger at early sowing than the late ones.

Data in Tables (5 and 6) showed that sowing dates had a significant effect on the leaf: stem ratio in both seasons. The late sowing date, gave significantly higher leaf: stem ratio.

6. Dry weight of plant organs:

6.1. Dry weight of leaves/plant:

As presented in Tables (5 and 6), sowing dates showed significant effect on the dry weight of leaves/plant in both seasons. In general, dry weight of leaves/plant progressively decreased as sowing dates was delayed until July 1. These resutls are expected since sowing dates had a significant effect on the number of leaves/plant.

Similar conclusions are in accordance with those obtained by Ebrahim (1982), who reported that dry weight of leaves/ plant significantly decreased with delaying sowing date from April 15 to June 1 at each cut in both seasons.

6.2. Dry weight of stems/plant:

Dry weight of stems/plant was significantly affected by sowing dates in the two successive seasons (Tables 5 and 6). The late planting, gave significantly lowest dry weight of stems/plant than the other planting sowings. Generally, dry weight of stems decreased as sowing date was delayed. Such result is in line with that of Ebrahim (1982), who found that stem weight decreased remarkably and consistently by delaying time of sowing, while early sowing casused a production of greatest weight of stems/ plant.

6.3. Dry weight/plant:

Data in Tables (5 and 6) revealed that sowing dates showed significant effect on dry weight per plant in the both seasons. Dry weight/plant decreased significantly as sowing was delayed until July 1. Sowing dates seemed to have a considerable effect on accumulation of dry weight in plant. Accumulation of more dry matter of plant during early sowing could be attributed to favourable environmental

conditions prevailing during the growth of sorghum plants, such as temperature, relative humidity, light duration and intensity. These results are true and expected since early sowing increased significantly, number of leaves/ plant, number of stems/m^2, dry weight of leaves and stems per plant. Similar conclusions was obtained by Fergany (1967), Kassam and Andrews (1975) and Ebrahim (1982).

B. Effect on yield:

1. Fresh forage yield:

Evidently, fresh forage yield was significantly affected by sowing dates in the two successive season (Table 7). However, the yield decreased considerably and consistently with delaying the date of sowing. This result was true at all cuts and total fresh forage yield.

In 1981 season, sowing on May 17 produced 15.48, 12.80 and 28.28 ton fresh forage yield more than that of sowing July 1 whereas in 1982 season sowing on May 17 gave 11.32, 11.05 and 22.37 ton more than that of sowing on July 1 at first, second cuts and total fresh forage yield respectively. This might be attributed to the effect of sowing dates on plant height, stem diameter, number of leaves/plant and LAI of sorghum plants. These results are in general agreement with those obtained by Costa (1971),

Table 7 : Effect of sowing date on the forage yield of sorghum in 1981 and 1982 seasons.

Sowing date	Fresh yield (ton/fad.)				Dry yield (ton/fad.)			
	1 st+ cut	2 nd++ cut	Total	Relative	1 st+ cut	2 nd++ cut	Total	Relative
				1981 Season				
17 th May	27.89a	18.94a	46.83a	100	5.48a	3.75a	9.23a	100
1 st June	24.51ab	11.88b	36.39b	78	5.02a	2.56b	7.58b	82
16 th June	21.67b	9.40c	31.07b	66	4.23b	1.80c	6.03c	65
1 st July	12.41c	6.14d	18.55c	40	2.71c	1.28d	3.99d	43
				1982 Season				
17 th May	28.79a	19.48a	48.27a	100	5.91a	3.84a	9.75a	100
1 st June	24.71b	12.14b	36.85b	76	5.16b	2.60b	7.76b	80
16 th June	22.08c	9.73bc	31.81b	66	4.46c	1.85c	6.31c	65
1 st July	17.46d	8.44c	25.90c	54	3.48d	1.46c	4.94d	51

+ 60 days after sowing

++ 45 days after first cut

Azeredo et al., (1978) and Ebrahim (1982).

2. Dry forage yield:

Results in Table (7) showed that differences between sowing date in the dry forage yield at each cut and total forage yield were significant in the both seasons. Early sowing of May 17 gave the highest dry forage yield compared to the other sowing dates. In 1981 season, early sowing gave 0.45, 0.80 and 1.52 ton/fad. at first cut, 1.20, 0.75 and 0.52 at the second cut, 1.65, 1.55 and 2.04 ton/fad. for the total dry forage yield more than June 1, June 16 and July 1, respectively. In 1982, early sowing at May 17 surpassed the sowing date at June 1, June 16 and July 1 by 0.76, 0.69 and 0.98 ton/fad. at the first cut by 1.24, 0.75 and 0.40 ton/fad. at the second cut and 2.00, 1.44 and 1.37 ton/fad. for the total dry forage yield. These results are true since early sowing increased significantly the dry weight of different parts of the sorghum plant namely: leaves and stems per plant. It may be concluded that delaying sowing date caused a rapid conversion of plants from vegetative to reproductive phase which account much for the early cessation of increase in the dry matter content of plants. Such conclusions are in accordance with those obtained by Blum (1972) in Isreal, Fribourg et al. (1975)in U.S.A and Ebrahim (1982) in Egypt, found that the yield of dry matter decreased by delaying sowing.

3. Protein yield:

The results in Table (8) showed clearly that there was a progressive and consistent depression in the yield of crude protein with delaying the sowing date until July 1. In both seasons, sowing on May 17 gave the highest protein yield/fad. In both seasons sowing date on May 17 increased the total protein by 82.86, 126.20 and 181.12 and 74.43, 118.88 and 170.29 kg/fad. as compared with the other sowing dates namely June 1,June 16 and July 1, respectively in the two seasons.

Such effect was mainly due to the effect of sowing dates on the dry forage yield of sorghum plants. The same trend of results were also recorded by Hussein et al. (1979) and Mirhadi and Kobayashi (1981).

Table 8 : Effect of sowing on the protein yield (Kg/fad.) of sorghum in 1981 and 1982 seasons.

Sowing date	1981 Season				1982 season			
	1 st cut	2 nd cut	Total yield	Relative	1 st cut	2 nd cut	Total yield	Relative
17 th May	225.55 a	151.14 a	376.69a	100	230.53a	163.66a	394.19a	100
1 st June	201.98 b	91.85 b	293.83b	78	200.18b	119.58b	319.76b	81
16 th June	162.94 c	85.55 b	248.49c	66	173.79c	101.52bc	275.31c	70
1 st July	130.85 d	64.72 b	195.57d	52	143.74d	80.16c	223.90d	57

+ 60 days after sowing ++ 45 days after first cut

C. Effect on Chemical Composition:

1. Protein percentage:

As presented in Tables(9 and 10)sowing dates exhibited a significant effect on percentage of protein in the tissues of the different parts of sorghum plant, namely, leaves and stems. Delaying sowing date increased the protein content in the different plant organs of sorghum. The effect of sowing date on the percentage of protein was studeid by many investigators. Rai (1964), and Ebrahim (1982), they reported that the protein percentage of leaves, stems and total plant increased with delaying sowing date.

2. Carbohydrate percentage:

Sowing dates had a significant effect on the percentage of carbohydrate in the different organs of sorghum plant, namely, leaves and stems in the two successive seasons (Tables 9 and 10). It is apparent that the carbohydrate % decreased with delaying sowing date. Planting dates seemed to have a considerable effect on accumulation of dry matter in leaves, stems and whole plant. Accumulation of more dry matter in the different organs of sorghum plant during early sowing could be attributed to favourable environmental conditions prevailing during the growth and

Table 9 : Effect of sowing date on chemical composition of sorghum plant in 1981 season.

Sowing date		Protein %			Carbohydrate %			HCN %		
		Leaves	Stems	Whole plant	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant
a. First cutting (60 days after sowing)										
17 th	May	7.16 a	4.80 a	5.32a	32.08 a	28.96a	29.65a	0.590b	0.914 a	0.842a
1 st	June	7.55 a	5.03 b	5.58a	30.58ab	27.59b	28.24b	0.646b	0.965 a	0.894ab
16 th	June	8.26 a	5.22 c	5.88ab	28.31bc	25.91c	26.43c	0.695b	1.025 a	0.952bc
1 st	July	9.51ab	5.42 d	6.30b	27.33 c	23.33d	24.42d	0.746a	1.099 a	1.022c
b. Second cutting (45 days after first cut)										
17 th	May	8.42 a	5.56 a	6.17a	30.92 a	27.61a	28.31a	0.501b	0.821 b	0.752a
1 st	June	9.14 a	5.77 b	6.58a	29.42ab	26.57b	27.26b	0.551b	0.867 b	0.790ab
16 th	June	10.24ab	5.97 c	7.25b	27.19bc	24.41c	25.24c	0.593ab	0.931ab	0.829ab
1 st	July	11.28 b	6.03 d	7.67b	26.15 c	21.63d	23.04d	0.636 a	0.976 a	0.863b

development of sorghum plants, such as temperature, relative humidity, light duration and light intensity (Tables 2 and 3), as well as superiority of sorghum plant concering number of leaves/plant and leaf area index.

3. Hydrocyanic acid content (HCN):

The results in Tables (9 and 10) indicate that the Highest HCN% was in the stems compared with leaves. Similar result was obtained by Longo (1969). On the other hand, Wheeler (1950), found that leaves were high in HCN acid especially the yonger leaves.

Differences between sowing dates in the percentage of HCN acid was significant in both seasons except the stems in the first season. The obtained data showed that HCN% increased as sowing date was delayed. The sowing date at July 1 gave the highest precentage of HCN acid in the two successive seasons in both leaves and stems. Similar results was obtained by Nasr (1973), who reported that HCN% increased as the date of sowing was delayed. On the other hand, Fergany (1967) reported that HCN in plants of summer season surpassed those of nili season.

11. Effect of Varieties on the Growth, Yield and Chemical Composition of Sorghum:

A. Effect on growth characters:

1. Plant height:

Results in Tables (11 and 12) show that varieties exhibited significant effects on plant height of sorghum plant. Sudan (2) produced significantly higher plants than either sordam (79) or Pioneer (988) in both seasons. The difference in plant height between varieteis is attributed to difference in the gentical make-up. However, Clapp and Chamblee (1970); El-Hifny et al. (1972) and Ebrahim (1982), who reported that there was a great variation in the differential respone of plant height.

2. Stem diameter:

With regared to the varieties effect data presented in Tables(11 and 12) show that there was a significant effect on the stem diameter in the two successive seasons. Sudan (2) resulted in thinner stalks than the other two varieties. Pioneer (988) plants were significantly thicker than those of sordan (79).

The results also indicate that the stem diameter was inferior at second cut as compard with first cut in

Table 11 : Effect of varieties on the growth characters of sorghum plants in 1981 season

Varieties	Plant hieght (cm)	Stem diameter (mm)	Number of stems/ m^2	Number of leaves/ plant	Leaf area index	Dry weight of plant organs (g) Leaves	Stems	Whole plant	Leaf: Stem ratio
a. First cutting (60 days after sowing)									
Pioneer (988)	227.18 c	11.89 a	21.80 a	9.06 a	7.78 a	11.01a	38.41a	49.42 a	0.250 a
Sordan (79)	237.20 b	11.06 b	18.38 b	8.67 b	6.76 b	10.26b	36.62b	46.88 b	0.230 b
Sudangrass Giza (2)	269.97 a	10.59 c	16.63 b	8.15 c	5.07 c	9.50c	34.62c	44.12 c	0.216 c
b. Second cutting (45 days after first cut)									
Pioneer (988)	152.25 c	10.78 a	25.23 a	7.43 a	3.95 a	8.65a	25.33a	33.98 a	0.361 a
Sordan (79)	163.33 b	10.38ab	22.84 b	7.21 a	3.39 ab	8.04b	22.48b	30.52 b	0.335 b
Sudangrass Giza (2)	183.48 a	9.83 b	20.70 c	6.78 b	2.79 b	6.60c	19.64c	26.24 c	0.304 b

Table 12 : Effect of varieties on the growth characters of sorghum plants in 1982 season.

Varieties	Plant height (cm)	Stem diameter (mm)	Number of stems /m^2	Number of leaves/plant	Leaf area index	Dry weight of plant organs (g) Leaves	Stems	Whole plant	Leaf: Stem ratio
a. First cutting (60 days after sowing)									
Pioneer (988)	241.55 b	10.75 a	27.90 a	8.69 a	8.25a	11.07 a	40.20 a	51.27 a	0.268 a
Sordan (79)	251.13 a	10.43 a	24.86 b	8.40 a	6.90b	10.57 a	38.06 b	48.63 ab	0.249 a
Sudangrass Giza (2)	268.70 a	9.98 a	20.95 c	7.84 b	4.83c	9.42 b	36.36 c	45.78 b	0.228 b
b. Second cutting (45 days after first cut)									
Pioneer (988)	146.09 b	10.43 a	33.13 a	7.01 a	3.81a	8.15 a	19.41 a	27.56 a	0.399 a
Sordan (79)	152.68 b	9.95 b	28.66ab	6.55 b	3.25b	6.95 b	17.42 b	24.37 b	0.376 b
Sudangrass Giza (2)	161.16 a	9.22 c	23.84 b	6.22 b	2.75c	6.45 c	15.45 c	21.90 c	0.348 c

both seasons. These results might be attributed to the reduction in the vegetative phose of growth at second cut. Similar findings were obtained by Burger et al. (1961), El-Hifny et al. (1972) and Ebrahim (1982), they reported that the stem diameter is a varietal characteristic.

3. Number of stems/ m^2

Data reported in Tables(11 and 12) indicate clearly that there was a significant differences in the number of stems/ m^2 among sorghum varieties. In both season, Pioneer (988) surpassed significantly the other varieties in number of stems/m^2. These resutls are in harmony with those obtained by Stickler and Pauli (1961), Clapp and Chamblee (1970), El-Hifny et al. (1972) and Ebrahim (1982).

4. Number of leaves/plant:

Number of leaves/plant differed significantly among genotypes at each cut in both two seasons Tables(11 and 12) Pioneer (988) exhibited greater number of leaves/plant than the other two varieties. Ebrahim (1982), in Egypt, found that high varietion in number of leaves/plant among four sorghum varieties.

5. Leaf area index:

The results in Tables (11 and 12) showed that differences between varieties in LAI were significant in the two successive seasons. Sudan (2) had significantly smaller LAI than the other two varieties, while Pioneer (988) revealed a significant superiority in LAI over Sordan (79)and Sudan(2). These results were excpected since Pioneer (988) gave higher number of stems/m^2 as well as number of leaves/plant. These results are in agreement with those obtained by El-Hifny et al. (1972) and Ebrahim (1982), who found high variation between sorghum varieties in leaf area. The results in Tables (11 and 12) demonstrate that the leaf: stem ratio at each cut was affected by varietal characteristics. Pioneer (988) surpassed the other varieties, whereas Sudan (2) produced the lowest values.

6. Dry weight of plant organs:

6.1. Dry weight of leaves/plant:

The obtained data in Tables (11 and 12) indicate clearly that dry weight of leaves/plant was affected by varietal characteristics. The differences among varieties in leaves dry weight per plant were signicicantly confirmed in 1981 and 1982 seasons. Varieties could be arranged in ascending order as follows: Sudan (2), Sordan(79) and Pioneer (988) at the first and second cuts in the two seasos. Pioneer (988) was superior and Sudan (2) was the inferior in there effect on the dry weight of leaves/plant. These results might be attributed to the significant effect

of varieties on the number of leaves/plant. Similar results were obtained by Ebrahim (1982), who found high variation between four sorghum varieties in the dry weight of leaves/plant.

6.2. Dry weight of stems/plant:

Data in Tables(11 and 12) demonstrate that the stems dry weight/plant at each cut varied with varieties. Pioneer (988) surpassed the other varieties whereas Sudan (2) produced the lowest values. The following is a descending order according to dry weight of stems/plant: Sudan (2), Sordan (79) and Pioneer (988). These results were excepected science Pioneer (988) surpassed significantly the other two varieties in the number of stems/m^2. These results are in agreement with those obtained by Ebrahim (1982).

6.3. Dry weight of whole plant:

Varieties exerted a marked effect on the dry weight of whole plant at each cut in the two successive seasons. Pioneer (988) produced greatest dry weight/plant, whereas Sudan (2) produced the lowest values at the two cuts in the two seasons. These results may be attributed to the significant effect of varieties on the dry weight of leaves and stems per plant. Similar results were obtained by

B. Effect on yield:

1. Fresh forage yield:

The results in Table (13) showed that the fresh forage yield at each cut or as a total yield was remarkably influenced by varieties characteristics. The present data show that Pioneer (988) surpassed Sordan (79) and Sudan (2) by 3.55 and 6.91 in the first cut, 2.21 and 4.69 in the second cut and 5.76 and 11.60 ton/fad. in the total yield respectively in 1981 season. Concerning the fresh forage yield in 1982 season, the results indicate that Sudan (2) was inferior in the first, second cut and total yield, while Pioneer (988) and Sordan (79) were superior and the differences between them failed to reach the level of significance at 5% in first and second cut. The total fresh forage yield in both seasons could be arranged in descending order to three groups,i.e., Pioneer (988), Sordan (79) and Sudan (2). These results are in agreement with those obtained by Wedin (1970), Habib et al. (1971), Blum (1972), Broadhead and Freeman (1980) and Ebrahim (1980).

2. Dry forage yield:

Differences between the varieties in dry forage yield at each cut as well as the total fresh forage yield were significantly confirmed in both seasons Table (13).

Table 13 : Effect of varieties on the forage yield of sorghum in 1981 and 1982 seasons.

Varieties	Fresh Yield (ton/fad.)			Relative	Dry Yield (ton/fad.)			Relative
	1 st+cut	2 nd+cut	Total		1st+cut	2nd+ cut	Total	
				1981 Season				
Pioneer (988)	25.01 a	12.83 a	37.84 a	100	5.01 a	2.43 a	7.44 a	100
Sordan (79)	21.46 b	10.62 b	32.08 b	84.78	4.24 b	2.08 b	6.32 b	84.95
Sudangrass Giza (2)	18.10 c	8.14 c	26.24 c	69.34	3.75 b	1.74 c	5.49 c	73.79
				1982 Season				
Pioneer (988)	25.92 a	13.01 a	38.93 a	100	5.20 a	2.50 a	7.70 a	100
Sordan (79)	24.16 a	11.63 a	35.79 b	91.93	4.88 a	2.20ab	7.08 a	91.95
Sudangrass Giza (2)	19.72 b	8.81 b	28.52 c	73.25	4.26 b	1.87 b	6.13 b	79.61

It is worthmentioning that the varieties could be arranged in this concern in a descending order as follows: Pioneer (988), Sordan (79) and Sudan (2). These results hold fairly true in both seasons at each cut and as well as total yield. Superiority of Pioneer (988) might have been due to more number of stems/ m^2, stem diameter and number of leaves per plant. The difference in fresh and dry yield between varieties is due to the variation in the gentical make-up. Similar results were obtained by Clapp and Chamblee (1970), Wedin (1970), Habib et al. (1971), Worker (1973) and Fribourg et al. (1976) and Ebrahim (1982).

3. Protein yield:

Data reported in Table (14) indicate clearly that there were significant differences in protein yield of sorghum plant among varieties. Pioneer (988) revealed a significant superiority in the protein yield followed by Sordan (79) and Sudan (2) in descending order. This results might be attributed to the effect of varieties in forage dry yield as well as protein percentage in plant organs of sorghum.

C. Effect on Chemical Composition:

The resutls in Tables(15 and 16) demonstrate that varieties showed significant effect on chemical composition of

Table 14 : Effect of varieties on the protein yield (kg/fad.) of sorghum in 1981 and 1982 seasons.

Varieties	1981 season				1982 season			
	1 st+ cut	2nd++ cut	Total yield	Relative	1 st+ cut	2 nd++ cut	Total yield	Relative
Pioneer (988)	201.80a	116.39a	318.19 a	100	201.58a	126.91 a	328.49 a	100
Sordan (79)	187.88a	100.07b	287.95 b	90.50	189.50a	111.37 b	300.87 b	91.59
Sudangrass Giza (2)	158.08b	87.88 b	245.96 c	77.29	162.63b	101.04 b	263.67 c	80.26

+ 60 days after sowing ++ 45 days first cut

Table 15 : Effect of varieties on chemical composition of sorghum plant in 1981 season.

Varieties	Protein %			Carbohydrate %			HCN %		
	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant
			a. First cutting (60 days after sowing)						
Pioneer (988)	8.53 a	5.52 a	6.19a	31.99a	27.68 a	28.64a	0.62b	0.95b	0.87a
Sordan (79)	8.16ab	5.09ab	5.76ab	29.73b	27.58 a	28.05ab	0.73a	1.07a	0.99b
Sudangrass Giza (2)	7.67 b	4.74 b	5.37b	27.02c	25.31 b	25.67b	0.66b	0.99ab	0.91ab
			b. Second cutting (45 days after first cut)						
Pioneer (988)	10.21a	6.26a	7.26a	30.84a	26.29a	27.44	0.51c	0.82c	0.74a
Sordan (79)	9.79ab	5.81b	6.85ab	28.57b	25.07b	25.99 ab	0.64a	0.98a	0.89 b
Sudangrass Giza (2)	9.31b	5.43b	6.40 b	25.85c	23.81c	24.32 b	0.56b	0.90b	0.81 b

Table 16 : Effect of varieties on chemical composition of sorghum plant in 1982 season.

Varieties	Protein %			Carbohydrate %			HCN %		
	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant
a. First cutting (60 days after sowing)									
Pioneer (988)	8.65 a	5.70a	6.33a	34.63 a	30.61a	31.47a	0.56 b	0.90 a	0.82 a
Sordan (79)	8.29ab	5.21ab	5.87ab	31.51 b	27.50b	28.37ab	0.67 a	1.02 a	0.94 b
Sudangrass Giza (2)	7.83 b	4.90b	5.50 b	29.13 c	25.15c	25.96 b	0.59 b	0.93 a	0.86 ab
b. Second cutting (45 days after first cut)									
Pioneer (988)	10.37 a	6.31a	7.51a	33.67 a	27.71a	29.47a	0.46 c	0.82 a	0.71a
Sordan (79)	9.98ab	5.86ab	7.03ab	30.51 b	26.57b	27.69ab	0.59 a	0.92 a	0.82a
Sudangrass Giza (2)	9.51 b	5.48b	6.66b	28.20 c	25.07c	25.99b	0.50 b	0.85 a	0.74a

sorghum plants.

1. Protein percentage:

Varieties differed significantly in the protein percentage in plant organs, namely, leaves, stems and whole plant. It is obvious that the protein content was greater in Pioneer (988) than in Sordan (79) and Sudan (2). These results hold true at the different cuts in the two successive seasons. The average protein percentage in the whole plant among the tested varieties ranged from 5.37 to 6.19% and from 5.50 to 6.33% at the first cut in the two seasons, respectively. These results are in agreement with those obtained by Burns and Wedin (1964), Rai (1964), Worker and Marble (1968), Clapp and Chamblee (1970), and Pedreira (1970), Worker (1973), Harms and Tucker (1973) and Ebrahim (1982). They reported that the total crude protein production varied by variety and stage of harvest.

2. Carbohydrate percentage:

In both seasons, the varieties differed significantly in the carbohydrate percentage Tables(15 and 16). The results indicate that Pioneer (988) gave the highest percentage of carbohydrate in leaves, stems and whole plant,

whereas the lowest percentage was obtained from Sudan (2). Accordingly, it could be predicated that protein content in leaves, stems and whole plant is positively correlated with carbohydrate percentage of the different organs of the plant. These results hold true at the different cuts in both seasons. However, the average carbohydrate in the whole plant among varieties ranged from 25.67 to 28.64% and 25.96 to 31.47% at the first cut and from 24.32 to 27.44 and 25.99 to 29.47% at the second cut in the 1981 and 1982 seasons, respectively. Similar resutls were obtained by McBee and Miller (1982).

3. Hydrocyanic acid content (HCN):

The mean performances of the varieties for the HCN content are shown in Tables(15 and 16). It was found that HCN acid content was higher in the first cut growth than in the second growth of the plant of sorghum forage crops in the corresponding ages. Similar results were obtained by Karim (1965), George (1970), and Nasr (1973).
They found 15% less than HCN acid in the second growth of sorghum than in the first growth. The tested varieties differed significantly in the percentage of HCN acid in both seasons at each cut. In this concern, the varieties could be arranged in a descending as follows: Pioneer (988),

Sudan (2) and Sordan (79). It is obvious that the HCN% of leaves, stems and whole plant was greater in Sordan (79) than the other two varieties. The variation in HCN acid percentage may be attributed to differences in the genetical make-up of different cultivars. These findings are in harmony with those obtained by George (1970) and Nasr (1973), who reported that sudangrass was higher in HCN acid content than sweet sorghum.

III. Effect of Seeding Rates on the Growth, Yield and Chemical Composition of Sorghum:

A. Effect on growth characters:

1. Plant height:

Data in Tables (17 and 18) show the effect of seeding rates on plant height of sorghum at different cuts. Plant height was significantly increased with increasing seeding rates up to 20 kg/fad. at the different in the two successive cut. This increase in plant height at high seeding rates may be due to competition among plants for light. These results are in harmony with these obtained by Koller and Scholl (1968), Blum (1970) and Ebrahim (1982). They reported that increased seeding rate increased plant height. On the contrary, Abd El-Gawad (1981), found that increasing seeding rate of sorghum led to a reduction in plant height,

Table 17 : Effect of seeding rates on the growth characters of sorghum plants in 1981 season.

Seeding rates kg/fad.	Plant height (cm)	Stem diameter(mm)	Number of stems/ m^2	Number of leaves/ plant	Leaf area index	Dry weight of plant organs (g)			Leaf : stem ratio
						Leaves	Stems	Whole plant	
			a. First cutting (60 days after sowing)						
10	229.02 c	11.76 a	16.81 c	9.10 a	5.47 c	11.07a	38.89 a	49.96 a	0.215 c
15	244.46 b	11.20 b	18.90 b	8.62 b	6.40 b	10.20b	36.37 b	46.57 b	0.230 b
20	260.87 a	10.58 c	21.10 a	8.16 c	7.44 a	9.50c	34.38 c	33.88 c	0.256 a
			b. Second cutting (45 days after first cut)						
10	157.08 c	10.98 a	19.80 c	7.54 a	2.70 c	8.50a	24.14 a	32.64 a	0.303 c
15	166.52 b	10.36 b	22.80 b	7.13 b	3.43 b	7.69b	22.62 b	30.31 b	0.335 b
20	175.45 a	9.65 c	26.18 a	6.75 c	4.01 a	7.11c	20.69 c	27.80 c	0.363 a

Table 18: Effect of seeding rates on the growth characters of sorghum plants in 1982 season.

Seeding rates kg/fad.	Plant height (cm)	Stem diameter (mm)	Number of stems/ m^2	Number of leaves/ plant	Leaf area index	Dry weight of plant organs (g)			Leaf: stem ratio
						Leaves	Stems	Whole plant	
			a. First cutting (60 days after sowing)						
10	243.92 c	11.01 a	21.83 c	8.64 a	5.35 c	11.06 a	40.51 a	51.57 a	0.225 c
15	254.00 b	10.40 b	24.36 b	8.35 a	6.67 b	10.49 b	38.27 b	48.76 b	0.246 b
20	263.46 a	9.74 c	27.52 a	7.94 b	7.96 a	9.50 c	35.84 c	45.34 c	0.274 a
			b. Second cutting (45 days after first cut)						
10	142.41 c	10.35 a	24.63 c	6.95 a	2.53 c	7.79 a	19.13 a	26.92 a	0.333 c
15	153.89 b	9.86 b	28.94 b	6.60 b	3.32 b	7.11 b	17.48 b	24.59 b	0.379 b
200	163.64 a	9.41 c	32.06 a	6.23 c	3.96 a	6.65 b	15.62 c	22.27 c	0.411 a

while Porter et al. (1960), Robinson et al. (1964) Stickler and Younis (1966), Fergany (1967) and Kallah (1981), reported that seeding rate did not significantly influence on plant height of sorghum.

2. Stem diameter :

Stem diameter was significantly affected by seeding rates Tables (17 and 18). Data show clearly that there was a progressive and consistent decrease in stem diameter with increasing seed rate from 10 to 20 kg/fad. These results were true at different cuts for the two growing seasons. The dense sowing gave the maximum plant density which increased the competition among plants for space, water, nutrients and other environmental factors and then resulted in the decreasing of stem diameter. These results are in accordance with those reported by Burger et al. (1961), Kukedi (1968), Choudhari and Tatwawadi (1977), Abd El-Gawad (1981) and Ebrahim (1982). They found that increasing seeding rate of sorghum led to a reduction in stem diameter. On the other hand, Burger and Compbell (1961) and Fergany (1967), reported that stem diameter of culms of different seeding rates did not differ significantly.

3. Number of stems/m^2:

Results in Tables (17 and 18) indicat clearly that number of stems/m^2 was significantly affected to different

extents by plant population (seeding rate). The number of stems/m^2 before the different cuttings increased by increasing seed rate up to the highest level, i.e. 20 kg/ fad. in the two seasons. As it is well known, the number of stems/m^2 is a product of number of plants per unit area. Since the high number of stems/m^2 resulting from dense sowing is a logic result of increasing seeding rate. Similar results were obtained by Burger and Campbell (1961), Escalada and Plucknett (1975) and Ebrahim (1982), who reported that number of stems/m^2 were directly related to seeding rate.

4. Number of leaves/plant:

The obtained resutls in the two seasons indicated that number of leaves/plant was significantly affected by seeding rates Tables (17 and 18). The highest number of leaves/plant was obtained at rate of 10 kg/fad., while the lowest one was obtained by using 20 kg/fad. The reduction in number of leaves/plant at higher seeding rates, might be attributed to the competition between plants for the above and under ground space was greater indense sowing than thin one. These results are in harmony with results, obtained by Kukedi (1968), Abd El-Gawad (1981) and Ebrahim (1982), while Fergany (1967) showed that the number of leaves/ plant was not significantly affected by seeding rate.

5. Leaf area index (LAI):

The LAI tended to increase as the seed rate increased at different cuts in the two successive seasons Tables (17 and 18). Similar conclusion was confirmed by Kukedi (1968), Nunez and Kamprath (1969), El-Hifny et al. (1972) and Ebrahim (1982). They reported that LAI was directly related to seed rate in sorghum plants.

As regard to the effect of seed rate on leaf: stem ratio, data represented in Tables (17 and 18) showed heighest seeding rate gave the highest leaf: stem ratio. Similar resutls were obtaine by Rakhimkulov and Amangel'diev (1973) and Hassanein (1983), who found that leaf: stem ratio of sudangrass decreased with increasing spacing.

6. Dry weight of plant organs:

6.1. Dry weight of leaves/ plant:

Resutls in Tables (17 and 18) indicate clearly that dry weight of leaves/ plant was significantly affected by seeding rate in the two seasons. Increasing seeding rate caused significant decreases in dry weight of leaves/plant. The highest leaves dry weight/plant was obtained at the rate of 10 kg/fad. , while the lowest one was obtained by using 20 kg/fad. The reduction in dry weight of leaves/plant at higher seeding rates, being results of decreasing the number

of leaves/plant, might be attributed to the competition between plants for growth factors namely, water, nutrients and light which are necessary for leaf formation. These findings are in general agreement with those reported by Ebrahim (1982).

6.2. Dry weight of stems/plant:

Dry weight of stems/plant was significantly decreased at different cuts as seeding rate was increased. These results were true for the two growing seasons. This reduction may be due to the reduction in number of stems/plant as a result of induced competition by increasing seeding rate. Similar result was obtained by Ebrahim (1982).

6.3. Dry weight/plant:

The effect of seeding rate on the dry weight of whole plant at different cut are presented in Tables (17 and 18). In both seasons, an increase in the dry matter of plant was observed by decreasing seed rate. In the first season, dry weight/ plant was significantly decreased from 49.96 to 46.57 and 33.88 g. at the first cut, 32.64 to 30.13 and 27.80 g. at the second cut. In the second season, dry

weight/plant decreased from 51.57 to 48.76 and 45.34 g. at the second cut, when seeding rate was increased from 10 to 15 or 20 kg/fad. The high dry weight/plant obse-rved in thin sowing may be attributed to the vigorousness of plants of thin sowing than dense one. These results are in harmony with results, obtained by Ebrahim (1982).

B. Effect on yield:

1. Fresh forage yield:

Results in Table (19) indicate clearly that fresh forage yield was significantly influenced to different extents by plant population (seeding rates). The fresh forage yield at each cut as well as the total yield/fad. increased with the increase in seed rate up to the high-est level i.e. 20 kg/fad. Increasing seed rate from 10 to 20 kg/fad. increased the fresh forage yield by 26 and 12% in 1981 season, whereas the increase amounted to 21 and 11% in 1982 season at first and second cuts, respect-ively. Total fresh forage yield/fad. of dense sowing (20 kg/fad.) exceeded that of thin sowing (10 kg/fad.) by 26 and 21% in 1981 and 1982 seasons, respectively. These results are in harmony with obtained by Halasz (1975), Tsukuda et al. (1977), Abd El-Gawad (1981), Ebrahim (1982) and Hassanein et al. (1983). They reported that increasing

Table 19 : Effect of seeding rates on the forage yield of sorghum in 1981 and 1982 seasons.

Seeding rates kg/fad.	Fresh yield (ton / fad.)				Dry yield (ton / fad.)			
	1st cut	2nd cut	Total	Relative	1st cut	2nd cut	Total	Relative
				1981 Season				
10	19.00 c	9.87 c	28.87 c	100	4.08 c	1.97 c	6.05 c	100
15	21.88 b	11.10 b	32.98 b	114	4.50 b	2.22 b	6.72 b	111
20	23.99 a	12.48 a	36.47 a	126	4.90 a	2.50 a	7.40 a	122
				1982 Season				
10	21.11 c	10.41 b	31.52 c	100	4.35 c	2.08 c	6.43 c	100
15	23.18 b	11.70 a	34.88 b	110	4.83 b	2.34 b	7.17 b	111
20	25.51 a	12.68 a	38.19 a	121	5.26 a	2.54 a	7.80 a	121

seed rate of sorghum increased the forage yield.

2. Dry forage yield:

Seed rate had a significant effect on the dry forage yield at each cut and the total yield/ fad. Table (19).

In the first season, the dry yield of dense sowing (20 kg/fad.) outyielded that of thin one (10 kg/fad.)by 0.82, 0.53 and 1.35 tons/fad. at first, second cut and total dry forage yield. In the second season, the corresponding valueswere 0.91, 0.46 and 1.37 tons/fad.

These results reveal that the forage yield per faddan was greatly influenced by the number of stems/m^2 as well as plant height regardless of the increase in number of leaves/plant, stem diameter, dry weight of leaves/plant as well as dry weight of stems/plant which resulted from decreasing seeding rates. These results are harmony with those obtained by Halasz (1975), Tsukuda et al. (1977), Abd El-Gawad (1981), Ebrahim (1982) and Hassanein et al. (1983). They recommended with the dense plantings to attain maximum forage yield of sorghum plants.

3. Protein yield:

The obtained results in the two seasons indicated that the protein yield at each cut and the total yield

significantly increased by increasing seeding rates Table(20).

Increases in total protein yield reached 12 and 26% in the first season and 12 and 23% in the second season as the seed rate increased from 10 to 15 or 20 kg/fad., respectively. This superiority in protein yield could be attributed mainly to the increase in forage yield. Similar results were obtained by Koller and Scholl (1968) and Ebrahim (1982).

C. Effect on Chemical Composition:

1. Protein percentage:

Results in Tables (21 and 22) show that protein percentage was significantly influenced by seeding rates. The percentage of protein in the leaves, stems and whole plant decreased with the increase in the seed rate up to 20 kg/fad. in the two successive seasons. These reduction in protein percentage at higher seeding rates, might be attributed to the competition between plants for growth factors namely, water and nutrients, which are necessary for protein formation. These findings are in general agreement with those reported by Koller and Clark (1965), Koller and Scholl (1968), Worker (1973) and Ebrahim (1982). They reported that the protein percentage in the different plant organs decreased consistantly with increasing seed rate at each cut.

Table 20 : Effect of seeding rates on the protein yield (kg/fad.) of sorghum in 1981 and 1982 seasons.

Seeding rates kg/fad.	1981 season				1982 season			
	1st+cut	2nd++cut	Total yield	Relative	1st+cut	2nd++cut	Total yield	Relative
10	165.68 c	86.62 c	252.30 c	100	167.88 c	99.16 c	267.04 c	100
15	181.84 b	100.26 b	282.10 b	112	184.80 b	113.93b	298.73 b	112
20	200.23 a	117.46 a	317.69 a	126	201.03 a	126.23a	327.26 a	123

+ 60 day after sowing ++ 45 days after first cut

Table 21 : Effect of seeding rates on chemical composition of sorghum plant in 1981 season.

Seeding rates kg/fad.	Protein %			Carbohydrate %			HCN %		
	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant
	a. First cutting (60 days after sowing)								
10	8.49 a	5.42 a	6.10 a	26.98 c	24.38 c	24.95 b	0.618 c	0.874 c	0.817 a
15	8.13 ab	5.12 ab	5.77ab	29.89 b	26.57 b	27.29ab	0.662 b	1.026 b	0.946 ab
20	7.74 b	4.82 b	5.45 b	31.86 a	28.63 a	29.32 a	0.727 a	1.103 a	1.021 b
	b. Second cutting (45 days after first cut).								
10	10.71 a	6.18 a	6.21 a	25.82 c	22.87 c	23.63 b	0.515 c	0.819 c	0.739 a
15	9.75 ab	5.82 b	5.92ab	28.74 b	25.18 b	26.08ab	0.572 b	0.898 b	0.815 ab
20	9.40 b	5.50 b	5.55 b	30.70a	27.11 a	28.02 a	0.623 a	0.991 a	0.896 b

Table 22 : Effect of seeding rates on chemical composition of sorghum plant in 1982 season.

Seeding rates kg/fad.	Protein %			Carbohydrate %			HCN %		
	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant	Leaves	Stems	Whole plant
				a. First cutting (60 days after sowing)					
10	8.62 a	5.56 a	6.21 a	29.47 c	25.46 c	26.32 b	0.559 c	0.819c	0.763 a
15	8.26 ab	5.29 ab	5.92ab	31.81 b	27.83 b	28.68ab	0.605 b	0.974b	0.894 b
20	7.89 b	4.94 b	5.55b	33.98 a	29.97 a	30.81a	0.663 a	1.056a	0.973 c
				c. Second cutting (45 days after first cut)					
10	10.34 a	6.23 a	7.41 a	28.51 c	24.31 c	25.52 b	0.461 c	0.761c	0.674 a
15	9.94 ab	5.87 b	7.04ab	30.85 b	26.49 b	27.75ab	0.512 b	0.864b	0.762 b
20	9.58 b	5.54 b	6.71 b	33.03 a	28.56 a	29.76 a	0.572 a	0.958a	0.838 c

2. Carbohydrate percentage:

Data reported in Tables (21 and 22) showed that the carbohydrate percentage was significantly affected to different extents by plant population (seeding rates). Carbohydrate percentage in leaves, stems as well as whole plant become greater by increasing seed rate from 10 to 20 kg/fad. These increases in carbohydrate content resulted from the increases in seed rate were quite expected, since the leaf: stem ratio was significantly increased in the same trend. Similar results were obtained by Mc Bee and Miller (1982). They reported that the closer-spaced plants were significantly higher in total carbodydrates. Whereas, Eilrich et al. (1964), reported that carbodydrates percentage was not significantly affected by plant populations.

3. Hydrocyanic acid content (HCN):

The effect of seeding rates on HCN content were significant at each cut in the two seasons (Tables 21 and 22). Increasing plant population by increasing seeding rate increased HCN% in leaves, stems as well as whole plant. In 1981 season, it ranged in whole plant from 25 to 9% and from 21 to 11% in the first and second cuts, when seeding

rate increased from 10 to 20 kg/fad. The same trend hold true as previously shown in the second season. Whereas, Fergany (1967), found that seeding rate had no significant effect on HCN acid content.

IV. Effect of the Interactions:

1. Effect on the interaction between varieties and sowing dates:

The effect of the interaction between sowing date and varieties on the growth characters, yield and chemical composition was not significant in the 1981 season. Results in Table (23) indicated clearly that the effect of the interaction of sowing date with varieties on dry weight of leaves/plant, forage fresh yield and carbohydrate content in leaves and stems was significantly confirmed at the 1 st and 2 nd cut in 1982 season. The highest values from the previous characters resulted from sowing Pioneer (988) on May 17 th, while the lowest one was obtained from Sudan (2) sown on June 16 th and July 1 st.
From the previous results it is clear that high fresh forage yield/fad. can be achieved by sowing Pioneer (988) or the new varieties of high yielding capacity during May.

2. Effect of the interaction between sowing dates and seeding rates:

Data represented in Table (24) showed that the effect of the interaction of sowing dates with seeding rates on LAI in the two seasons and on protein yield in the first

Table 23: Effect of the interaction between varieties and sowing dates on some characters of norghum in 1982 season.

Sowing dates	Varieties	Dry weight of leaves/ plant at 2nd cut	Fresh yield (ton/ fad.) at 2nd cut	Carbohydrate % Leaves at 1 st cut	Leaves at 2 nd cut	Stems at 1 st cut
17 th May	Pioneer (988)	10.00 a	20.20 a	38.89 a	37.95 a	34.83 a
	Sordan (79)	7.97 c	17.84 a	33.94 c	32.98 c	29.94 c
	Sudangrass Giza (2)	7.66 c	11.42 b	31.55 d	30.62 d	27.56 d
1 st June	Pioneer (988)	8.97 b	11.49 b	35.56 b	34.71 b	31.56 b
	Sordan (79)	7.59 c	10.42 b	32.22 d	31.28 d	28.22 d
	Sudangrass Giza (2)	7.15cd	8.51 b	29.89 f	29.21 e	26.00 e
16 th June	Pioneer (988)	7.43 c	10.33 b	32.67 d	31.62 d	28.67 d
	Sordan (79)	6.64 d	9.62 b	30.39 c	29.34 e	26.38 e
	Sudangrass Giza (2)	6.12 d	8.03 b	27.89 e	26.88 f	23.89 ef
1 st July	Pioneer (988)	6.12 d	10.03 b	31.39de	30.40de	27.39 de
	Sordan (79)	5.63de	8.64 b	29.44 e	28.43 e	25.44 e
	Sudangrass Giza (2)	4.89e	7.27 b	27.22 e	26.07 f	23.17 f

Table 24; Effect of the interaction between sowing dates and seeding rates on some characters of sorghum in 1981 and 1982 seasons.

Sowing dates	Seeding rates kg/ fad.	1981 Season		1982 Season	
		LAI at the 2 nd cut	Protein yield kg/ fad. 2nd cut	LAI at the 1 st cut	LAI at the 2 nd cut
17 th May	10	3.85 c	135.94 c	7.57 d	3.68 c
	15	4.90 b	151.80 b	9.49 b	4.71 b
	20	5.98 a	165.68 a	11.18a	5.74 a
1 st June	10	2.76 e	100.39 f	5.95 e	2.40 e
	15	3.50cd	122.79 d	7.23 d	3.76 c
	20	3.96 c	135.57 c	8.64 c	3.90 c
16 th June	10	2.51 e	90.68 g	5.54 e	2.18 ef
	15	3.22 d	100.96 f	5.54 e	2.82 e
	20	3.63 c	112.91 e	6.83de	3.37 cd
1 st July	10	1.68 f	69.60 l	3.36g	1.87 f
	15	2.07ef	80.15 k	4.42f	2.36 e
	20	2.43 e	90.75 g	5.18ef	2.82 e

season were significant. The effect of seeding rates were more clear when the sorghum plant sown late on July 1 st, whereas this effect decreased with earler sowing dates on May 17 th. The highest protein yield was obtained from higher seeding rate (20 kg/fad.) of sorghum plant at 2 nd cut when sown early on May 17 th , whereas, the lowest protein yield was obtained from 10 kg/fad. when sown late on July 1 st.

3. Effect of the interaction between varieties and seeding rates:

The results in Table (25) indicate that the effect of the interaction of varietiey and seeding rates on L.A.I and the number of stems/ m^2 was significant in 1981 season, while in the second season, the effect was significant on stem diameter, L.A.I. and the carbohydrate percentage of stems.

In 1981 season, the highest number of stems/m^2 as well as L.A.I. was obtained from Pioneer (988) and seeding rate 20 kg/fad. While the lowest number of stems/m^2 and L.A.I. was obtained from Sudan (2) and 10 kg/fad. (Table 25).

In 1982 season, the effect of the interaction on L.A.I. was similar as in the first season. On the other

Table 25: Effect of the interaction between varieties and seeding rates on some characters of sorghum in 1981 and 1982.

Varieties	Seeding rates kg/fad.	1981 Season		1982 Season		
		No. of Stems/ m^2	LAI	Stem diameter (mm)	LAI	Carbohdrate of stem %
Pioneer (988)	10	18.86 d	6.37 d	11.63 a	6.69 c	25.66 e
	15	21.90 b	7.45 c	10.70 b	8.20 b	27.63 c
	20	24.64 a	8.62 a	9.91 d	9.86 a	29.83 a
Sordan (79)	10	16.56 e	5.67 e	10.97 b	5.31 d	24.79 f
	15	18.48 d	6.73 d	10.52 bc	6.98 c	26.33 d
	20	20.11 c	7.89 b	9.80 d	8.43 b	28.58 b
Sudangrass Giza (2)	10	15.02 f	4.37 g	10.45 c	4.06 f	22.45 g
	15	16.32 e	5.02 f	10.00 d	4.84 e	25.50 e
	20	18.55 d	5.81 e	9.50 e	5.58 d	27.25 c

hand, the highest stem diameter was obtained from Pioneer (988) with the lowest seeding rate (10 kg/ fad.), whereas the lowest stem diameter was obtained from Sudan (2) and 20 kg seeds/fad. such effect was expected since varieties and seeding rates had significant effect on the number of stems/m^2.

4. Effect of the intraction between sowing dates, varieties and seeding rates:

The effect of the interaction of sowing dates, varieties and seed rate on the L.A.I. as well as protein yield was significantly at the first cut in 1981 season (Tables 26 and 27).

The highest L.A.I. as well as protein yield/fad. at the 1 st cut in 1981 season was obtained from Pioneer (988) when sown on May 17 th with the highest seeding rate (20 kg/fad.). On the other hand the lowest values from the two previous chatacters were obtained from Sudan (2) when sown late on July 7 st with the lowest seed rate (10 kg/fad.).

Table 26: Effect of the interaction between sowing dates, varieties and seeding rates on LAI at the first cut in 1981 season.

Seeding rates kg/fad. / Sowing dates	Pioneer (988)			Sordan (79)			Sudangrass Giza (2)		
	10	15	20	10	15	20	10	15	20
17 th May	9.16 a	10.89 c	13.20a	7.54e	10.33c	12.22b	6.02f	7.24 e	8.12 de
1 st June	7.36 e	8.90 d	10.63c	5.91f	7.63e	9.10d	4.58g	5.17 f	6.19 ef
16 th June	5.70 f	7.51 e	9.36d	4.77fg	5.50e	7.00e	3.16k	3.63 g	4.13 g
1 st July	4.56 g	5.50 f	6.26e	3.02k	4.53g	5.40f	2.50k	3.31gk	3.90 g

Table 27 : Effect of the interaction between sowing dates ,varieties and seeding rates on protein yield (kg/fad.) at the first cut in 1981 season.

Seeding rates kg/fad. / Sowing dates	Pioneer (988)			Sordan (79)			Sudangrass (2)		Giza
	10	15	20	10	15	20	10	15	20
17 th May	230.47 b	238.12 b	267.89 a	221.39c	229.00bc	265.26a	182.31de	193.93d	201.33 cd
1 st June	214.19 c	224.02 c	240.22ab	200.99d	216.22 c	220.90c	130.97g	177.68e	192.69 d
16 th June	172.25 e	185.20 d	199.93 d	147.14f	156.79 f	176.01e	124.20gk	145.04f	159.93 f
1 st July	129.14 g	148.89 f	171.20 e	122.54k	137.35fg	160.66ef	112.55k	129.59g	146.70 f