RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

A. First experiment:

"The performance of three new long spike wheat varieties under seven nitrogen levels"

The present investigation aimed to evaluate 3 wheat varieties under 7 N levels. The interaction between these two experimental factors is also considered.

I. Effect of wheat varieties and N-levels on some growth characters at 90 days from planting:

1. Effect of wheat varieties.

The combined analysis of data, listed in Table (6), indicate significant differences among the three studied wheat varieties as affected by nitrogen levels in all the studied growth characters, reflecting their different genetic background as follows.

1.1. Plant height (cm):

The tallest wheat variety (99.68cm) was Sids 7 compared with Sids 6 and Sids 8 wheat varieties, respectively. In this respect, **Abd El-Majeed et al. (1998)** observed that wheat cultivar Sids 6 was significantly higher in plant height as compared with Sids 7 bread and durum wheat cultivars in 4 locations at new lands in middle Egypt.

1.2. Number of leaves per plant:

Sids 7 cultivar significantly expressed the highest value (7.45) for this trait as compared with Sids 6 and Sids 8 cultivars, respectively. Similar results were obtained by **Roshdy (1988), Mahgoub (1990) and Shalaby et al. (1992).**

Table (6): Effect of wheat varities and N- levels on some growth characters at 90 days from plating (combined analysis of 1996/97 and 1997/ 98 seasons).

Characters / Treatments	Growth characters						Growth analysis				
							R. G. R.		N. A. R.		
	plant height (cm.)	No. of leaves/ plant	leaves dry weight/ plant (g.)	Stem dry weight/ plant (g.)	Plant dry weight (g.)	L.A.I.	90-100 day (mg/g/day)	100-110 day (mg/g/day)	90-100 day (mg/cm^2/ day)	100-110 day (mg/cm^2/ day)	S.L.W. mg/cm^2
	Varieties										
Sids 6	95.31	6.83	1.27	3.50	4.77	3.85	12.15	8.36	2.52	2.28	4.34
Sids 7	99.68	7.45	1.66	5.67	7.33	4.09	14.49	8.83	2.67	2.57	4.53
Sids 8	94.11	6.65	1.10	5.18	6.28	3.78	12.06	7.83	2.40	2.23	4.37
LSD (0.05)	1.85	0.31	N.S	0.33	0.57	0.10	0.38	0.61	0.08	0.22	N.S
	N- levels										
N1	83.64	5.87	0.48	3.52	4.00	3.23	6.94	5.99	1.77	1.52	3.79
N2	88.49	6.60	0.87	3.68	4.55	3.59	10.23	7.37	2.17	2.02	4.09
N3	91.29	6.88	1.15	3.87	5.02	3.79	11.97	7.99	2.37	2.31	4.39
N4	96.37	7.08	1.48	4.22	5.70	3.98	13.95	8.73	2.68	2.49	4.65
N5	103.33	7.36	1.73	4.55	6.28	4.17	15.83	9.28	2.89	2.76	4.74
N6	108.18	7.63	2.00	4.85	6.85	4.36	17.39	10.07	3.19	2.90	4.84
N7	114.10	8.14	2.14	5.24	7.38	4.64	18.38	10.70	3.36	3.10	4.95
LSD (0.05)	2.38	0.50	0.20	0.22	0.30	0.12	0.45	0.33	0.13	0.19	0.12

1.3. Dry weight of different plant organs (g.):

Also, the organized data in the same Table (6) elucidate that Sids 7 cv. surpassed that of Sids 6 followed by Sids 8 with regard to shoots dry weight/plant and plant dry weight which reached to 5.67 and 7.33 gm, respectively by using Sids 7. These results are in similar trend with **Eastham et al. (1984), Roshdy (1988), Shalaby** ***et al.*** **(1992), Ghanem et al. (1994) and Moselhy (1995)**. On the other side, the three studied wheat varieties in respect to leaves dry weight/plant.

1.4 leaf area Index (LAI):

Sids 7 cv. significantly expressed as the highest value (4.09) of this trait followed by Sids 6 and Sids 7 wheat varieties, respectively. In this respect, these differences variance among the studied wheat varieties may be due to germplasm differential response of wheat varieties to nitrogen fertilization under saline and normal conditions. The fending is in partial harmony with that obtained by **El-Gayar et al. (1984) and Moselhy (1995).**

1.5. Relative growth rate (RGR).

In the two periods (90-100 and 100-110 days from sowing), RGR was differed significantly by using the three studied wheat varieties. It is evident that Sids 7 had the highest RGR (14.49 and 8.83 mg/g./day at first and second periods, respectively) followed by Sids 6 and Sids 8, respectively. Whereas, RGR tended to decrease with the advance of growth from the first to the second period of growth. In this respect, **Biscoe et al. (1975)** explained this effect on the leasis of the increase of maintenance respiration which increased with advance of barley growth.

1.6. Net assimilation rate (NAR):

Net assimilation rate was significantly affected by using the three studied wheat varieties through the two periods (Table 6).

However, the increase in NAR reached its maximum value (2.67 and 2.57 mg/cm^2/day) by using Sids 7 at first and second period, respectively followed by Sids 6 meanwhile Sids 8 owns the minimum value. Also, NAR tended to decrease with the advance of growth (from 90-100 to 100-110 day from sowing). In this regard, the decrease of NAR observed herein, with the advance of growth from the first to the second period ascetains the findings of **Biscoe *et al.* (1975)** who indicated that the progressive increase of plant dry weight along with the increase of maintenance respiration with the advance of the season could account for each decrease in barley.

1.7. Specific leaf weight (SLW), mg/cm^2.

The recorded results in Table (6) show that there were not statistical significant variances among the three studied wheat varieties, i.e. Sids 6, Sids 7 and Sids 8 in regard to SLW.

It could be concluded that, Sids 7 cv. produced the highest values of RGR and NAR may be due to the increase in plant height dry matter content and LAI. Generally, Sids 7 cv. gave the highest values of growth characters, dry weight/plant, LAI, RGR and NAR compared with Sids 6 or Sids 8 cultivars.

2. Effect of nitrogen levels:

The combined data in Table (6) shows that gradually increased N-levels significantly increased wheat growth characters as follows:

2.1. Plant height (cm.).

According to the recorded results in the Table (6), its clearly that plant height of wheat was increased by increasing N-levels up to 100 kg N/fed. as soil application + urea 4% as foliar application treatment. The tallest plants (114.10 cm) were obtained by adding the aformentioned treatment. According to these results soil and folialr application of N increased photosynthatic capacity of wheat plants and thereby, affored them better dry matter partitioning towards stem elongation **(Milthorpe and Moorby, 1979).** The increase in plant height due increasing nitrogen levels could be attributed to the increase in internodes length since nitrogen encourages cell division and enlargement and lence the meristemic activity of the plant.

2.2. Number of leaves/plant:

The increase in N-level resulted in a significant increases in number of leaves/plant. The highest number of this trait (8.14) was obtained by adding 100 kg N/fed + urea 4% as foliar spray treatment. The data further indicate that foliar applied N was more effective than soil applied only in this respect. Similar trend was obtained by **Gabr (1988)** who reported that applied N through wheat foliage increased the number of leaves per wheat plants.

2.3. Dry weight of different plant organs (g.):

Data presented in Table (6) show that each N increment produced a significant increase in each of leaves, shoots, and plant dry weights of wheat plants. The highest weights were 2.14, 5.24 and 7.38g for leaves, shoots and plant dry weight, respectively such values were obtained by adding 100 kg N/fed + urea 4% treatment. It seems evident that N application through soil and foliage was more effective to increase dry weight of plant organs. These growth attributes could account for the increase obtained herein in plant top dry weight. Similar trend was obtained by **Abd El-Latif and El-Tuhamy (1986) and Sadek (1990)**. The increase in dry weight of plant may be due to the role of nitrogen in enhancing growth and thereby internode elongation number of leaves/plant in wheat was extensively reported by other, of them, **El-Bana (1991), Megahed (1991) and Darwiche (1994).**

2.4. Leaf area index (LAI):

Increasing N-levels from zero up to 100 kg N/fed + urea 4% treatment, resulted in an increases of LAI which reached to its maximum value (4.64) by adding the previous mentioned treatment. This increase of LAI are due to the increase in nitrogen application levels. It is a good manifestation of the role of this element in plant growth. Moreover, this effect is of great value on the expected productivity of wheat, since leaves plays an important role in photosyntheetic potentialities of wheat plants. Similar results were obtained by **Sadek (1990), Megahed (1991) , Darwich (1994) and Moselhy (1995).**

2.5. Relative growth rate (RGR).

Also, the organized data in Table (6) elucidate the effect of N-level application on RGR of wheat plants at the first period (90-100 day) and the second period (100-110 day) from sowing. The results shows that each increment of N-levels produced a significant increase in RGR. Moreover, the highest values were (0.450 and 0.333 mg/g/day) with regard to first and second periods, respectively by adding 100 kg N/fed + urera 4% treatment. Also, it seems evident that RGR tended to decrease with the advance of wheat growth from the first to the second period of growth. In this connection, **Biscoe et al. (1975)** explained this effect on the basis of the increase of maintenance respiration which was increased with advance of barley growth.

2.6. Net assimilation rate (NAR).

Concerning the two periods (90-100 and 100-110 days from sowing), the increase in N-level produced a significant increase in NAR. Since, the maximum values of this trait (3.36 and 3.10 mg/g/day) at the first and second periods, respectively were obtained by adding 100 kg N/fed + urea 4 % treatment. It is worth to mention that NAR took a trend of decrease with the advancement of wheat growth. However, the increase of NAR during the second period but relatively less than the first period might indicate that LAI took a greater trend of decrease with the advancement of growth due to leaf senescence. Certainly, the commence of grain filling at the end of the second period, could also account for the increase of NAR due to the increase of N-level during this period. In this respect, **El-Bana (1991) and Megahed (1991)** recorded significant increase in NAR of wheat plants due to the increase in N-level. Whereas, the decrease of NAR observed herein, with the advance of growth from the first to the second period as certain findings of **Biscoe *et al.* (1975)** who mentioned that the progressive increase of plant dry weight along with the increase of maintenance respiration with the advance of the season could account for such decrease in barley.

2.7. Specific leaf weight (SLW), mg/cm^2:

It is clearly seems that the increase in N-level from zero up to 100 kg N/fed + urea 4% treatment produced a significant increase in SLW. These data indicate that the increase of N-level was effective to improve leaf weight as expressed by a significant increase in SLW during the growth period. Since, the highest value of SLW (4.95 mg/cm^2) was obtained by adding 100 kg N/fed + (4% urea) treatment. The effect of increasing nitrogen level on SLW was also reported by **Gomaa (1983) and Megahed (1991).**

It could be concluded that, 100 kgN + 4% urea treatment had the highest values of plant height, number of leaves/plant, dry weight of different plant organs, LAI, RGR, NAR and SLW. However, the difference between 100 kgN/fed. and 100 kgN/fed. + 4% urea solution treatments/fed in number of leaves/plant, dry weight of leaves/plant and SLW were insignificant.

3.Interaction effect between wheat varieties and N-levels:

It must be notice that all the traits which did not reached to 5% levels of significant, did not recorded in the Tables. With another words, did not Tabled. Whereas, all the studied traits which affected significantly by the interaction between wheat varieties and N-levels in one or the two growing seasons were tabulated. Consequently, the data were excluded.

3.1. Plant height (cm.):

Data in Table (7) shows plant height at 90 days from planting as affected by the interaction between the three studied wheat varieties and N- levels in the first season only (1996/1997). It is evident that plant height was significantly affected by N-levels and wheat varieties. The tallest plants (117.64 cm.) was obtained by fertilizing Sids 7 wheat variety with 100 kg N/fed + (urea 4% as foliar spray) treatment. It is quite interesting to note that each increment of N by any wheat variety produced a significant increases in plant height but with different magnitudes. These results are in line with those obtained by **Roshdy (1988) and Abo-Shetaia and Abd El-Gawad (1995).**

3.2. Relative growth rate (R.G.R):

Table (7) show the interaction effect between wheat varieties and N- levels on relative growth rate in the first season only (1996/1997). The interaction effect of the two factors, affected significantly RGR at the first period only (90-100 day from sowing). The maximum RGR (19.58 mg/g/day) was obtained by adding 100kg N/fed. + (urea 4% af foliar spray) on Sids 7 wheat variety. The increase of RGR due to the icnrease in N-level for wheat varieties was also reported **by Aggarwal and Sinha (1987),**

Table (7): Interaction effect between wheat varieties and N- levels on plant height, RGR, and SLW in 1996/97 and 1997/ 98 growing seasons.

Treatments	N1		N2		N3		N4		N5		N6		N7	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
	Plant height (cm.)													
Sids 6	82.05		86.26		86.05		89.92		96.47		105.01		111.04	
Sids 7	86.13		86.29		89.97		96.62		109.61		111.90		117.64	
Sids 8	84.45		86.65		87.92		94.45		96.61		96.48		105.39	
LSD (0.05)	1st.: 5.36 2nd.: N.S													
	Relative growth rate (R.G.R.) after 90-100 days from sowing (mg/g./day)													
Sids 6	6.52		9.41		10.63		12.49		14.81		17.04		18.08	
Sids 7	7.79		11.97		14.32		16.03		17.79		18.52		19.58	
Sids 8	6.35		9.34		11.00		13.09		15.07		16.29		17.29	
LSD (0.05)	1st.: 0.64 2nd.:N.S													
	Specific leaf weight (SLW) mg/ cm^2													
Sids 6	3.75	3.87	3.94	4.13	4.15	4.25	4.44	4.66	4.49	4.74	7.64	4.86	4.76	4.93
Sids 7	3.79	3.81	4.25	4.47	4.61	4.74	4.70	4.80	4.79	4.87	4.87	4.88	4.99	5.14
Sids 8	3.72	3.81	3.91	3.86	4.04	4.41	44.64	4.68	4.79	4.77	4.91	4.89	4.91	4.93
LSD (0.05)	1st.: 0.18 2nd.: 0.24													

Shalaby et al. (1992), El-Kalla et al. (1994), and Abd El-Maboud (1996) who reported that RGR of growing wheat plants were increased due to the increase of nitrogen applications up to 100kg N/fed.

3.3. Specific leaf weight (SLW), mg/cm^2:

The data recorded in Table (7) indicate to superiority of interaction between Sids 7 wheat variety and application of 100kg N/fed. +(urea 4% as foliar spray) treatment (4.99 and 5.14 mg/cm^2) through the first and second seasons, respectively. These finding shows that increasing N-levels on wheat varieties exerted a stimulating effect on their SLW. These obtained results are Similar with those found by **Khattab et al. (1996) and Khattab (1998).**

II. Effect of wheat varieties and N-levels on total chlorophyll and proline contents and grain growth parameters.

1. Effect of wheat varieties

Total chlorophyll and proline contents at booting and milk ripe stages and grain parameters in the three wheat varieties as affected by N fertilization (Table, 8).

1.1. Chlorophyll and proline contents:

1.1.1. Chlorophyll content:

Significant differences were detected among the tested wheat varieties regarding total chlorophyll content at both booting and milk ripe stages (Table,8). Sids 7 wheat variety came at the first rank (43.28 and 47.06 mg/100 g D.M., respectively) followed by Sids 6 and Sids 8, respectively. In this connection, **Salama et al. (1994)** reported that at high salinity the degradation of chlorophyll was the same in wheat varieties lower in the salt tolerance than in

Table (8): Effect of wheat varieties and N-levels on total chorophyll and proline contents and grain growth parameters (Combined analysis of 1996/97 and 1997/98 seasons)

Characters / Treatments	Total chlorophyll content		Proline content		Grain filling rate (GFR) (mg/spike/ day)	Effective Grain filling period (EGFP) (days)
	at booting stage(mg/ 100g DM)	at milk ripe stage (mg/100g DM)	at booting stage (m. mol/L.)	at milk ripe stage (m.mol/L)		
	Varieties					
Sids 6	43.07	46.38	23.96	26.93	843.6	38.56
Sids 7	43.28	47.06	25.03	27.53	866.2	39.25
Sids 8	42.68	46.22	23.90	26.87	832.9	38.10
LSD (0.05)	0.26	0.29	0.72	0.41	17.78	0.23
	N- levels					
N1	40.90	44.62	28.46	30.96	752.9	36.89
N2	42.11	45.64	26.23	28.96	822.5	37.68
N3	42.88	46.25	25.01	27.78	902.6	38.25
N4	43.35	46.89	23.73	26.59	868.1	38.84
N5	43.97	47.40	22.42	25.28	883.8	39.44
N6	44.54	48.06	21.17	24.23	905.3	40.04
N7	44.92	48.53	19.96	22.99	916.4	40.68
LSD(0.05)	0.27	0.28	0.42	0.37	19.21	0.36

the sensitive wheat varieties. Similar data were obtained by **Ahmed (1995), Wiseman (1995) and Zoppo *et al.* (1999).**

1.1.2. Proline content.

Results in Table (8) indicated that there was a statistical significant difference among leaves of the three studied wheat varieties in proline concentration. These results were true at both booting and milk ripe stages. The maximum proline content was obtained by Sids 7 wheat variety (25.03 and 27.53 m.mol/L. at booting and milk ripe stages, respectively), followed by Sids 6 and Sids 8. In this respect, proline might act as an osmoregulator considered as an adaptive response to stress conditions **(Handa et al. , 1985 and Petal, 1991).**

1.2. Grain growth parameters:

Combined analysis showed significant differences among the studied three wheat varieties for grain growth parameters as shown in Table (8) as follows.

1.2.1. Grain filling rate (GFR):

The recorded data indicated that Sids 7 cv. gave the highest value for this trait (866.2 mg/spike/day) followed by Sids 6 and Sids 8 varieties, respectively. In this respect, the high capacity of the source to assimilate metabolites translocated to the developing organs (grains) in this variety might owe much to this phenomenon. Also, developing spikes of great number of grains, i.e. increasing the storage capacity of this sink. The well balance between source and sink in wheat plants might contribute much for increasing grain filling rate **(Daynard et al., 1971).**

1.2.2. Effective grain filling period (EGFP).

According to the recorded results in the same Table, it is noteworthy to mention that the effective grain filling period (EGFP) reached to the highest value (39.25 days) with Sids 7 wheat variety followed by Sids 6 and Sids 8, respectively. Such finding might be due to that different varieties were differed in the accumulation of dry matter at a more favourate rate than grain filling. These shows that incresing grain yield of wheat varieties depends on photosynthetic surface and the period during which photosynthesis prevails. The extent of stems and the number of grains/spike formed and late maturity tended to have a long grain filling period. Similar results were obtained by **Abd El-Gawad et al. (1985c) and Abd El-Ghany (1997).**

2. Effect of nitrogen levels:

2.1. Total chlorophyll and proline contents:

Data for total chlorophyll and proline contents in wheat leaves at booting and milk ripe stages are presented in Table (8).

2.1.1. Total chlorophyll content (mg/g. D.M.):

Total chlorophyll content was significantly increased by increasing N-levels from zero up to 100 kg N/fed + (urea 4% foliar spray) treatment at the two wheat growth stages. Since, the highest values of 44.92 and 48.53 mg/g. D.M. at booting and milk ripe stages, respectively were obtained by adding the previous mentioned treatment. Furthermore, the obtained results in the same table showed that chlorophyll content tended to increase with the advance of growth from booting to milk ripe stages. These results are in accordance with those obtained by **Ahmed (1995)** who revealed that increasing nitrogen application from zero up to 90 kg N/fed. gradually increased total chlorophyll content after 90 days from planting of wheat plants.

2.1.2. Proline content (m.mol/L.)

Data illustrated in Table (8) showed that the free prolien content in leaves of wheat plants at booting and milk ripe stages were gradually significantly decreased by adding N-levels from zero up to 100 kg N/fed. + (urea 4% as foliar application) treatment. In this connection, the highest values of proline contents were 28.46 and 30.96 m.mol/L. at booting and milk ripe stages, respectively by using control treatment (without nitrogen fertilization). According to the data recorded in the same Table, showed that the value of free proline contents were higher at milk ripe stage than at booting stage by the control treatment. Such increment in proline contents in control treatment (zero level of N) gradually increased the effect of salinity which had an increased significantly in free amino acids of wheat plants. In this respect, **Greenway and Munus (1980)** pointed out that many plant species at high salinity produced different amino acids and carbohydrates, to mitigate or prevent the loss of activity of several enzymes.

2.2. Grain growth parameters:

2.2.1. Grain filling rate (GFR), (mg/spike/day)

Data recorded in Table (8) shows the effect of N-levels on GFR. It is evident that each nitrogen increment from zero up to 100 kg N/fed. + 4% urea treatment produced significant increases in GFR which reached its maximum value (916.4 mg/spike/day) by adding the previous aforementioned treatment. Such increases indicates that the effect of nitrogen fertilization persisted and lasted up to grain filling stage. Also, this could be attributed to the significant increase observed in each of LAI, RGR and NAR (Table, 6) due each increase of N-level. In addition, it seems evident that added N particularly through foliage (urea 4%) enhanced rate of grain filling. Similar results were obtained by **Aly and El-Bana (1994)** who recorded that addition of 50 kg N/fed. increased GFR of wheat plants.

2.2.2. Effective grain filling period (EGFP) in days:

Also, it is clearly seems from the same Table that each increment of N-level increased EGFP. Since, 100 kg N/fed. + (4% urea solution) treatment tended to obtain the longest EGFP (40.68 days). Furthermore, it could be noticed that the effect of these treatment was more evident when nitrogen was applied through soil and foliar application. It watched that similar effect was observed in GFR (Table, 8) indicating that both were favoured by the increase of N fertilizer level. These increases could account for the increase previously observed in spike grain weight (Table, 8) and could be attributed to the increase of LAI. These results are in harmony with those obtained by **Aly and El-Bana (1994)** who found that the increase of N fertilizer level up to 75 kg N/fed. caused prolonged in EGFP of wheat plants.

3. Interaction effect between wheat varieties and N- levels:

3.1. Proline content (m.mol/L.):

According the results recorded in Table (9), indicated that proline content in leaves of wheat varieties was significantly affected with regrad to adding N-levels. These affected was obtained at botting stage for the 1^{st} season (1996/1997) only.

It was clearly noticed that proline content was gradually decreased significantly by adding N- levels over all the studied wheat varieties. In this respect, the lowest value (19.72 m.mol/L.) was obtained by Sids 8 wheat variety by adding 100kg N/fed. + (urea 4% as foliar spray) treatment. Whereas, the highest value (29.04 m.mol /L.) was obtained in leaves of Sids 7 wheat variety which did not exposed to N-level treatment (control) . Such increase in Proline content at the case of absence of N-application may be due to the high levels of salinity in both of soil and

Table (9): Interaction effect between wheat varieties and N- levels on proline content at booting stage 1996/97 season and effective filling period in 1996/1997 and 1997/98 seasons.

	N1		N2		N3		N4		N5		N6		N7	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
	Proline content at booting stage (m.mol/L.)													
Sids 6	27.19		25.19		23.97		23.03		21.94		21.04		20.22	
Sids 7	29.04		26.88		25.88		24.14		22.92		21.67		20.27	
Sids 8	24.65		26.03		25.04		23.73		22.38		20.74		19.72	
LSD (0.05)	1st.: 0.76 2nd.: N.S													
	Effective filling period (days)													
Sids 6	37.34	36.53	38.45	37.22	38.81	37.54	39.22	38.03	39.82	38.54	40.61	39.36	40.83	40.20
Sids 7	37.20	36.56	38.25	38.21	38.61	39.21	39.41	39.73	40.72	40.00	41.30	40.71	41.74	41.18
Sids 8	37.38	36.35	37.09	36.86	37.95	37.40	38.54	38.17	39.02	38.51	39.48	38.80	40.40	39.78
LSD (0.05)	1st.: 0.66 2nd.: 0.59													

irrigation water. The same findings were obtained by **Ellen (1990), Shalaby et al. (1992), El- Kalla et al. (1994), Ahmed (1995) and Moselhy (1995).**

3.2. Effective grain filling period (EGFP), days:

Data in Table (9) show the effective grain filling period (EGFP) as affected by the interaction between wheat varieties and N-levels at 1996/1997 and 1997/1998 growing seasons. The results showed that each increment of nitrogen on the three wheat varieties, i.e. Sids 6,7 and 8 increased EGFP. These increases were true over the two growing seasons. This period reached to its maximum as a days number of 41.74 and 41.18 days at first and second seasons, respectively by adding 100kg N/fed. + (urea 4% as foliar spray) treatment plus Sids 7 wheat variety. These increases could account for the increase previously observed in spike grain weight (Tables 8 and 10) and 1000-grain weight. Similar result were obtained by **Aly and El-Bana (1994)** who revealed that the increase of nitrogen application up to 50 kg N/fed to wheat varieties grown under sandy soil caused a significant increases in grain filling rate (GFR). whereas, 75 kg N/fed. tended to extend significantly the effective grain filling period (EGFP).

III. Effect of wheat varieties and N-levels on grain yield and yield components:

The effect of wheat varieties and N-levels on yield and its components, combined analysis of 1996/97 and 1997/98 growing seasons are shown in Table (10).

1. Effect of wheat varieties

Data of yield and yield components of Sids 6, 7 and 8 wheat varieties (combined analysis of 1996/97 and 1997/98 seasons) are presented in Table (10). Generally the studied traits were effected

Table (10): Effect of wheat varieties and N- levels on yield and yield components (combined analysis of 1996/97 and 1997/ 98 seasons).

Characters / Treatments	Yield components								Yield			
	Plant height (cm)	No. of spikes/ m^2	Spike length (cm.)	No. of spikelets / spike	No. of grains / spikelet	No. of grains /spike	Spike grain weight (g.)	1000-grain weight (g.)	Grain yield (Ton/Fed.)	Straw yield (Ton/Fed.)	Biological yield (Ton/Fed)	Harvest index (%)
	Varieties											
Sids 6	97.20	253.4	14.18	19.54	2.26	44.44	1.86	41.96	2.00	3.81	5.81	34.28
Sids 7	103.04	268.6	17.12	20.11	2.29	46.37	1.97	42.68	2.26	4.23	6.49	34.59
Sids 8	97.22	250.0	13.39	19.46	2.26	44.24	1.85	41.88	1.96	3.74	5.70	34.23
LSD (0.05)	2.36	3.00	1.00	0.34	N.S	1.13	0.05	0.20	0.06	0.12	0.17	N.S
	N- levels											
N1	84.37	212.6	7.55	18.36	2.10	38.60	1.53	39.85	1.37	2.83	4.20	32.54
N2	92.58	240.1	11.81	18.90	2.21	41.92	1.70	41.23	1.73	3.42	5.15	33.62
N3	96.30	252.0	13.73	19.29	2.27	43.80	1.82	41.79	1.92	3.74	5.66	34.05
N4	100.70	263.0	15.76	19.85	2.31	45.93	1.95	42.55	2.15	4.06	6.21	34.62
N5	105.30	274.3	17.90	20.36	2.34	47.94	2.06	43.14	2.36	4.39	6.75	35.07
N6	110.40	284.9	20.25	20.86	2.39	49.86	2.16	43.71	2.60	4.67	7.27	35.71
N7	115.20	303.0	22.90	21.34	2.42	51.70	2.29	44.46	2.91	5.11	8.02	36.30
LSD (0.05)	1.54	4.69	1.26	0.29	0.02	0.77	0.04	0.33	0.05	0.11	0.17	0.23

significantly. Whereas, number of grains/spikelet and harvest index were not affected significantly as follows:

1.1. Plant height (cm.).

The recorded results show that Sids 7 cv. had the highest plants (103.04 cm), and superior than those of Sids 6 and Sids 8 varieties, respectively. These results might be attributed to the differences in their genetical consitution. Also, these results are in harmony with those previously obtained by **Khattab et al. (1996) and Abd El-Ghany (1997).**

1.2. Number of Spikes/m^2

Sids 7 wheat variety exhibited significantly highest value (268.6) for this trait followed by Sids 6, by Sids 8 wheat varieties, respectively. This result are in harmony with those previously obtained by **Abo-Warda (1989), Ellen (1990) and Shams El-Din and El-Habbak (1992).**

1.3. Spike length (cm.)

With regarding to spike length, data revealed that Sids 7 cv. gave the highest value (17.12 cm.), meanwhile, Sids 6 and Sids 8 wheat varieties gave the lowest values as respect this trait. It is worthnoting that, the superiority of this genotype in this character could be attributed to the highest values of number of spikelets per spike. Similar results were previously obtained under saline conditions by **El-Gayar et al.(1985) and Hassan (1996).**

1.4. Number of spikelets/spike.

Also, as shown in Table (10), Sids 7 cv. had the highest number of spikelets/spike (20.11) of this trait, and surpassed that of Sids 6 and Sids 8 wheat varieties. It is evident that the superiority of Sids 7 may be attributed to the adaptation of its genetic genotype to Ras-Sudr conditions. Such results are in full agreement with those obtained by **El-Gayar et al. (1984), Hassan (1996), Abd El-Gahny (1997), Abo-Warda (1997) and Abd El-All (1999).**

1.5. Number of grains/spikelet:

Number of grains/spikelet were not significantly affected by using Sids 6, 7 and 8 wheat varieties as shown in Table (10). Sids 7 cv. produced the highest grain number per spikelet (2.29) and Sids 6 and Sids 8 cvs. gave the lowest numbers.

1.6. Number of grains/spike:

In regard to grains number per spike, Sids 7 wheat variety gave the highest value (46.37), but, Sids 6 and Sids 8 wheat varieties ranked as the second. These findings are confirmed by the results of spike length and number of spikelets/spike, where Sids 7 showed the highest value followed by Sids 6 and Sids 8. The present results are in line with those reported by **Basilious et al. (1992), Kheiralla et al. (1993) and Yousef and Hanna (1998).**

1.7. Spike grain weight (g.)

Also, the data presented in Table (10) indicate that Sids 7 wheat variety had the heaviest value (1.97 gm per spike), Sids 6 and Sids 8 possessed the second heaviest value. These results indicate that Sids 7 had the highest values each of grain weight and number of grains/spike as compared with Sids 6 and Sids 8, respectively. Such results are in full agreement with those obtained by **Khattab et al. (1996), Abd El-Ghany (1997), Abo-Warda (1997) and Sabry et al. (1999).**

1.8 1000-grain weight (g.)

The differences among the three studied wheat varieties regarding to 1000-grain weight reached the significant level. Sids 7 had the highest value (42.68g.) but, Sids 6 and Sids 8 gave the lowest 1000-grain weight. These results indicate the genetical genotype of Sids 7 variety are suitable and adapted for salinity and calcareous conditions. The present finding agree with those reported by **Abd-El-Ghany (1997), Abo-Warda (1997) and Sabry et al. (1999).**

1.9. Grain yield (Ton/fed).

Data recorded in the same Table showed that Sids 7 wheat variety had the maximum grain yield/fed. (2.26 Ton/fed) followed by Sids 6 and Sids 8 varieties. It is owrthy to mention that the superiority of Sids 7 wheat variety in this trait could be attributed to the high values of dry matter content, LAI, RGR, NAR, total chlorophyll and proline contents, GFR, effective grain filling period, number of spikes/m^2, number of spikelets/spike, number of grains/spike, spike grain weight and 1000-grain weight. These results are in harmony with those previously obtained by **Khattab et al. (1996), Abo-Warda (1997), and Abd El-All (1999)**.

1.10 Straw yield (Ton/fed).

Also, the results indicate that Sids 7 variety surpassed that of Sids 6 and Sids 8 varieties in respect to this trait, which reached to (4.23 Ton/fed). The superiority of Sids 7 in respect to straw yield/fed may be attributed to its highest values of each plant height, plant dry weight and number of plants/m^2. These findings are in agreement with those obtained by **Abd El-Ghany (1997), Abo-Warda (1997) and Abd El-All (1999).**

1.11 Biological yield (Ton/fed).

In respect to biological yield/fed., the data showed similar trend observed for grain and straw yields/fed. where Sids 7 variety had the highest value (6.49 ton/fed.) followed by Sids 6 and Sids 8 wheat varieties. Moreover, this superiority of Sids 7 attributed to the highest values for plant growth and dry matter content of yield and its component. These results are in accordance with those obtained by **Abd El-Ghany (1997), Abo-Warda (1997). Abd El-All (1999) and Sabry et al. (1999).**

Generally, all the studied characters of Sids 7 wheat variety were superior than those of Sids 6 and Sids 8 varieties. These results might be attributed to the differences in its genetical constitution. These results are in harmony with those obtained by **Khattab et al. (1996), Abd El-Ghany (1997) and Abd El-All (1999) and Sabry et al. (1999).**

1.12. Harvest index (%).

Data listed in Table (10), indicate insignificant differences due to harvest index (%) in all studied wheat varieties, i.e. Sids 6, 7 and 8 wheat varieties.

2. Effect of nitrogen levels:

Combined data in Table (10) show yield and yield components of wheat plants as affected by nitrogen fertilization:

2.1. Plant height (cm.):

It is clearly seen that wheat plants got taller with each increase in the level of N fertilization from zero up to 100 kg N/fed. + (4% urea solution) treatment, which produced the tallest plants (115.20 cm). Also, foliar application of 4% urea plus 100 kg N/fed treatment was more efficient than 100 kg N/fed. only as regard to enhancing internode elongation. These results confirm those reported by **Zeidan et al. (1975) and Saad et al. (1984),** as they showed that spraying urea (3%) at heading stage or urea in combination with Cu + Zn at tillering stage tended to increase wheat plant height. Similar results were obtained by **El-Gareib and El-Monoufi (1988) and Abd El-All and Bassiouny (1994).**

2.2. Number of spikes/m^2.

Data in Table (10) indicate that each N increment produced a significant increase in the number of spikes/m^2. This number got highest (303.00) when wheat plants received 100 kg N/fed. + (urea 4% as foliar application) treatment. Also, these data clearly indicate that foliar application (4% urea) in addition to soil application (100 kg N/fed) treatment was effective to increase this trait to get or reached maximum number, as compared with applied N as soil application only (100 kg N/fed.). Such increase could be attributed to the role of foliar N application in minimizing the rate of tiller senesence which is always observed due to shortage of soil or fertilizer N to meet the needs of the developing tillers **(Rawson and Donald, 1969)**. Also, several workers got increases in the number of spikes/m^2 of wheat plants due to addition of nitrogen **(Gabr, 1988; El-Bana, 1991; El-Bana and Ali, 1993 and Abd-Alla and Bassiouny, 1994).**

2.3. Spike length (cm):

Results presented in Table (10) showed that N application significantly induced longer spike length. Adding 100 kg N/fed. + (urea 4% as foliar spray) treatment induced the highest value of this trait (22.90 cm.) The results further indicate that, giving N particularly through foliage (urea 4%) was more effective in this respect. These results are in line with those obtained by **Aly and El-Bana (1994), Ahmed (1995) and Moselhy (1995)**. It is worthing to notice that nitrogen is an essential element for cereals and a good supply of its necessary to the vegetative growth of wheat plants and photosynthetic activity, and hence building longer spikes. In this regard, **Fayed et al. (1993)** found that spike length of wheat plants significantly increased with increasing N-fertilizer up to 80 kg N/fed.

2.4. Number of spikelets/spike:

Table (10) shows that the increasing N-level from zero up to 100 kg N/fed. + (urea 4% as foliar spray) treatment which produced the highest number of spikelets/spike (21.34). In this connection, spike elongation caused by each N increment, was reflected in more spikelet positions on spike rachis. Certainly, delay of terminal spikelet initiation and formation gave more chance for significant increase in the number of spikelets/spike. Similar increase in this trait was reported by others due to the increase in N fertilization for wheat, **Ellen (1990), Abd El-Ghany (1997) and Moustafa et al. (1997).**

2.5. Number of grains/spikelet:

The data in Table (10) clearly indicate that the increase in N-level from zero up to 100 kg N/fed. + (urea 4% as foliar spray) treatments were accompained by a significant increase in number of grains/spikelet. Also, these data clearly indicate that the increase of N-fertilizer level was more effective on floral fertility which reflect on grain development within spikelet (number an weight) with more magnitude than spikelet initiation. This might clearly indicate the more efficient effect of added N on increasing grain number within spikelet which reached its maximum number (2.42) by adding 100 kg N/fed. + (urea 4% as foliar spray) treatment as compared with N applied as soil application only. Since, addition of N particularly through foliage (urea 4%) was effective to increase floral fertility with spikelet and favoured the development of grains within spikelet. Similar results were obtained by **Abo-warda (1989), Ellen (1990), Ahmed (1995), Moselhy (1995) and Moustafa et al. (1997).**

2.6. Number of grains/spike:

Data in Table (10) show that each increment in N-level from zero up to 100 kg N/fed. + (urea 4% as foliar spray) treatment produced a significant increase in the number of grains/spike which reached to (51.70). Such increase could be attributed to the increases in the number of spikelets/spike and number of grains/spikelet. This increase could also be attributed to an increase in floral partiality and thereby the number of grains per spikelet and per spike. In this respect, **Saleh (1981)** indicated that applying N was effective to increase floral fertility of wheat plants. Also, Several workers **(Gabr, 1988; El-Bana, 1991; El-Bana and Aly, 1993 and Abd-Alla and Bassiouny, 1994)** reported that N increased the number of grains/spike due to the increase in the number of spikelets/spike.

2.7 Spike grain weight (g.):

The results presented in Table (10) indicated a significant effect of N-level on spike grain weight in the combined average. The heaviest spike grain weight (2.29 g.) was obtained by adding 100 kg N/fed. + (urea 4% as foliar application). Such increases could be attributed to the significant increase obtained in each number of grains/spike and 1000 grains weight as shown in the same Table. In this respect, several workers reported noticeable increase in grain weight/spike of wheat due to the increase in N fertilizer level to **Basillious and Abd El-Aleem (1992)** applied 120 kg N/fed., **Abo-Warda (1993)** applied 120 kg N/fed., **Abd El-Ghany (1997)** applied 90 kg N/fed. and **Moustafa, et al. (1997)** applied 150 kg N/fed. Furthermore, it is clearly seems that adding N partiality through foliage (urea 4%) was more effective than applying it through soil only. In this connection, **Gabr (1988)** found that late added N through foliage increased significantly grain weight/ spike of wheat plants.

2.8. 1000-grain weight (g.):

The recorded results organized in Table (10) shows that 1000-grain weight of wheat plants was significantly affected by adding N-levels. The highest value (44.46 g.) was recorded by adding 100kg N/fed. + 4% urea treatment. Also , it is clearly seems that each increase in N-level resulted in an increase in this trait. These data are in accordance with those reported by **Moselhy (1995), Abd El-Ghany (1997), Moustafa et al. (1997), Sabry et al. (1999) and Abo El-Ela (2001).** It is evident that, nitrogen application partiality of foliar spray (urea 4%) was more effective than it application through soil with the same rate. In this respect, **Zeidan et al. (1975) and Gabr (1988)** found that applied N through wheat foliage significantly increased 1000-grain wheat. On the other hand, **Abd El-All (1999)** showed no significant effect on 1000-Kernal weight in the combined average of three seasons as a result of adding N upto 150 kg N/fed.

2.9. Grain yield (Ton/fed):

Nitrogen levels had a significant increases in grain yield of wheat plants. Also, increasing nitrogen from zero up to 100 kg N/fed. + (urea 4% as foliar spray) treatment caused gradually increasing in this trait. The highest grain yield (2.91 ton/fed.) was increased by (1.54 Ton/fed.) over the control treatment. In this respect, it could be mentioned that the increase of grain yield mainly could be attributed to the increase in each of number of spikes/ m^2, number of grains/ spikes, grain weight/ spike and 1000-grain weight, as well as grain filling rate and effective grain filling period. In this regard, several workers got a significant increase in grain yield of wheat due to application of N up to 100 kg N/fed. **(El-Bana and Aly, 1993),** and 120 kg N/fed. **(Abd El-Latif and El-Tuhamy, 1986; El-Gharib and El-Monoufi, 1988; Abd–Alla and Bassiouny, 1994 and Abo Warda and Sadek 1998)**. Also, it is clearly noticed that giving nitrogen as soil and partial through wheat foliage (urea 4%) was more effective in this respect. Similar response was reported by others when they tried urea application through wheat foliage **(Zeidan et al., 1975, Srivastave and Mehrotra, 1981 and Gabr, 1988).**

It could be concluded that N is fundamentally needed for producing higher grain yield. Under the conditions of the experiment a level of 100 kg N+ 4% urea solution/fed treatment could be recommend on the overall average of the tested varieties.

The increase in the grain yield is mainly due to the beneficial effect of N on all growth and yield component characters namely, number of spikelets/spike, number of spikes/m^2. Also, a good supply of N increased vegetative growth and grain filling period, consequently, grain yield was increased.

2.10. Straw yield (Ton/fed):

The recorded results in Table (10) shows that, wheat straw yield/ fed. significantly increased and gradually by increasing N-level from Zero up to 100kg N/fed. + (urea 4% as foliar spray) treatments, which resulted in achieved the highest straw yield/fed. (5.11 ton/fed.), which increased by 180.56% as compared with the control treatment. It is worthy to mention that, the increase in straw yield is mainly due to the effect of nitrogen on plant height and dry weight of different plant organs and the other component characters. In this respect, **Gabr (1988), Aly and El-Bana (1994) and Abd–Alla and Bassiouny (1994)** mentioned that the increase of N-level up to 70, 100, and 120kg N/fed produced significant increase in wheat straw yield. In respective order, it could be mentioned that, the effect of applying N-levels was more pronounced when adding partiality N as foliar spray (urea4%) to each treatment through foliage, as compared with soil application only.

2.11. Biological yield (Ton/fed):

Data in Table (10) show that each increment of N-levels produced in increases of wheat biological yield/fed. The highest increase was 91.2% as compared with the control treatment, which obtained by adding 100kg N/fed. + (urea 4% as foliar spray) treatment which raised biological yield/fed. to the highest value (8.02 ton/fed.). This effect could be attributed to the increase obtained in each of grain and straw yields/fed. The increase in biological yield resulting from N application is mainly due to the positive effects of N on vegetative growth and grain formation, and consequently, the role of N as the most essential nutritive element for cereals is clearly demonstrated. In this respect, **Megahed (1991), El Bana (1991) and Moslehy (1995)** reported significant increases in wheat biological yield/fed. due to the increase in N-level up to 75, 70 and 90 kg N/fed., respectively. Other workers achieved the same trend **Abd El-Ghany (1997), Moustafa et al. (1997), Sabry et al. (1999) and Abou EL-Ela (2001)**. On the other hand, **Abd El-All (1999)** found that excessive N levels over 90 kg N/fed. negatively effected biological yield.

2.12. Harvest index (%):

Data presented in Table (10) showed that harvest index (%) was significantly increased by increasing N-levels up to 100kg N/fed. + (urea4% as foliar spray) treatment. At this level, harvest index increased by 11.6% as compared with the control treatment. This mean that the highest harvest index was 36.30% which obtained by the of mentioned treatment. In this respect, the increases of harvest index by increasing N-levels could be attributed to raising the ratio between grain yield/fed., its components and biological yield/fed. In this connection, many investigators reported significant increasing affects for increases nitrogen application on wheat harvest index i.e. **Abo- Warda (1993), Moselhy (1995), Abd El-Ghany (1997), Moustafa et al. (1997), Sabry et al. (1999) and Abou El-Ela (2001).**

3. Interaction effect between wheat varieties and N-levels:

3.1. Plant height (cm.):

Data in table (11) shows the interaction effect between the tested wheat varieties and N-levels on plant height at 1996/1997 and 1997/1998 growing seasons. it is clearly evident that in both seasons, wheat varieties x N-levels interacted significantly and consistently plant height. The tallest plant (119.88 and 118.01cm) for first and second season, respectively were obtained from treated Sids 7 wheat variety with 100kg N/fed. + (urea 4% as foliar application) treatment. These results are in similar with the obtained by **Shalaby et al. (1992) and Abd El-Majeed et al. (1998).**

3.2. Number of spikes/m^2:

The data illustrated in Table (11) indicate clearly that number on spikes/m^2 were increased significantly and consistently with increasing levels of N-fertilizer on the three studied wheat varieties at the second season only. The maximum number (323.00) was obtained by Sids 7 wheat variety plus 100kg N/fed + (urea 4% as foliar spray) treatment as compared with the other interaction treatments. These results are in harmony with those obtained by **Abo-Warda (1989) and Ibrahim and Abd- El All (1991).**

3.3. Spike length. (cm.):

Table (11) shows the interaction effect between the three wheat varieties and N-levels on spike length of wheat plants. It is clearly to notice that in both seasons this interaction affected significantly and consistently spike length. The highest value of

Table (11): Interaction effect between wheat varieties and N- levels on yield and yield component in 1996/97 and 1997/ 98 growing seasons.

N-levels	N1		N2		N3		N4		N5		N6		N7	
seasons	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
	Plant height (cm.)													
Sids 6	86.88	83.84	92.33	89.68	94.94	92.16	99.06	95.30	103.36	99.89	102.12	106.00	115.45	111.98
Sids 7	85.46	84.63	96.02	94.99	101.97	100.25	108.36	105.30	111.84	109.70	116.95	113.21	119.88	118.01
Sids 8	84.01	81.40	92.29	90.19	95.06	94.30	97.94	98.23	103.70	103.39	109.79	107.49	114.56	111.33
LSD (0.05)	1st.: 2.74 2nd.: 2.77													
	Number of spikes/ m^2													
Sids 6		200.0		235.1		247.6		261.8		277.3		283.2		306.3
Sids 7		217.9		256.9		273.0		283.1		294.1		309.8		323.0
Sids 8		207.6		229.9		242.1		254.6		267.5		288.5		310.8
LSD (0.05)	1st.: N.S 2nd.: 8.98													
	Spike length (cm.)													
Sids 6	7.64	7.18	12.33	10.85	15.08	11.92	14.37	14.66	15.90	15.53	18.71	17.25	22.74	21.27
Sids 7	8.19	7.69	14.40	12.82	15.67	15.31	20.66	18.85	23.90	21.67	23.20	23.28	24.34	24.40
Sids 8	7.02	7.61	10.65	9.84	12.88	11.53	13.73	12.30	15.78	14.66	20.42	18.68	23.23	20.65
LSD (0.05)	1st.: 2.5 2nd.: 1.84													
	Number of spikelets / spike													
Sids 6		1.49		1.65		1.76		1.83		1.94		2.03		2.12
Sids 7		1.51		1.74		1.87		1.99		2.12		2.21		2.34
Sids 8		1.49		1.66		1.75		1.85		1.92		2.02		2.11
LSD (0.05)	1st.: N.S 2nd.: 0.05													

Table (11): Cont.

N-levels	N1		N2		N3		N4		N5		N6		N7	
seasons	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
	Spike grain weight (g.)													
Sids 6		1.49		1.65		1.76		1.83		1.94		2.03		2.12
Sids 7		1.51		1.74		1.87		1.99		2.12		2.21		2.34
Sids 8		1.49		1.66		1.75		1.85		1.92		2.02		2.11
LSD (0.05)	1st.: N.S 2nd.: 0.05													
	Grain yield (Ton/Fed.)													
Sids 6	1.41	1.25	1.72	1.62	1.88	1.83	2.09	2.02	2.34	2.26	2.57	2.41	2.93	2.73
Sids 7	1.51	1.38	1.85	1.88	2.10	2.14	2.40	2.36	2.62	2.62	2.87	2.88	3.14	3.18
Sids 8	1.35	1.29	1.74	1.60	1.86	1.78	2.06	1.98	2.25	2.15	2.42	2.44	2.74	2.76
LSD (0.05)	1st.: 0.09 2nd.: 0.09													
	Straw yield (Ton/Fed.)													
Sids 6		2.61		3.20		3.58		3.83		4.21		4.38		4.84
Sids 7		2.85		3.71		4.08		4.37		4.77		5.13		5.50
Sids 8		2.68		3.16		3.45		3.76		3.99		4.42		4.87
LSD (0.05)	1st.: N.S 2nd.: 0.19													
	Biological yield (Ton/Fed.)													
Sids 6	4.33	4.86	5.14	4.83	5.54	5.41	6.06	5.85	6.72	6.48	7.20	6.79	8.08	7.58
Sids 7	4.66	4.24	5.50	5.59	6.12	6.23	6.87	6.77	7.44	7.39	7.95	8.02	8.58	8.68
Sids 8	4.16	3.98	5.21	4.76	5.50	5.23	6.01	5.74	6.48	6.15	6.87	6.87	7.65	7.64
LSD (0.05)	1st.: 0.29 2nd.: 0.28													

spike length (24.34 and 24.40 cm.) at 1st and 2nd season, respectively, were obtained by adding 100 kg N/fed + (urea 4% as foliar spray) on Sids 7 wheat plants treatments. These results are in harmony with those obtained by **El-Ashmoony (1990), Ellen, (1990) and Sabry et al. (1999).**

3.4. Number of spikelets/ spike:

Data presented in Table (11) reflect the significant effect of the interaction between the three wheat varieties and N-levels on the number of spikelets/spike at the second season only. It could be clearly noticed that this trait reached to its maximum number (2.34) by adding 100kg N/fed. + (urea 4% as foliar spray) to Sids 7 wheat variety treatment. These results are in similar with obtained by **Abd El-Ghany (1997) and Azza Abd El-All (1999) and Sabry et al. (1999).**

3.5. Spike grain weight (g.):

Data on spike grain weight of the interaction between the studied wheat varieties and N-levels are presented in Table (11). This trait was affected significantly with the interaction between the studied factors at the second season only. It is worthnoting that the heaviest grain weight in spike (2.34 g.) was obtained by treated Sids 7 wheat variety with 100kg N/fed. + (urea 4% as foliar spray). These results are in similar trend with of **Mahgoub (1990), Ellen (1990), Shalaby et al. (1992) and El-Kalla et al. (1994).**

3.6. Grain yield (Ton/fed):

Grain yield/fed showed significant differences due to the interaction effect between wheat varieties and N-levels in the two seasons (Table, 11). The highest grain yield/fed (3.14 and 3.18 ton/fed) for the first and second seasons, respectively were obtained by treated Sids 7 wheat variety with 100kg N/fed + urea 4% as foliar application. Similar results were reported by **Ellen (1990), Shalaby et al. (1992), El-Kalla et al. (1994) and Moselhy (1995).**

3.7. Straw yield (Ton/fed):

The recorded results of straw yield/fed. as affected by the interaction between wheat varieties and N-levels are shown in Table (11). The differences among the interaction treatments, regarding this trait reached the significant levels through the second season only. Sids 7 wheat variety with 100kg N/fed. + urea 4% as foliar application treatment gave the highest straw yield/fed. (5.50 Ton/fed.). The present findings agree with those recorded by **Shalaby et al. (1992), El-Kalla et al (1994) and Abd El-Maboud (1996).**

3.8. Biological yield (Ton/fed):

The data presented in Table (11) indicate significant effect between wheat varieties and N-levels. The heaviest biological yield (8.58 and 8.68 Ton/fed) at first and second season, respectively were produced from Sids 7 wheat variety as received 100kg N/fed. + (urea 4% through foliage) treatment. The present results are in line with those reported by **Ellen (1990), Shalaby et al. (1992), El-Kalla et al. (1994) and Ahmed (1995).**

IV. Effect of wheat varieties and N-levels on chemical contents and some technological properties:

Chemical analysis of the oven dry and ground samples was done for N, P, K, and Na, percentages in grain and straw. Presented data of the analysis and determination were on dry matter basis. Results and discussion will be presented for chemical composition in grain and straw and total carbohydrate content, wet and dry glutein content in wheat flour (%).

The effect of wheat varieties and N-levels on chemical content and some technological properties, combined analysis of both seasons are shown in Table (12).

1. Effect of wheat varieties on:

1.1. Nitrogen content (%).

Nitrogen content in both grains and shoots were significantly affected by using Sids 6, 7 and 8 wheat varieties, (Table, 12). However, the highest values (2.49 and 0.65 in grain and straw, respectively) were observed in Sids 7 genotype followed by Sids 6 and Sids 8 wheat varieties, respectively . The magnitude of such increments may be due to the true that nitrogen plays a role in raising salt tolerance of wheat plants. These results are in similar trend with of **Mahmoud et al. (1993) and Saleh and El-Faham (1993), Ahmed (1995) and El-Bagoury et al. (1998).**

1.2. Phosphorus content (%)

The results reported in Table (12) show that the increases in phosphorus content in both grains and straw among Sids 6, 7 and 8 wheat varieties did not reach to 5% level of significance.

1.3. Potassium content (%)

Data for potassium contents in grain and straw of the three studied wheat varieties presented in Table (12). Potassium contents in grains and straw were significantly affected. However, the highest values were obtained by using Sids 7 wheat cultivar, i.e. 0.372 and 0.377% in grains and straw, respectively followed by Sids 6 and Sids 8, varieties, respectively. The magnitude of such contents may be attributed to the true that potassium play a role in raising salt tolerance of wheat plants. Such results is in full agreement with those obtained by **Fernandez (1984), Mahmoud et al. (1993) and Ahmed (1995).**

Table (12): Effect of wheat varieties and N- levels on chemical content and some technological properties (combined analysis of 1996/97 and 1997/ 98 seasons).

Characters / Treatments	Grain nitrogen content (%)	Straw nitrogen content (%)	Grain phosphorus content (%)	Straw phosphorus content (%)	Grain Potassium content (%)	Straw Potassium content (%)	Grain Sodium content (%)	Straw Sodium content (%)	Total car bohydrate content (%)	Wheat flour wet glut lin (%)	Wheat flour dry glut lin (%)
						Varieties					
Sids 6	2.34	0.614	0.266	0.157	0.369	3.65	0.141	0.280	70.86	33.04	14.06
Sids 7	2.49	0.650	0.273	0.159	0.372	3.77	0.150	0.286	71.24	33.30	14.16
Sids 8	2.27	0.600	0.266	0.160	0.356	3.63	0.144	0.283	70.77	33.20	14.05
LSD (0.05)	0.089	0.021	N.S	N.S	0.009	0.09	N.S	N.S	0.13	N.S	N.S
						N- levels					
N1	1.94	0.480	0.240	0.133	0.341	3.14	0.172	0.294	68.51	31.32	12.84
N2	2.15	0.561	0.256	0.147	0.353	3.51	0.162	0.291	70.08	32.58	13.46
N3	2.38	0.607	0.264	0.153	0.361	3.63	0.157	0.288	70.78	32.95	13.78
N4	2.48	0.666	0.273	0.162	0.368	3.76	0.151	0.285	71.19	33.59	14.46
N5	2.59	0.695	0.279	0.168	0.377	3.92	0.142	0.282	71.49	33.91	14.76
N6	2.68	0.718	0.291	0.175	0.383	3.99	0.135	0.277	72.67	34.50	15.04
N7	2.74	0.732	0.298	0.178	0.393	4.12	0.117	0.272	72.99	34.85	15.37
LSD (0.05)	0.08	0.020	0.004	0.003	0.014	0.09	0.007	0.001	0.22	0.22	0.14

1.4. Sodium content (%).

The obtained results in the same Table showed that there were no significant differences among the three studied wheat varieties, i.e. Sids 6, 7 and 8 in respect to sodium % in both grains and straw.

1.5. Total carbohydrate content in grains (%).

The data show that total carbohydrate content in grains of wheat varieties: Sids 6, 7 and 8 were significantly affected (Table, 12). The highest value of this trait (71.24%) were obtained with Sids 7 wheat variety followed by Sids 6 and Sids 8, respectively. In this respect, the increase in carbohydrate under salt stress in some wheat varieties might be attributed to that the available carbohydrates can not be translocated and utilized because of deficiency in ATP. This deficiency may results from lower inorganic phosphate intake under salinity **(Mass and Nieman, 1978)** or from the use of ATP from salt transport and storage vocuoles **(Munns and Termeat, 1986).**

1.6. Wet and dry glutein content in wheat flour (%)

Table (12) shows that there were not statistically significant differences among the three studied wheat varieties (Sids 6, 7 and 8) in respect to flour wet and dry glutein contents. The results are in accordance with those reported in the literature **(Abo El-Seud, 1987 and El-Bagoury *et al.*, 1998).**

2. Effect of nitrogen levels:

2.1. Nitrogen content (%):

The grain and straw N contents were significantly affected by N- level fertilization. It is evident from Table (12) that grain and straw N contents of wheat plants were significantly and gradually increased by increasing N- rates from zero up to 100 kg N/fed + (urea 4% as foliar spray) treatment. This treatment recorded the highest values (2.74 and 0.732%) of grain and straw N contents, respectively. These results may be due to the nitrogen translocation efficiency took almost an apposite direction to the grain and straw of wheat plants. In this respect, under semi-arid conditions, **Alessi and Power (1973)** found that N content and its uptake by wheat plants were increased when N was applied. Also, Similar results were obtained by **Mahmoud et al. (1993), Ahmed (1995), El-Tilib et al. (1995), Moselhy (1995) and El-Bagoury et al (1998).**

2.2. Phosphorus content (%):

Data illustrated in Table (12) showed that P content in grain and straw of wheat plants were gradually and significantly increased by increasing N-rates from zero up to 100kg N/fed. + (4% urea as foliar spray) treatment. The last treatment produced the greatest P contents (0.298% and 0.178%) in grain and straw of wheat plants, respectively. In this respect, **El-Bagoury et al. (1998)** pointed out that increasing nitrogen application from 40 to 120 kg N/fed. for Sakha 8 and Sakha 92 wheat varieties gradually and significantly increased phosphorus content in wheat plants. Similar results were obtained by **Mahmoud et al. (1993), Ahmed (1995), El-Tilib et al. (1995) and Moselhy (1995).**

2.3. Potassium content (%)

According to the data obtained in Table (12), there were significant increases in potassium content in both grain and straw of wheat plants as affected by adding N- levels from zero up to 100kg N/fed +(urea 4% as foliar spray). This treatment (N 7) produced the highest values (0.393 and 4.12%) in grain and straw of wheat plants, respectively, These results further indicate that applying N partially (urea 4%) through foliage to soil N application with the same treatment was most effective in these percentages as compared with N as soil application only. Similar results were obtained by **Mahmoud et al. (1993), Ahmed (1995), El-Tilib et al. (1995), and Moselhy (1995).**

2.4. Sodium content (%):

Data presented in Table (12) show that sodium content in each of both grain and straw of wheat plants were significantly decreased by increasing nitrogen application from zero up to 100kg N/fed + (urea 4% as through foliage) treatment. On the reverse, this treatment caused the lowest sodium values (0.117 and 0.272%) in grains and straw of wheat plants, respectively. In this respect, the decrease of plant sodium % due to increasing nitrogen addition, may be due to the competition between sodium and other elements (i.e. potassium) on the soil exchange complex as well as compression on exchange sites of roots account for plant sodium decrease. These findings are in agreement with those by **Mahmoud et al. (1993), Ahmed (1995), El-Tilib et al. (1995) and Moselhy (1995).**

2.5. Total Carbohydrate content in grains (%):

It is evident from Table (12) that increasing N-levels from zero up to 100/kg N/fed + (urea 4% as foliar application) treatment produced gradually and significantly increase in total carbohydrate content in wheat grains. The last treatment (N 7) resulted in the highest value (72.99%) of this trait. It was mentioned that such nitrogen fertilization increased each of LAI, RGR, NAR and SLW. Since, wheat grains, as all cereals is mainly filled by current assimilates (Austin et al., 1977), the increase of LAI with the increase in NAR all together acted to increase the rate of grain filling, as well as its effective period. Also, it could be mentioned that the increase in grain carbohydrate content due to foliar N addition partially (urea 4%) with soil N application obtained the higher carbohydrate contents as compared with N soil application only. The more effect of nitrogen in this respect was mentioned by **Below et al. (1981)** who indicated the importance of nitrogen role in maintaining hormonal balance in maize grain which in turn increased its carbohydrate and protein storage capacity. Similar results were obtained by **El-Bagoury et al. (1998)** which revealed that increasing N-levels up to 120 kg N/fed. on gave the highest value of carbohydrate content in grains of two wheat varieties.

2.6. Wet and dry glutein content in wheat flour (%):

Data illustrated in Table (12) showed the effect of N-level applications on wet and dry glutein content in wheat grains. It is evident that increasing N-level from Zero up to 100kg N/fed + (urea 4% as foliar spray) treatment. This treatment resulted in the highest value (34.85 and 15. 37%) of wet and dry glutein, respectively. In this connection, **El-Bagour et al. (1998)** pointed out that increasing nitrogen application from 40 to 120kg N/fed. on Sakha 7 and Sakha 92 wheat varieties gradually and significant increased wet and dry glutein contents in wheat flour. Also, these results could be attributed to an improvement in wheat plant growth by increasing each of LAI, RGR, NAR, GFR, and EGFP. Similar results were obtained by **Austin et al. (1977) and Below et al. (1981)**. It could be concluded that the treatment of 100 kg N + 4% urea solution/fed produced the highest values of grain yield and grain quantity in this soil.

3. The interaction effect between wheat varieties and N-levels:

3.1. Grain phosphorus content (%):

Table (13) shows the interaction effect between the tested wheat varieties and N-levels on grain phosphorus content. It is clearly evident that in the first season only, this trait was

Table (13): Interaction effect between wheat varieties and N- levels on chemical content and some technological properties in 1996/97 and 1997/ 98 growing seasons.

N-levels	N1		N2		N3		N4		N5		N6		N7	
seasons	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
	Grain phosphorus content (%)													
Sids 6	0.240		0.251		0.261		0.273		0.277		0.289		0.293	
Sids 7	0.241		0.258		0.264		0.272		0.280		0.293		0.308	
Sids 8	0.240		0.263		0.270		0.275		0.280		0.287		0.290	
LSD (0.05)	1st.: 0.015 2nd.: N.S													
	Grain potasium content (%)													
Sids 6		0.343		0.361		0.368		0.376		0.382		0.388		0.403
Sids 7		0.344		0.360		0.368		0.375		0.387		0.399		0.409
Sids 8		0.343		0.349		0.350		0.357		0.364		0.364		0.372
LSD (0.05)	1st.: N.S 2nd.: 0.055													
	Straw sodium content (%)													
Sids 6	0.293	0.294	0.292	0.292	0.288	0.286	0.285	0.286	0.280	0.285	0.277	0.274	0.272	0.272
Sids 7	0.301	0.304	0.294	0.296	0.293	0.291	0.884	0.288	0.282	0.286	0.276	0.281	0.274	0.274
Sids 8	0.293	0.294	0.293	0.290	0.286	0.286	0.284	0.285	0.277	0.283	0.278	0.277	0.271	0.273
LSD (0.05)	1st.: 0.091 2nd.: 0.042													

Table (13): Cont.

N-levels	N1		N2		N3		N4		N5		N6		N7	
seasons	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
	Total carbohydrate content in grain (%)													
Sids 6	68.24		69.75		70.71		71.20		71.80		72.79		72.89	
Sids 7	68.53		70.71		71.43		71.78		72.68		73.09		73.38	
Sids 8	68.54		69.79		70.59		70.79		71.87		72.79		72.90	
LSD (0.05)	1st.: 0.33 2nd.: N.S													
	Wet glutein content in wheat flour (%)													
Sids 6	31.24		32.29		32.73		33.43		33.87		34.32		34.83	
Sids 7	31.19		32.50		33.35		33.80		34.24		34.79		34.99	
Sids 8	31.39		32.90		33.05		33.62		33.92		34.35		34.80	
LSD (0.05)	1st.: 0.04 2nd.: N.S													

significantly affected with regard to this interaction. The highest grain phosphorus content (0.308%) was obtained by treated Sids 7 wheat variety with 100kg N/fed + (urea 4% as foliar spray) treatment. These finding are confirmed by the recorded results by **Ellen (1990), Shalaby et al. (1992), Ahmed (1995), and Moselhy (1995).**

3.2. Grain Potassium content (%):

In respect to grain potassium content, the data recorded in Table (13) showed similar trend observed for the interaction effect between wheat varieties and N-levels no grain phosphorus content. Sids 7 wheat variety fertilized by 100kg N/fed +(urea 4% as foliar spray) treatment gave the highest value (0.409%) in the second season only. In this respect **Ahmed (1995) and Moselhy(1995)** reached similar conclusion. Also, **El-Bagoury *et al.* (1998)** pointed out that increasing N application from 40 to 120 kg N/fed. for Sakha 8 and Sakha 92 cvs. gradually and significantly increased P and K percentages in wheat plants.

3.3. Straw sodium content (%):

As shown in Table (13) the interaction between wheat varieties and N-levels interaction treatments had a significant effect on straw sodium content through the first and second growing seasons.

However, the straw sodium content in both seasons took an opposite direction, which significantly decreased by increasing N-levels on the three wheat varieties. The highest values (0.301 and 0.304%) were obtained by the unfertilized treatment of Sids 7 at first and second season, respectively, whereas, the lowest values (0.271, and 0.272%) were obtained by treated Sids 8 and Sids 6 varieties with 100kg N/fed. + (urea 4% as foliar spray) at first and second season, respectively. Similar results were obtained by **Ellen (1990), Shalaby et al. (1992), Ahmed (1995) and Moselhy (1995).**

3.4. Total carbohydrate content in grains (%):

Table (13) shows that increasing nitrogen application on the three studied wheat varieties, gradually and significantly increased total carbohydrate in grains, these results was true through the first season only. It could be noticed that the maximum value (73.38%) was obtained by adding 100kg N/fed. + (urea 4% through foliage) on Sids 7 variety which superior than Sids 8 and Sids 6 wheat varieties, respectively. The same trend was obtained by **Ahmed (1995) and Moselhy (1995).**

3.5. Wet glutein content (%):

Significant (wheat varieties x N-levels) interaction effects were detected on wet glutein content in wheat grain (Table, 13). Whereas, the highest content (34.99%) was produced from treated Sids 7 wheat variety with 100kg N/fed + (urea 4% through foliage) treatment in the first season only. These results are in accordance with those obtained by **El-Kalla et al. (1994), Ahmed (1995), and Khodier et al. (1999).**

B- Second experiment:

"Effect of irrigation intervals, wheat varieties and plant antitranspirants on growth characters, yield and its qualiy of three wheat varieties"

This research was designed and implemented to study the effect of four irrigation intervals (every 7, 14 and 21 days and common irrigations), three plant antitranspirations (tap water, vapor gard and Nu-film) on growth, yield and yield components and grain chemical contents of three wheat varieties (Sids 6,7 and 8). Resutls of the studied characters will be presented and discussed on the basis of the combined analysis of the two growing seasons (1997/98 and 1998/99). Results will be discussed in the following order:

I. Growth characters and growth analysis:

1. Effect of irrigation intervals.

Results in Table (14) represent the effect of irrigation intervals on some growth characters of three wheat varieties at 90 days from planting and some growth analysis combined over the two growing seasons.

Increasing irrigation intervals from 7-day to 14-day and 21-day caused a significant continuous effect in most wheat growth characteristics and growth analysis.

1.1. Plant height:

Results in Table (14) showed that the time exposed between the subsequent irrigation increased from 7 to 14 day, plant height of wheat increased by 5.2%. On the other hand, prolonging the time between the subsequent irrigations up to 21 days significantly decreased plant height by 1.01% over 7-day interval. Similar results were also obtained by **Talukder (1987), Shalaby et al. (1992), Mourad et al. (1993) and El-Kalla et al. (1994)**

1.2. Number of leaves/plant:

The results in Table (14) showed that irrigation intervals affected number of leaves/ plant in the combined average. The four irrigation intervals were not significant.

1.3. Dry weight of different plant organs:

The results in Table (14) showed that prolong the time elapsed between the subsequent irrigations caused a significant effect in dry weight of leaves, shoots and total plant of wheat at 90 days from planting in the combined average of both seasons. In general biweekly irrigated (every 14 days) produced the highest dry

Table (14): Effect of irrigation intervals, wheat varieties and plant antitranspirants on some growth charaeters at 90 days from planting, RGR, NAR and SLW (combined analysis of 1996/97 and 1997/ 98 seasons).

Characters / Treatments	Growth characters					Growth analysis					
							R. G. R.		N. A. R.		
	plant height (cm.)	No. of leaves/ plant	leaves dry weight/ plant (g.)	Shoots dry weight/ plant (g.)	Plant dry weight (g.)	L.A.I.	90-100 day (mg/g/day)	100-110 day (mg/g/day)	90-100 day (mg/cm^2/ day)	100-110 day (mg/cm^2/ day)	S.L.W. mg/ cm^2
Irrigation intervals											
7 days	88.12	7.65	0.865	3.33	4.19	3.70	16.81	11.71	3.73	2.86	4.31
14 days	92.74	7.93	0.876	3.45	4.33	4.13	17.18	12.25	4.05	3.09	4.61
21 days	87.10	7.75	0.854	3.45	4.30	3.65	16.28	11.55	3.73	2.82	4.30
Common Irri-	89.04	7.89	0.867	3.39	4.26	3.76	16.95	11.69	3.88	2.92	4.37
LSD (0.05)	0.460	N.S.	0.011	0.01	0.01	0.22	0.35	0.38	0.14	0.13	0.06
Varieties											
Sids 6	89.05	7.71	0.860	3.37	4.23	3.73	16.62	11.67	3.80	2.92	4.35
Sids 7	89.82	8.28	0.889	3.50	4.39	4.07	17.60	12.45	4.12	3.09	4.50
Sids 8	88.88	7.54	0.852	3.34	4.19	3.62	16.20	11.29	3.65	2.76	4.35
LSD (0.05)	0.36	0.17	0.012	0.06	0.06	0.18	0.20	0.37	0.13	0.12	0.05
Antitranspirants											
Tap water	87.26	6.96	0.849	3.30	4.15	3.58	15.91	10.74	3.66	2.73	4.31
Vapor gard	89.41	8.59	0.880	3.47	4.35	4.14	17.85	12.90	4.16	3.20	4.49
Nu-film	91.08	7.98	0.872	3.45	4.32	3.71	16.65	11.29	3.76	2.85	4.40
LSD (0.05)	0.30	N.S	0.004	0.05	0.04	0.15	0.16	0.19	0.12	0.10	0.02

weight of different plant organs and weekly irrigated (every 7 days) gave the lowest dry weight. However, the difference between the intervals (14 and 21 days) in dry weight of shoots ant was insignificant.

It could be concluded that prolonging the time elapsed between the subsequent irrigations caused a significant effect or dry weight of different plant organs. This result is very well accepted since it clarifies and manifests the role of water in plant growth and development starting from dissolving and absorbing nutrients, movement and distribution of plant metabolities. Its contribution in all of the essential metabolic and anabolic processes and other requirements of growth, development and production. The obtained results confirmed those of **Shalaby et al. (1993), Mourd et al. (1993) and Abd El-Maboud (1996).**

1.4. Leaf area index (LAI).

Leaf area index (LAI) expresses the ratio of leaf surface to the ground area occupied by the crop **(Watson, 1952).** The effect of irrigation intervals on LAI of wheat at 90 days from planting in the combined analysis of 1997/98 and 1998/99 seasons are shown in Table (14). Results showed that LAI significantly increased as a result of applied the water irrigation every 14-day interval. On the other hand, prolonging the time between the subsequent irrigation up to 21 days significantly decreased LAI by 1.35% compared with 14 days irrigation intervals.

Many investigators reported also marked differences among water irrigation intervals in plant height, dry matter content and LAI of wheat **Shalaby *et al* (1992), Mourad et al. (1993), El-Kalla et al. (1994) and Abd El-Maboud (1996).**

1.5. Relative growth rate (RGR):

Relative growth rate (RGR) is defined as the increase of plant material per unit of time **(Radford, 1967).** Results in Table (14) showed that the RGR of wheat at 90-100 and 100-110 days as combined data over 1997/98 and 1998/99 growing seasons was significantly affected by application of irrigation intervals. It is obviously clear that RGR significantly increased as irrigation interval was increased from 7 to 14 days and deceased from 14 to 21 –day. This result was true for the two periods from growth. A long the same line, **El-Kalla et al. (1994), Fredrick and Camberato (1995) and Abd El-Maboud (1996),** reported a significant reduction in RGR of wheat as irrigation intervals such increased results is very well expected since stimulation of active growth and development needs adequate amounts of water through irrigation. Meanwhile, the essentiality of water as a main component for the vegetative growth confirm this reality.

1.6. Net assimilation rate (NAR):

Net assimilation rate (NAR), or unit leaf rate, is the net gain of assimilation, mostly photosynthetic per unit leaf area or it dry weight and time **(Gardner *et al.*, 1985).**

The highest NAR of wheat was noticed at the irrigation interval of 14-day compared with the other irrigation intervals with significant differences in both periods of growth (90-100 and 100-110 days). The highest NAR (4.05, 3.09 mg/cm^2/day) was obtained when irrigation was every 14-day interval, whereas, the smallest NAR (3.73, 2.82 mg/cm^2 /day) was obtained when irrigation was ever 21-day. Clarified the effect of adequate irrigation in increasing NAR.

1.7. Specific leaf weight (SLW):

Narrowing irrigation intervals from 21-to 14 and down to 7-day caused a significant effect in SLW (Table, 14). Moreover, the magnitude of the increase in such SLW varied according to the duration of the irrigation intervals. It is obviously clear that, the highest SLW was obtained when irrigation was at 14-day interval, whereas, the smallest SLW was obtained when irrigation was at 21-day. This result confirm the role of water in increasing RGR, NAR, and SLW especially after the cell division stage and during cell enlargement which is the cruschial and critical stage of vegetative growth as well as reproductive phase.

2. Effect of wheat varieties:

The results presented in Table (14) indicated a significant effect of the three wheat varieties on some growth characters at 90 days from planting, as well as growth analysis combined over the two growing seasons.

2.1. Plant height:

Varieties varied markedly in their plant height in the combined average. Sids 7 cv. was the tallest variety (89.82cm) and significantly surpassed the other wheat varieties. Sids 6 and Sids 8 cvs. are included in one group with a plant height ranging from 89.05 cm for Sids 6 and 88.8cm. for Sids 8 cv. without significant differences between them. The significant differences were observed between the three varieties of plant height. It could be concluded that marked differences were found among the tested varieties in plant height due to the differences in the genetical make up of the evaluated varieties. The results reported **by Ibrahim et al. (1995), and Ali (1997),** showed that wheat varieties widely varied in plant height.

2.2. Number of leaves /plant:

The three evaluated varieties in the present study showed significant differences in number of leaves/ plant in the combined average of two seasons (Table, 14). Sids 7 had the highest number of leaves/plant, bearing 8.28 leaves followed by Sids 6 (7.71) leaves and Sids 8 (7.54 leaves) without at the same time there is no significant difference between Sids 8 and Sids 6 varieties. Increased number of leaves / plant in Sids 7 comparing with Sids 6 and Sids 8 may be due to increase plant height in Sids 7.

Many investigators reported as considerable variations in the number of leaves/ plant of the different wheat varieties **[Eastham et al. (1984), Shalaby et al. (1992), and Ghanem et al. (1994)].**

2.3. Dry weight of different plant organs:

The three varieties of wheat possessed markedly differences in dry weight of leaves, shoots and total weight/plant (Table, 14). These differences reached the level of significant in the average of both seasons. It is evident that Sids 7, outweighted the long spike varieties in dry weight of different plant organs with significant differences compared with Sids 6 and Sids 8. The results indicated that Sids 7 significantly surpassed the long spike varieties Sids 6 and Sids 8 in total dry weight by 4.0 and 4.76%, respectively. Some significant differences are found among the long spike varieties where Sids 7 plant height and out numbered leaves/ plant the two varieties Sids 6 and Sids 8 significantly. It could be concluded that the results of the combined analysis of both seasons indicated that Sids 7 surpassed Sids 6 and Sids 8 in plant height, number of leaves/plant as well as dry weight of different plant organs. Many workers reported also marked differences among wheat varieties in dry weight of different plant organs **Eastham et al. (1984), Shalaby et al. (1992), Ghanem et al. (1994), and Moselhy (1995).**

2.4. Leaf area index (LAI):

Results in Table (14) showed significant differences in the LAI among the evaluated three varieties. The combined data of 1997/98 and 1998/99 seasons indicated that the tested varieties could be grouped into 2 groups with marked differences two groups. The 1st, group with Sids 7 at the top beating and average of 4.07, followed by the other group of two varieties in Sids 6 (3.73) and Sids 8 (3.62). The obtained increase of LAI may be due to the increase in plant height, number of leaves/ plant and the weight of leaves / plant of Sids 7 compared with Sids 6 and Sids 8 varieties. Many investigators reported marked differences in the LAI of wheat varieties. **Massoud (1995), Ali (1997) and Abo-El-Ela (2001)** showed significant differences in the flag leaf area among the evaluated varieties of wheat.

2.5. Relative growth rate (RGR):

The three tested varieties of wheat varied markedly in RGR in 90-100 and 100-110 days (Table,14). The combined analysis of the two seasons showed that the tested varieties could be classified into three groups, the first group included Sids 7, with average RGR of 17.6 and 12.45 mg/g/day in the 1st and 2nd growth periods, respectively as the highest variety. The 2nd group included Sids 6 with an average RGR of 16.62 and 11.67 mg/g/day. The 3rd group included Sids 8 with average RGR of 16.20 and 11.29 mg/g/day. The results reported by **Shalaby et al. (1992), Ghanem et al. (1994) and Moselhy (1995)**. They showed that wheat varieties varied widing in RGR.

2.6. Net assimilation rate (NAR):

The three evaluated varieties showed significant differences in the values of their NAR in the two growth periods (Table, 14). The combined analysis of both seasons included that the tested varieties could be grouped into 3 groups with marked differences between these groups. The 1st group included Sids 7 at the top bearing 4.12 and 3.09 mg/cm^2/day in 90-100 and 100-110 periods, respectively, followed by Sids 6 (3.8, 2.92 mg/cm^2/day), then Sids 8 is followed with an average of 3.65 and 2.76 mg/cm^2/day NAR in the 1st and 2nd growth periods, respectively which, is considered as significantly in favour in this character compared with the other two varieties. Many workers reported also considerable varieties in the NAR of the different wheat varieties. **Shalaby et al. (1992), Ghanem et al. (1994) and Moselhy (1995)**.

2.7. Specific leaf weight (SLW):

Varieties varied markedly in their value of SLW (Table, 14). The combined analysis of the two seasons average showed that the evaluated varieties could be classified into two groups. The 1st group includes Sids 7, with an average of 4.50 mg/cm^2 as the highest value, the 2nd group includes Sids 6 and Sids 8 with the same result 4.35 and 4.36 mg/cm^2 SLW. It could be concluded that marked differences were found among the tested varieties in RGR, NAR, and SLW due to the differences in the genetical make up of the evaluated varieties. The results reported by **Shalaby et al. (1992), Ghanem et al. (1994) and Moselhy (1995)** showed that wheat varieties widely varied in the values of growth analysis.

3. Effect of plant antitranspirants:

The results in Table (14) indicated that the effect of plant antitranspirant treatments on some growth characters such as plant height, number of leaves/ plant and dry weight of different plant organs of wheat at 90 days from planting and growth analysis in the combined average of 1997/98 and 1998/99 seasons.

3.1. Plant height:

The results showed that Vapor grad and Nu- Film had a significant increase plant height. Spraying the same respective treatments significantly increased plant height over the check treatment by 2.5 and 4.4%. It is quite evident from the present results that plant antitranspirants is very important on wheat growth expressed in terms of plant height in Wadi- Sudr conditions. The increase in plant height probably resulted from the increase in the internode length due to the increase in the activity of meristematic tissues. The results reported by several investigators showed that plant height of wheat respond to plant antitranspirants applications **(Jones and Mansfield (1970) Haggag et al., (1994) and Orphanos (1998).**

3.2. Number of leaves/Plant:

It is clear from data of Table (14) that foliar application of plant antitranspirants insignificantly increased the number of leaves/plant. These increases in number of leaves/ plant as a result of spraying Vapor gard and Nu-film over the check treatment were 0.5% and 1.2%, respectively. The highest number of leaves/ plant was obtained by applying Vapor gard treatment. Such increases in number of leaves/ plant may be due to increase plant height as a result of applying plant antitranspirants.

3.3. Dry weight of different plant organs:

The results in Table (14) showed that spraying plant with antitranspirants significantly increased dry weight of leaves, shoots and total weight per plant. Foliar application with Vapor gard or Nu- Film treatments increased dry weight of leaves by 3.65%, 2.71% and shoots by 5.15%, 4.55% and total dry weight by 4.82, 4.10 respectively compared with control treatment (tap water). Such increases in dry weight of different plant organs as a result of spraying plant antitranspirants may be due to increase in plant height and number of leaves/ Plant. The present results are in agreement with those reported by **Haggag *et al.*, (1994) and Patel and Patel (1997).**

2.4 Leaf area index (LAI):

It is clear from the same Table that plant antitranspirants showed a significant effect on the LAI as was revealed from combined average in 1997/ 1998 and 1998/1999 growing seasons. Applying Vapor gard produced the highest values of LAI (4.14) whereas the control or Nu- Film treatment gave the lowest value (3.58). Difference between the control and Nu- Film treatment was insignificant. The increase in LAI may be due to the increase in number of leaves/ plant as well as the area of leaves/ plant of wheat. Plant antitranspirants application increased LAI by 9.9% and 1.2 when sprayed with Vapor gard and Nu- film respectively.

3.5. Relative growth rate (RGR):

Data on RGR as affected by plant antitranspirants in the combined average are shown in Table (14) It is clear from the same Table that the mean values of RGR significantly increased by Vapor gard and Nu- Film treatments in the 1st and 2nd periods (90-100 days, 100-110 days). The average values were 17.85 and 16.65 mg/g/day in the 1st period and 12.90 and 11.29 mg/g/day in the 2nd period as a result of spraying Vapor gard and Nu- film treatment. The increases in RGR is mainly resulted from the increment detected in all studied growth traits and dry weight of plant. These increases are in accordance with those recorded by **Haggag et, al., (1994), Patel and Patel (1997), Bora and Mathur (1998) and Gu-Sanling et. al. (1998).**

3.6. Net assimilation rate (NAR):

Data in Table (14) demonstrate the results of the combined average of 1997/98 and 1998/99 seasons for the values of NAR as affected by plant antitranspirants. Net assimilation rate was significantly increased in both periods from growth by spraying Vapor gard and Nu- Film treatments. Such increases were 13.66 and 2.73% at 90-100 days and 14.68 and 4.40% at 100-110 days for the same respective treatments compared with the check treatment. The highest NAR (4.16 and 3.20 mg/ Cm^2/day) were obtained by application of Vapor gard. However, the difference between the conotrl and Nu- film treatments at 90-110 days was not significant. This result might be due to the affect of plant Vapor gard increased vegetative growth and photosynthetic pigments of wheat plant in Wadi-Sudr conditions.Similar results were also obtained by **Haggag *et al*. (1994) and Patel and Patel (1997).**

3.7. Specific leaf weight (SLW):

Foliar application with Vapor gard and Nu-film treatments significantly increased SLW in the combined data are shown in Table (14). The same respective treatments increased SLW over the control treatment by 0.18 and 0.09 mg/cm^2. The maximum average (4.49 mg/mg^2) was obtained from Vapor gard spraying and average (4.31 mg/cm^2) was gave from the check treatment. It was observed that applying Vapor gard produced the highest values of some growth characters, dry matter content, LAI, RGE, NAR, and SLW. This was true in Wadi- Sudr conditions.

4. Interaction effect between irrigation intervals and wheat varieties :

4.1. Leaves dry weight:

Data collected in Table (15) it is evident that leaves dry weight/ plant was significantly affected by the interaction between

Table (15):Interaction effect between irrigation intervals and wheat varieties on some growth characters at 90 days from planting and some growth analysis in 1997/98 and 1998/99 seasons.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
	Leaves dry weight/ plant (g.)							
Sids 6		0.871		0.863		0.850		0.856
Sids 7		0.886		0.908		0.877		0.892
Sids 8		0.838		0.856		0.836		0.850
LSD (0.05)	1st: N.S. 2nd : 0.009							
	Shoots dry weight (g.)							
Sids 6		3.39		3.56		3.47		3.46
Sids 7		3.45		3.76		3.67		3.62
Sids 8		3.33		3.36		3.50		3.41
LSD (0.05)	1st: N.S. 2nd : 0.05							
	Plant dry weight (g.)							
Sids 6		4.26		4.43		4.32		4.32
Sids 7		4.34		4.67		4.55		4.51
Sids 8		4.16		4.32		4.33		4.26
LSD (0.05)	1st: N.S. 2nd : 0.06							
	Relative growth rate (R.G.R.) after 90-100 day (mg/g./day)							
Sids 6	16.58	16.98	16.97	17.07	15.50	16.44	10.16	17.27
Sids 7	16.82	17.87	17.91	18.75	16.49	17.23	17.57	18.07
Sids 8	15.75	16.89	15.94	16.64	15.55	16.39	16.36	16.30
LSD (0.05)	1st: 0.20 2nd : 0.35							
	Specific leaf weight (mg/ cm^2)							
Sids 6	4.27	4.33	4.53	4.55	4.27	4.21	4.34	4.33
Sids 7	4.41	4.37	4.82	5.11	4.36	4.32	4.49	4.47
Sids 8	4.26	4.24	4.50	4.52	4.38	4.32	4.32	4.31
LSD (0.05)	1st: 0.06 2nd : 0.06							

irrigation intervals and some new wheat varieties in the second season only. The highest value was achieved with irrigation intervals (14 days) and wheat variety (Sids 7). These results are in confirmation with those obtained by **Aggarwal and Sinha (1987) and Sadek and Abo-Warda (1995).**

4.2. Shoots dry weight/plant.

It can be noticed from results recorded in Table (15) that shoots dry weight/ plant was significantly affected by increasing irrigation intervals and wheat varieties in second season only.The highest weight was achieved with 14 days + Sids 7 treatment. These results are in good harmony with those obtained by **Sadek and Abo-Warda (1995), Abd EL-Maboud (1996) and Khodier et. al. (1999).**

4.3. Plant dry weight:

Plant dry weight was significantly affected by increasing irrigation intervals and some new wheat varieties treatments at the second season only (Table, 15). These increases may be due to the increases in each of leaves and shoots dry weights/ plant separately. The highest plant dry weight was obtained by irrigated every 14-day interval + Sids 7 treatment in the second season only. These results are in harmony with there obtained by **Shalaby et al. (1992) and El-Kalla et al. (1994).**

4.4. Relative growth rate (RGR) after 90-100day :

Data in Table (15) indicated that relative growth rate (RGR) after 90-100 day (mg/g./day) was significantly increased with increasing the interaction treatments between irrigation intervals and wheat varieties in both seasons. Such results were true for both seasons. The highest increase were gained by irrigated every 14-day. + Sids 7 treatment. The results are in good harmony with those obtained by **Shalaby (1992), and El-Kalla et . al. (1994).**

4.5 Specific leaf weight (SLW):

Data collected in Table (15) showed that specific leaf weight (SLW) were positively increased by irrigation intervals and wheat varieties treatments. Such results were true for both seasons. The highest mean value were obtained by using 14-day + Sids 7 treatment. The observations are in confirmation with those obtained by **Shalaby et. al. (1992), El-Kalla et. al. (1994) and Rahman et. al. (1995).**

5. Interaction effect between irrigation intervals and plant antitranspirants

5.1. Number of leaves/ plant:

Data recorded in Table (16) clearly indicated that number of leaves/ plant were significantly affected by the interaction between irrigation intervals and antitranspirant treatments. The highest mean value (18.43) were obtained by 14- day + Vapor gard treatment in the second season only. Similar results were obtained by **Shalaby et al. (1992), and Rahman et al. (1995).**

5.2. Leaves dry weight / plant:

Results in Table (16) represent weight of leaves / plant as affected by irrigation intervals and antitranspirant treatments. It is clear that irrigation intervals and antitranspirants had a significant effect on leaves dry weight/ plant in the first season only. Also, the highest mean values (0.893) were obtained by using 21-day +Vapor gard treatment.

5.3. Shoots dry weight/ plant:

Data in Table (16) showed that shoots dry weight was significantly affected by the interaction between irrigation intervals and antitranspirants in the second season only. The highest mean

Table (16): Interaction effect between irrigation intervals and plant antitranspirants on growth characters of wheat plants at 90 days from planting in 1997/1998 and 1998/1999 growing seasons.

Seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
	Number of leaves/ plant							
Tap water		16.70		16.62		16.53		16.55
Vapor-gard		18.22		18.43		18.42		18.14
Nu-film		17.86		17.76		17.78		18.04
LSD(0.05%)	1st: N.S 2nd : 0.11							
	Leaves dry weight (g.)							
Tap water	0.834		0.851		0.863		0.856	
Vapor-gard	0.868		0.889		0.893		0.875	
Nu-film	0.870		0.880		0.880		0.865	
LSD(0.05%)	1st 0.045 2nd : N.S							
	Shoots dry weight (g.)							
Tap water		3.32		3.43		3.49		3.43
Vapor-gard		3.45		3.63		3.65		3.57
Nu-film		3.40		3.62		3.50		3.49
LSD(0.05%)	1st : N.S 2nd : 0.04							
	Plant dry weight (g.)							
Tap water		4.17		4.30		4.32		4.27
Vapor-gard		4.32		4.52		4.51		4.45
Nu-film		4.27		4.50		4.37		4.36
LSD(0.05%)	1st N.S 2nd : 0.06							

value (3.65) were obtained by using 21- day + Vapor gard treatment. These results are in harmony with those obtained by **Abd El- Maboud (1996), and Khodier et al. (1999).**

5.4. Plant dry weight.

It can be seen from the data of plant dry weight at the 1997/98 and 1998/99 successive season (Table, 16) that irrigation intervals and antitranspirants treatments affected significantly plant dry weight. it was noticed that the highest mean value (4.52) were obtained by adding 14-day + Vapor gard treatment. Similar results were obtained by **Aggarwal and Sinha (1987), Abd El Maboud (1996), and Khodier et al. (1999).**

6. Interaction effect between wheat varieties and plant antitranspirants:

6.1. Number of leaves/plant:

Results collected in Table (17) showed that number of leaves / plant after 90 days from sowing were positively increased by wheat varieties and antitranspirant treatments. The highest mean value (19.06) was obtained by adding Sids 7 + Vapor gard treatment at the second season only. These results were in full agreement with those obtained by **Shalaby et al. (1992), El-Kalla et al. (1994) and Saked and Abo- Warda (1995).**

6.2. Leaves dry weight:

Results in Table (17) showed that leaves dry weight/plant after 90 days from sowing (g.) were significantly increased by increasing the interaction effect between wheat varieties and antitranspirants treatments. The highest mean value (0.908) was obtained by adding Sids 7 + Vapor gard treatment at the first season only. Similar results were obtained by **Sadek and Abo-Warda (1995), Abd El- Maboud (1996) and Khodier et al. (1999).**

Table (17): Interaction effect between wheat varieties and plant antitranspirants on some growth characters at 90 days from planting and specific leaf weight in 1997/1998 and 1998/1999 growing seasons.

seasons	Sids 6		Sids 7		Sids 8	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Number of leaves / plant (after 90 day from planting)						
Tap water		16.64		16.68		16.48
Vapor gard		18.04		19.06		17.81
Nu-film		17.71		18.15		17.71
LSD (0.05%)	1st : N.S. 2nd : 0.10					
Leaves dry weight (g.) (after 90 day planting)						
Tap water	0.841		0.867		0.845	
Vapor gard	0.865		0.908		0.870	
Nu-film	0.871		0.890		0.860	
LSD (0.05%)	1st : 0.039 2nd : N.S					
Specific leaf weight (S.L.W.) (mg/cm^2)						
Tap water	4.24		4.40		4.27	
Vapor gard	4.44		4.66		4.45	
Nu-film	4.37		4.50		4.37	
LSD (0.05%)	1st :0.04 2nd : N.S					

6.3. Specific leaf weight (SLW):

Data reported in Table (17) indicated that specific leaf weight (SLW) was significantly increased by increasing the interaction effect between wheat varieties and antitranspirant treatment. The highest specific leaf weight value (4.66 mg/cm^2) was obtained by adding Sids 7 + Vapor gard treatment at the first season only. Similar results were obtained by **Shalaby et al. (1992 and 1993), El-Kalla et al. (1994), Saked and Abo- Warda (1995) and Khodier et al. (1999).**

7. Interaction effect between the three studied factors.

7.1. Number of leaves/ plant:

Results recorded in Table (18) indicated that number of leaves/ plant after 90 days were significantly affected by the interaction effect between the three studied factors treatments. The highest value (19.42) was achieved by using 14- day+ Sids 7 + Vapor gard treatments at the second season only.

7.2. Dry weight of different plant organs:

Results in Table (18) showed that prolong the time elapsed between the three studied factors treatments significantly increased with increasing in dry weight of leaves, shoots, and total plant of wheat at 90 days from planting. The highest dry weight of different plant organs mean values were obtained by using 14- day + Sids 7 + Vapor gard treatments leaves dry weight in the first season, whereas shoots and total dry weight at the second season. Similar results were obtained by **Sadek and Abo – Warda (1995), Abd El- Maboud (1996) and khodier et al. (1999).**

7.3. Relative growth rate RGR) after 90- 100 day (mg/g/day):

Results recorded in Table (18) indicated that relative growth rate (RGR) at 90-100 day period were significantly affected by the

Table (18): Interaction effect between the three studied factors on growth characters at 90 days from planting and growth analysis in 1997/98 and 1998/99 growing seasons.

seasons		A1[(1)]		A2		A3		A4	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Number of leaves/ plant.									
B1[(2)]	C1[(3)]		16.84		16.59		16.46		16.66
	C2		17.86		18.02		18.35		17.91
	C3		17.84		17.70		17.61		17.70
B2	C1		16.70		16.92		16.42		16.67
	C2		18.93		19.42		19.07		18.84
	C3		17.89		17.85		18.16		18.72
B3	C1		16.56		16.37		16.70		16.30
	C2		17.87		17.86		17.85		17.67
	C3		17.85		17.74		17.59		17.69
LSD(0.05)			1st. :N.S 2nd. : 0.19						
Leaves dry weight / plant (g.)									
B1	C1	0.829		0.840		0.854		0.841	
	C2	0.868		0.864		0.860		0.850	
	C3	0.886		0.862		0.881		0.865	
B2	C1	0.864		0.860		0.884		0.867	
	C2	0.895		0.929		0.914		0.899	
	C3	0.881		0.905		0.892		0.878	
B3	C1	0.828		0.843		0.857		0.866	
	C2	0.849		0.885		0.889		0.873	
	C3	0.844		0.866		0.870		0.852	
LSD(0.05)			1st. :0.005 2nd. : N.S						
Shoots dry weight/ plant (g.)									
B1	C1		3.34		3.40		3.45		3.45
	C2		3.43		3.65		3.56		3.51
	C3		3.40		3.65		3.40		3.41
B2	C1		3.37		3.69		3.77		3.46
	C2		3.54		3.86		3.77		3.73
	C3		3.43		3.73		3.71		3.67
B3	C1		3.24		3.22		3.47		3.37
	C2		3.36		3.39		3.62		3.46
	C3		3.38		3.49		3.41		3.39
LSD(0.05)			1st. :N.S 2nd. : 0.06						

Notes: 1. (A) Irrigation intervals 2. (B) Wheat varieties.
3. (C) Plant antitranspirants

Table (18):Cont.

seasons		A1		A2		A3		A4	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plant dry weight (g.)									
B1	C1		4.20		4.26		4.29		4.30
	C2		4.31		4.53		4.42		4.38
	C3		4.27		4.51		4.26		4.27
B2	C1		4.25		4.57		4.41		4.32
	C2		4.44		4.78		4.66		4.65
	C3		4.32		4.65		4.59		4.57
B3	C1		4.06		4.06		4.28		4.21
	C2		4.22		4.26		4.47		4.31
	C3		4.22		4.34		4.26		4.25
LSD(0.05)			1st. :N.S 2nd. : 0.05						
Relative growth rate (R.G.R.) after 90-100 day(mg/g./day)									
B1	C1	15.78		15.86		14.77		14.90	
	C2	17.59		18.11		16.65		17.69	
	C3	16.39		16.93		15.39		15.70	
B2	C1	16.03		17.83		15.67		16.77	
	C2	17.87		18.86		17.56		18.58	
	C3	16.57		17.06		16.25		17.37	
B3	C1	14.45		15.17		14.45		15.75	
	C2	16.97		16.64		16.58		17.32	
	C3	15.84		15.40		15.63		16.00	
LSD(0.05)			1st. :0.19 2nd. : N.S						
Sepecific leaf weight (S.L.W.) (mg/cm^2)									
B1	C1		4.17		4.46		4.13		4.30
	C2		4.50		4.65		4.30		4.38
	C3		4.31		4.55		4.21		4.32
B2	C1		4.30		4.72		4.24		4.37
	C2		4.43		5.01		4.40		4.58
	C3		4.38		4.38		4.32		4.47
B3	C1		4.17		4.41		4.22		4.30
	C2		4.29		4.64		4.40		4.41
	C3		4.25		4.53		4.33		4.31
LSD(0.05)			1st. :N.S 2nd. : 0.05						

interaction between the three studied factors treatment. The highest mean value (18.86) was achieved by using 14- day + Sids 7 + Vapor gard treatment at the first season only. Similar results were obtained by **El–Kalla et al. (1994), Sadek and Abo-Warda (1995) and Abd El-Maboud (1996).**

7.4. Specific leaf weight (SLW):

Results collected in Table (18) show that specific leaf weight were positively increased by the interaction effect between the three studied factor treatments. The highest mean value (5.01 mg/cm^2) was obtained by using 14-day + Sids 7 + Vapor grard treatments at the second season only. The results are in confirmation with those obtained by **Sadek and Abo – Warda (1995), Abd El- Maboud (1996) and Khodier et al. (1999).**

II. Effect of irrigation intervals, wheat varieties and plant antitranspirants on total chlorophyll and proline contents, stomata characters and grain growth parameters:

1. Effect of irrigation intervals on:

1.1. Total chlorophyll and proline contents:

The effect of irrigation intervals on total chlorophyll and proline contents at booting and milk ripe stages are shown in Table (19).

1.1.1. Total chlorophyll content

Bi-weekly irrigation interval (at 14 – day) produced the highest values (43.83) of total chlorophyll unit. Whereas, the Tri-weekly irrigated interval (every 21 day) gave the lowest unit (41.32). This was true in total chlorophyll units at booting and milk ripe stages. This result clarify the well known importance of water for chlorophyll formation.

Table (19): Effect of irrigation intervals, wheat varieties and plant antitranspirants on total chlorophyll, proline contents, stomata number, area and siz of upper and lower leaf surface at 90 day from planting and grain growth parameters (combined over of 1997/98 and 1998/99) seasons.

Characters / Treatments	Total chlorophyll unit		Proline content (m.mol/L.)		Stomata number of		Stomata air chamber area of		Stomata air chamber size of		Grain filling rate (mg/spike/day)	Effective grain filling period (days)
	at booting stage	at milk ripe stage	at booting stage	at milk ripe stage	upper leaf surface	lower leaf surface	upper leaf surface µ2	lower leaf surface µ2	upper leaf surface µ3	lower leaf surface µ3		
Irrigation intervals												
7 days	42.81	40.89	22.52	24.63	28.79	46.15	155.0	146.5	495.4	454.4	809.1	37.23
14 days	43.83	43.42	27.36	29.58	29.38	50.38	163.0	151.5	521.8	469.8	850.5	37.91
21 days	41.32	39.35	27.84	31.86	28.12	46.53	150.6	145.2	478.1	450.2	800.2	37.22
Common Irri-	42.33	40.37	24.68	27.27	28.91	47.59	157.3	147.4	503.5	457.2	807.7	37.35
LSD (0.05)	0.44	0.47	0.25	0.52	N.S	N.S	1.9	1.5	11.1	4.7	6.4	0.48
Varieties												
Sids 6	42.68	40.71	25.45	28.15	28.27	47.38	156.8	147.8	498.8	458.2	813.5	37.27
Sids 7	43.25	41.34	25.66	28.34	29.59	48.64	161.4	149.6	516.0	463.8	841.4	37.90
Sids 8	41.80	39.85	25.68	28.52	28.23	46.97	151.3	145.7	484.2	451.8	795.9	37.12
LSD (0.05)	0.39	0.38	N.S	N.S	N.S	N.S	1.1	0.9	8.3	2.7	4.7	0.38
Antitranspirants												
Tap water	40.97	39.06	25.61	28.72	28.17	46.71	153.1	146.6	486.3	454.7	764.3	36.41
Vapor gard	44.02	42.07	25.91	28.28	29.23	48.58	159.3	148.7	510.0	461.0	881.1	38.42
Nu-film	42.75	40.76	25.26	28.01	28.69	47.70	157.1	147.7	502.8	458.1	805.2	37.46
LSD (0.05)	0.22	0.22	0.28	0.36	N.S	N.S	0.61	0.8	6.7	0.6	4.5	0.36

1.1.2. Proline content

Tri- weekly irrigation interval (every 21 – day) had the highest proline content (27.84) in wheat plants at booting and milk ripe stages meanwhile, weekly irrigation interval (every 7 day) gave the lowest proline content. This results show the importance of water for cell division and cell enlargement in addition to its role in the physiological and biological activities which and up with an optimum vegetative growth. Such effect was reflected on producing high proline contents with prolonging irrigation intervals. Similar results were also reported by **Virgien (1965), Randal et al (1975), and Wiseman (1995).**

1.2. Stomata characters

The effect of irrigation intervals on stomata number, stomata air chamber area, and size of upper and lower leaf surface at 90 day form planting in the combined over of 1997/ 98 and 1998/99 seasons are shown in Table (19).

1.2.1. Stomata number

Slight increases in stomata number were shown as a result of Bi-weekly irrigation interval (at 14–day). This was true in stomata number of upper and lower leaf surface. However, the differences among the four irrigation intervals were insignificant. These results may be due to stomata number is genetical character. Similar results were obtained by **Hassan et al (1984), Salem (1986) and Salem (1999).**

1.2.2. Stomata air chamber area(μ^2)

The results in Table (19) indicated that the applied irrigation intervals had a significant effects on stomata area of upper and lower leaf surface in the combined data. Applied irrigation every 14 – day interval reduced this area meanwhile, Tri-weekly irrigated interval (every 21 day) gave the lowest numbers. This was true in both upper and lower leaf surfaces at 90 days from planting.

1.2.3. Stomata air chamber size (μ^3)

Stomata air chamber size of upper and lower leaf surface was almost similar to stomata air chamber area in its response to the applied irrigation intervals. The obtained stomata size at 7, 14, and 21–day irrigation intervals was 495.4, 521.8 and 478.1μ^3 of upper leaf surface and 454.4, 469.8 and 450.2μ^3 in lower leaf surface, respectively. However, the difference between the common irrigation and weekly irrigated interval (at7–day) treatments was not significant. This was true in size of upper or lower leaf surface. The present result are in agreement with those obtained by **Salem (1986), Abd El-Gawad et al (1993) and Abd El-Maboud (1996).** Who found that the applied irrigation intervals significantly affected stomata area and size.

1.3. Grain growth parameters

1.3.1. Grain filling rate (GFR), (mg/ spike/ day)

Irrigation intervals significantly affected on grain filling rate (GFR) in the combined average of 1997/98 and 1998/99 growing seasons are shown in Table (19). Bi-weekly irrigation interval (every 14–day) had the highest value (850.5 mg/ spike/day) and the Tri-weekly irrigation interval (every 21–day) gave the lowest value (800.2 mg/ spike/day). However, the difference between the common irrigation and weekly irrigated systems was insignificant.

1.3.2. Effective grain filling period (EGFP) days:

The combined average of both seasons indicated a significant differences among the four irrigation intervals in the effective grain filling period (Table 19). Bi-weekly irrigated intervals (every 14–day) produced the highest value (37.91 days) whereas as other irrigation systems gave lowest values. It is worthy to mention that increasing the effective grain filling period with applied adequate water irrigation intervals reflected the importance role of water in building up the photosynthetic apparatus. Similar results were obtained by **Hanway and Russell (1969), Abd El-Gawad et al (1985c) and Aly and El-Bana (1994).**

2. Effect of wheat varieties on:

2.1. Total chlorophyll and proline contents:

2.1.1. Total chlorophyll content:

The effect of varieties on total chlorophyll of wheat plants at booting and milk ripe stages in the combined data are presented in Table (19). Combined analysis of 1997/98 and 1998/99 seasons showed that Sids 7 cv. significantly increased total chlorophyll units at booting and milk ripe stages. Such increases in total chlorophyll units over Sids 6 and Sids 8 were 0.57 and 1.45 units at booting stage and 0.63 and 1.49 units at milk ripe stage. Similar results were also reported by **Bates (1973), Wiseman (1995) and Abd El-Maboud (1996).**

2.1.2. Proline content:

It is evident from Table (19) that the differences among the average value of the three tested varieties were not significant in both booting and milk ripe stages.

2.2. Stomata characters:

The Results in Table (19) showed that plant varieties markedly varied in their stomata number, area and size of upper and lower leaf surface at 90 days from planting in the combined average of both seasons.

2.2.1. Stomata number:

Sids 7 recorded higher number of stomata without significant differences among the other wheat varieties. This was true for stomata number of upper and lower leaf surface. The present results in Table (19) are mainly due to the genetical constitution of the tested varieties. Results reported by **Kurshid and Mahmoud (1967), Abd El–Gawad et al. (1985c), and Salme (1986)**. showed marked differences in the stomata numbers, and area of the evaluated wheat varieties.

2.2.2. Stomata air chamber area (μ^2):

Sids 7 was the highest variety in stomata area which was significantly inferior compared with the other two varieties. On other hand, Sids 8 was the lowest variety in stomata area. This was true in upper and lower leaf surface.

2.2.3. Stomata air chamber size (μ^3):

The highest stomata size of upper and lower leaf surface were (516 and 463.8 μ^2) was recorded by Sids 7 followed by Sids 6 (498.8 and 458.2 μ^3), then Sids 8 (484.2 and 451.9 μ^3). Sids 7 was at the top with an average stomata air chamber size which significantly surpassed the other wheat varieties. This was true in upper and lower leaf surface.

2.3. Grain growth parameters:

2.3.1. Grain filling rate (GFR) (mg/spike/ day).

The results indicated significant differences among the three tested varieties in grain filling rate in the combined analysis of both seasons. Sids 7 showed higher filling rate (841.4 mg/spike/day). Which was significantly higher than that of Sids 8 (795.9 mg/spike/day), while Sids 6 was in between (813.5 mg/spike/day).

2.3.2. Effective grain filling period (EGFP) (day):

The results in Table (19) indicated significant differences among the three tested varieties in effective grain filling period. Sids 7 recorded the highest value of effective grain filling period

(37.90 days), and significantly surpassed that of Sids 6 (37.27 days)or Sids 8 (37.12 day). However, the difference between Sids 6 and Sids 8 in this character was insignificant. It could be concluded that the cultivar Sids 7 recorded the highest values of some growth characters, dry matter content, LAI, RGR, NAR, SLW, total chlorophyll, stomata air chamber area, and size of both upper and lower leaf surface, and grain filling rate as well as effective grain filling period. On the other hand, Sids 8 gave the lowest values, while Sids 6 was inbetween.

3. Effect of plant antitranspirants:

3.1. Total chlorophyll and proline contents:

3.1.1. Total chlorophyll content:

The results in Table (19) indicated the effect of antitranspirants on total chlorophyll units at botting and milk ripe stages in the combined average of both seasons. Spraying Vapor gard and Nu- film significantly increased total chlorophyll units at booting and milk ripe stages. The highest values (44.02 and 42.07unit) were obtained by spraying Vapor gard and the lowest ones (40.97 and 39.06 unit) were produced by the check treatments. The increase in total chlorophyll is mainly due to the positive effect of plant antitranspirants on vegetative growth of wheat plants.

3.1.2. Proline content:

The results in the same Table showed clearly that Vapor gard treatment significantly increased proline content at booting whereas milk ripe stage by using tap water. On the other hand, Nu-film significantly decreased proline content in both stages.The present results indicates clearly that Vapor gard and tap water increased total chlorophyll and proline contents at booting and milk ripe stages. These results are in harmony with those obtained by

Haggage et, al. (1994), Nautiyal et. al (1996) and Aldesyuy et al. (1998).

3.2. Stomata characters:

3.2.1. Stomata numbers:

The results in the Table (19) indicated that plant antitranspirants showed no significant effect on the stomata numbers at upper or lower leaf surface at 90 days from planting. Vapor gard treatment produced the highest values of stomata number (29.23, 48.58) and the check treatment gave the lowest number (28. 17, 46.71). However, the differences among plant antitranspirants were not significant

3.2.2. Stomata air chamber area (μ^2):

The results presented in the same Table showed that Vapor gard and Nu- film treatments significantly increased stomata air chamber area in upper and lower leaf surface. The average of both seasons, showed that Vapor gard produced the highest values (159.3, 148.7μ^2) and the control treatment gave the lowest values (153.1, 146.6μ^2). Increased stomata air chamber area due to application of antitranspirants were reported **by Rao (1985) and (1986), Ibrahim et al. (1993), and Bora and Mathur (1998).**

3.2.3. Stomata air chamber size (μ^3):

The result from the same table showed that stomata air chamber size was significantly increased by adding plant antitranspirants. This was true in upper or lower leaves. Foliar application of Vapor gard had the highest values (510, 461μ^3) and the check treatment gave the lowest size (486.3, 454.7 μ^3). This results is expected since applying Vapor gard treatment significantly increased stomata air chamber area in upper and lower surface. This results is a good manifestation for the role of plant antitranspirants in plant growth, dry matter content, total chlorophyll proline content and stomata characters in upper and lowest leaf surface. The present results show the positive effect of plant antitranspirants on stomata characters leaves of wheat and are in general agreement with those obtained by **Rao (1985 and 1986), Ibrahim et. al, (1993) and Bora and Mathur (1998).**

3.3. Grain growth parameters:

3.3.1. Grain filling rate (GFR) (mg/ spike/ day):

The combined presented in Table (19) indicate that plant antitranspirants significantly increased grain filling rate. Foliar application with Vapor gard and Nu- film treatments significantly increased grain filling rate by 116.8 and 40.9 mg/spike day, respectively compared with control treatment. Applying Vapor gard produced the highest values and the control treatment gave the lowest values. This increases may be due to increase plant growth, total chlorophyll, proline content, and stomata, area, and size as a result of adding plant antitranspirants.

3.3.2. Effective grain filling period: (days)

Applying Vapor gard and Nu-film treatments significantly increased the respective characters by 2.01 and 1.05 days, respectively. Spraying Vapor gard produced the highest value. (38.42 days) and the lowest value (36.41) was obtained by the check treatment. This results may be due to the significant effect of Vapor gard treatment on plant growth, growth analysis, total chlorophyll, proline content, stomata number, area, size, and grain filling rate. It could be concluded that Vapor gard produced the highest values of vegetative growth, growth analysis, total chlorophyll, proline content, stomata area and size, grain filling rate and effective grain filling period. This was true in the combined data in Wadi-Sudr conditions (Table 19).

4. The interaction effect between irrigation intervals and wheat varieties

4.1. Proline content at milk ripe stage (m. mol/ L)

The results in Table (20) indicated that the interaction effect between irrigation intervals and wheat varieties on proline content at milk ripe stage (m. mol/L) was significantly increased with increasing irrigation intervals, wheat varieties treatment at the first season only. Proline content reached its highest values (31.83) by using 21 day + Sids 6 treatment (31.83).

4.2. Stomata number of upper leaf surface:

It can be noticed from results recorded in Table (20) that stomata number of upper leaf surface was significantly affected by increasing irrigation intervals and some new wheat varieties treatment in the first season only. The highest number was achieved with 14-day interval + Sids 7 treatment (30.37). These results are in confirmation with those obtained by **Rao (1986), Salem (1986), and Abd El-Gawad et. al. (1993).**

4.3. Stomata number of lower leaf surface:

Data reported in Table (20) showed that stomata number of lower leaf surface was significantly affected with increasing irrigation intervals and wheat varieties treatments in the second season only. The highest number (52.61) was achieved with irrigation interval (14-day interval) and wheat varieties (Sids 7) treatment. These results are in good harmony with those obtained by **Salem (1986), Abd El-Gawad et. al. (1993), and Abd El-Maboud (1996).**

4.4. Stomata air chamber area of upper leaf surface (μ^2):

Data collected in Table (20) showed that stomata air chamber area of upper leaf surface (μ^2) were positively increased

Table (20):Interaction effect between irrigation intervals and wheat varieties on proline contents, stomata measurement and grain grantee promoters in 1997/1998 and 1998/1999 growing seasons.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2^{nd} season	1st season	2nd season	1st season	2nd season
	Proline content at milk ripe stage (m.mol/L)							
Sids 6	23.86		30.43		31.83		27.94	
Sids 7	24.71		30.73		31.72		27.72	
Sids 8	25.09		30.05		31.72		28.00	
LSD (0.05)	1^{st}: 0.48 2^{nd} : N.S.							
	Stomata number of upper leaf surface							
Sids 6	27.91		28.96		27.54		28.62	
Sids 7	29.42		30.37		28.45		29.98	
Sids 8	28.79		28.46		27.78		28.05	
LSD (0.05)	1^{st}: 0.344 2^{nd} : N.S.							
	Stomata number of lower leaf surface							
Sids 6		45.23		51.04		47.13		47.41
Sids 7		48.45		52.61		47.72		48.73
Sids 8		45.10		50.65		45.86		48.04
LSD (0.05)	1^{st}: N.S. 2^{nd} : 0.531							
	Stomata air chamber area of upper leaf surface (μ^2)							
Sids 6	158.1	151.8	169.9	156.2	155.4	147.1	164.7	151.3
Sids 7	167.6	153.4	176.6	158.5	157.9	149.9	171.2	156.0
Sids 8	154.5	144.6	160.0	151.0	148.1	145.5	155.0	145.6
LSD (0.05)	1^{st}: 1.8 2^{nd} : 1.0							
	Stomata air chamber size of upper leaf surface (μ^3)							
Sids 6	506.0		453.7		497.2		527.2	
Sids 7	532.5		465.4		505.3		548.0	
Sids 8	494.6		531.2		474.1		496.2	
LSD (0.05)	1^{st}: 6.1 2^{nd} : N.S.							
	Grain filling rate (GFR) (mg/spike/day)							
Sids 6	804.5	809.1	843.6	842.5	805.0	779.6	808.5	814.9
Sids 7	821.6	848.4	877.[illegible]	[illegible]2.6	844.8	805.6	819.5	832.1
Sids 8	783.8	788.3	821.[illegible]	[illegible]5.5	784.4	781.6	785.0	786.3
LSD (0.05)	1^{st}: 6.8 2^{nd} : 5.0							

by irrigation intervals and wheat varieties treatments. Such results were true for both seasons. The highest mean value were obtained by using 14- day + Sids 7 treatment. These result s were in full agreement with those obtained by **Abd El- Gawad et. al (1993) and Abd El–Maboud (1996).**

4.5. Stomata air chamber size of upper leaf surface (μ^3):

It can be noticed from results recorded in Table (20) that stomata air chamber size of upper leaf surface (μ^3) were significantly affected by decreasing irrigation intervals and wheat varieties treatments in the first season only. The highest number (548.0) was obtained with common irrigation + Sids7 treatment. These results are in conformity with those obtained by **Abd El-Gawad et al. (1993), Kanayeem and Dgdalir (1993), and Abd El-Maboud (1996).**

4.6. Grain filling rate (GFR) (mg/spike/ day)

Data reported in Table (20) indicated that grain filling rate (GFR) mg/spike/day was significantly affected by increasing the interaction between irrigation intervals and wheat varieties treatments. Such results were true for both season. The highest GFR values (877.0 and 882.6) were obtained by adding 14-day + Sids 7 treatment in the first and second seasons, respectively.

5. Interaction effect between irrigation intervals and antitranspirants

5.1. Total chlorophyll content at milk ripe stage (mg/100 g.D.M):

Data in Table (21) showed that total chlorophyll at milk ripe stage (mg/ 100g. D.M.) was significantly by the interaction between irrigation intervals and antitranspirant treatments. The highest total chlorophyll content at milk ripe stage value (43.65)

Table (21):Interaction effect between irrigation intervals and plant antitranspirants on total chlorophyll, proline content, stomata measurement and grain growth parameters in 1997/1998 and 1998/1999 growing seasons.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Total chlorophyll content at milke ripe stage (mg/100g. D/M)								
Tap water		39.56		40.29		38.13		40.13
Vapor-gard		.42.52		43.65		40.72		41.98
Nu-film		40.97		42.84		39.55		40.73
LSD(0.05%)	1st: N.S 2nd : 0.46							
Prolein content at booting stage (m/mol/ L.)								
Tap water	23.62	22.56	27.20	26.32	27.09	28.51	24.62	24.48
Vapor-gard	23.56	21.97	28.04	27.60	27.12	28.95	25.67	24.53
Nu-film	22.17	21.23	27.52	26.99	26.87	28.57	24.98	23.82
LSD(0.05%)	1st: 0.26 2nd : 0.32							
Stomata number of lower leaf surface								
Tap water	45.63	45.75	48.75	50.28	45.30	45.75	46.33	47.26
Vapor-gard	46.49	46.67	50.45	52.44	47.09	47.79	48.70	48.84
Nu-film	46.01	46.27	49.32	51.59	46.08	47.16	47.77	48.08
LSD(0.05%)	1st: 1.00 2nd : 0.38							
Stomata air chamber area of upper leaf surface (μ^2)								
Tap water	155.0	147.9	165.8	153.3	151.4	146.3	155.6	149.3
Vapor-gard	166.2	151.7	174.1	156.7	155.6	148.6	149.4	152.4
Nu-film	159.0	150.1	172.6	155.7	154.3	147.6	166.0	151.2
LSD(0.05%)	1st: 1.98 2nd : 1.28							
Stomata air chamber size of lower leaf surface (μ^2)								
Tap water		145.5		150.3		144.2		146.8
Vapor-gard		147.3		153.0		146.1		148.7
Nu-film		146.6		151.8		145.0		147.6
LSD(0.05%)	1st: N.S 2nd : 1.4							

Table (21):Cont.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Stomata air chamber size of upper leaf surface (μ^3)								
Tap water	492.4		530.5		484.5		498.0	
Vapor-gard	531.8		557.3		498.1		542.2	
Nu-film	508.9		552.4		494.0		531.2	
LSD(0.05%)	1st: 5.5 2nd : N.S							
Stomata air chamber size of lower leaf surface (μ^3)								
Tap water		451.2		466.1		447.3		455.0
Vapor-gard		456.8		474.3		453.0		461.0
Nu-film		454.5		470.7		449.5		457.7
LSD(0.05%)	1st: N.S 2nd : 4.8							
Grain filling rate (GFR) (mg/spike/ day)								
Tap water	757.0	771.2	781.8	792.4	754.9	735.6	754.8	768.0
Vapor-gard	878.0	834.1	922.3	911.2	875.0	846.3	867.2	874.9
Nu-film	774.8	800.8	837.6	857.7	804.5	785.0	791.0	790.4
LSD(0.05%)	1st: 7.0 2nd : 6.0							
Effective grain filling period (EGFP) (days)								
Tap water	36.23	36.35	36.78	36.63	36.23	36.38	36.23	36.46
Vapor-gard	38.48	37.92	38.36	39.11	38.05	38.46	38.07	38.45
Nu-film	37.47	36.97	37.90	38.21	36.82	37.40	37.33	37.60
LSD(0.05%)	1st: 0.52 2nd : 0.49							

was obtained by adding 14-day + Vapor gard treatment in the second season only.

5.2. Proline content at booting stage (m.mol/L.)

Data reported in Table (21) indicated that proline content at booting stage (m.mol/L) was significantly increased by the interaction treatments between irrigation intervals and antitranspirants. Such results were true for both seasons. The highest proline content at booting stage value were obtained by irrigation every 14-day + Vapor gard in the first season whereas irrigated every 21- day + Vapor gard in both seasons .

5.3. Stomata number of lower leaf surface.

It can be noticed from data recorded in Table (21) that stomata number of lower leaf surface were significantly increased by the interaction between irrigation intervals and antitranspirants. Such results were true for both seasons. The highest stomata number of lower leaf surface values were obtained by adding 14-day + Vapor gard treatment (50.45 and 52.44) in first and second seasons respectively. These observation are in conformity with those obtained by **Rao (1986), Salem (1986), and Abd El-Gawad et al. (1993).**

5.4. Stomata air chamber area of upper leaf surface:

Data reported in Table (21) indicated that stomata air chamber area of upper leaf surface (μ^2) was significantly increased with the interaction between irrigation intervals upto 14 days and antitranspirants treatments. Such results were true for both seasons. The highest stomata air chamber area of upper leaf surface values (174.1 and 156.7) were obtained by adding 14-day + Vapor gard in the two seasons respectively. These results are in confirmation with those obtained by **Salme (1986), Abd El- Gawad et al. (1993), and Kanayeem and Dgdalir (1993).**

5.9. Effective grain filling period (days):

Data collected in Table (21) showed that effective grain filling period (EGFP, days) were positively affected by irrigation intervals and antitranspirant treatments. The highest mean value obtained by using 7-day + Vapor gard treatment (38.48) at the first season and by using 14 day + Vapor gard treatment (39.11) in the second season respectively.

6. Interaction effect between wheat varieties and antitranspirants

6.1. Total chlorophyll content at milk ripe stage (mg/ 100g. D.M.)

Data collected in Table (22) showed that total chlorophyll content at milk ripe stage (mg/ 100g.D.M) was positively increased by wheat varieties and antitranspirant treatments. The highest total chlorophyll content at milk ripe stage value (43.06) obtained by using Sids 7 + Vapor gard treatment at the second season only.

6.2. Stomata number of upper leaf surface:

It can be noticed from results recorded in Table (22) that tomata number of upper leaf surface was increased significantly by the interaction effect between wheat varieties and antitranspirants treatments. The highest stomata number of upper leaf surface value (30.21) was obtained by using Sids 7 + Vapor gard treatment at first season only. These observations are in conformity with those obtained by **Rao (1986), Rao and Ghai (1986), Abd El- Gawad et al. (1993) and Abd El- Maboud (1996).**

6.3. Stomata air chamber area of lower leaf surface (μ^2):

Data collected in Table (22) showed that stomata air chamber area of lower leaf surface (μ^2) was positively increased by wheat varieties and antitranspirants treatments. The highest mean

5.5. Stomata air chamber area of lower leaf surface (μ^2):

Data collected in Table (21) showed that stomata air chamber area of lower leaf surface (μ^2) were positively effected by irrigation intervals and antitranspirant treatments. The highest mean value (153.0) was obtained by using 14- day + Vapor gard treatment at the second season only. These results were agreement with those obtained by **Abd El-Gawad et al. (1993), Kanayeem and Dgdalir (1993), and Abd El- Maboud (1996).**

5.6. Stomata air chamber size of upper leaf surface (μ^3):

Raising irrigation intervals and antitranspirants treatments effected stomata air chamber size of upper leaf surface (μ^3) Table (21) over the two studied seasons. The highest value (557.3) was gained by adding 14-day + Vapor gard treatment at the first season only. These results are in good harmony with those obtained by **Abd El- Gawad et al. (1993), Kanayeem and Dgdalir (1993), and Abd El- Maboud (1996).**

5.7. Stomata air chamber size of lower leaf surface (μ^3):

Data collected in Table (21) showed that stomata air chamber size of lower leaf surface (μ^3) were affected by irrigation intervals and antitranspirant treatments. The highest mean value (474.3) was obtained by using 14-day + Vapor gard treatment at the second season only.

5.8. Grain filling rate (GFR) (mg/ spike/ day):

It can be noticed from results recorded in Table (21) that grain filling rate (GFR) (mg/spike/ day) were significantly affected by the interaction between irrigation intervals and antitranspirant treatments. Such results were true for both seasons. The highest mean values (922.3 and 911.2) were obtained by adding 14-day + Vapor gard treatment in the first and second seasons , respectively.

Table (22):Interaction effect between wheat varieties and plant antitranspirants on total chlorophyll, proline content, stomata measurement and grain growth parameters in 1997/1998 and 1998/1999 growing seasons.

seasons	Sids 6		Sids 7		Sids 8	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Total chlorophyll content at milk ripe stage (mg/100g.D.M.)						
Tap water		39.17		39.87		38.75
Vapor-gard		42.23		43.06		41.37
Nu-film		41.22		41.72		40.13
LSD(0.05%)	1st : N.S 2nd : 0.34					
Stomata number of upper leaf surface						
Tap water	27.85		29.18		27.54	
Vapor-gard	28.62		30.21		28.80	
Nu-film	28.53		29.27		28.41	
LSD(0.05%)	1st : 0.38 2nd :N.S					
Stomata airchamber area of lower leaf surface (μ^2)						
Tap water		146.5		148.7		144.9
Vapor-gard		148.2		150.9		147.2
Nu-film		147.4		149.5		146.3
LSD(0.05%)	1st : N.S 2nd : 0.95					
Stomata air chamber size of upper leaf surface (μ^3)						
Tap water	496.3		522.0		485.7	
Vapor-gard	535.0		550.4		511.8	
Nu-film	524.3		532.3		499.6	
LSD(0.05%)	1st : 5.2 2nd :N.S					
Stomata air chamber size of lower surface (μ^3)						
Tap water		454.2		461.2		449.4
Vapor-gard		459.6		468.0		454.3
Nu-film		457.1		463.6		453.6
LSD(0.05%)	1st : N.S 2nd : 2.4					
Grain filling rate (GFR) (mg/spike/ day)						
Tap water	762.1	767.5	584.4	782.7	752.7	750.1
Vapor-gard	888.9	874.5	919.0	901.7	849.0	853.7
Nu-film	795.2	792.5	831.7	842.2	778.9	790.7
LSD(0.05%)	1st : 5.9 2nd :5.8					
Effective grain filling period (EGFP) (days)						
Tap water	36.27	36.23	36.68	36.78	36.15	36.35
Vapor-gard	38.01	38.38	39.07	39.13	38.01	37.95
Nu-film	37.25	37.46	37.77	37.99	37.12	37.18
LSD(0.05%)	1st : 0.42 2nd : 0.46					

(150.9) was obtained by adding Sids 7 + Vapor gard treatment at the second season only.

6.4. Stomata air chamber size of upper leaf surface (μ^3):

Data reported in Table (22) indicated that stomata air chamber size of upper leaf surface was increased significantly by the interaction effect between wheat varieties and antitranspirant treatments. The highest stomata air chamber size of upper leaf surface value (550.4) was obtained by adding Sids 7 + Vapor gard treatment at the first season only. These results are in confirmation with those obtained by **Rao (1986), Salem (1986), Ab El-Gawad et al. (1993), and Abd El-Maboud (1996).**

6.5. Stomata air chamber size of lower leaf surface (μ^3):

Data recorded in Table (22) indicated that stomata air chamber size of lower leaf surface was significantly increased by increasing the interaction effect between wheat varieties and antitranspirant treatments. The highest mean value (468.0) was achieved by using Sids 7 + Vapor gard treatment at the second season only.

6.6. Grain filling rate (GFR) (mg/ spike/ day):

It can be noticed from results recorded in Table (22) that grain filling rate was significantly increased with increasing the interaction effect between wheat varieties and antitranspirant treatments. Such results were true for both seasons. The highest grain filling rate values (919.0 and 901.7) were obtained by using Sids 7 + Vapor gard treatment. These observations are in conformity with those obtained by **Abd- El-Gawad et al. (1993) and Moselhy (1995).**

6.7. Effective grain filling period (days):

Data recorded in Table (22) indicated that effective grain filling period (days) were increased significantly the interaction effect between wheat varieties and antitranspiratns treatments in both seasons. The highest mean values (39.07 and 39.13) were achieved by using Sids 7 + Vapor gard treatments. The results are in agreement with those findings by **Abd El-Gawad et al. (1993) and Moselhy (1995).**

7. Interaction effect between the three studied factors

7.1. Stomata air chamber area of upper leaf surface (μ^2):

Results in Table (23) showed that stomata air chamber area of upper leaf surface (μ^2) increased significantly by the interaction effect between three studied factors treatments. The highest mean values (159.9) was obtained by using 14- day + Sids 7 + Vapor gard treatment at the second season only. Similar results were obtained by **Rao (1986), Salem (1986) and Abd El- Maboud (1996).**

7.2. Grain filling rate (GFR) (mg/ spike/ day):

It can be noticed from results recorded in Table (23) that grain filling rate were significantly increased by increasing the interaction effect between the three studied factors treatments. The highest mean values of grain filling rates (956.3 and 941.1) were obtained by adding 14- day + Sids 7 + Vapor gard treatment at the first and second seasons, respectively. These results are in good harmony with those obtained by **Abd El- Gawad et al. (1993) and Moselhy (1995)**

7.3. Effective grain filling period (days) (EGFP):

Data collected in Table (23) showed that effective grain filling period (days) was positively increased by the interaction

Table (23):Interaction effect between the three studied factors on stomata measurement and grain growth parameters in 1997/98 and 1998/99 growing seasons.

seasons		A1(1)		A2		A3		A4	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Stomata air chamber are of upper surface (M^2)									
B1(2)	C1(3)		148.0		153.8		146.3		149.3
	C2		154.8		158.2		148.2		153.1
	C3		152.6		156.7		147.0		151.7
B2	C1		152.2		156.8		148.7		154.9
	C2		154.8		159.9		150.9		157.0
	C3		153.1		158.9		150.0		156.1
B3	C1		143.5		149.4		144.1		143.9
	C2		145.6		152.0		146.7		147.1
	C3		144.7		151.7		145.8		145.7
LSD(0.05)			1st. :N.S 2nd. : 1.45						
Grain filling rate (G.F.R.) (mg/spike/day)									
B1	C1	757.5	771.1	780.9	791.9	754.1	728.8	755.9	778.4
	C2	883.7	778.1	924.8	900.7	868.8	832.8	878.5	886.4
	C3	772.3	778.2	925.2	835.0	792.3	777.1	791.1	779.9
B2	C1	763.8	786.4	789.5	799.6	776.6	754.4	756.3	790.6
	C2	905.6	902.5	956.3	941.1	926.2	858.9	887.8	904.1
	C3	795.4	856.4	885.4	907.3	831.7	803.5	814.6	801.6
B3	C1	749.7	756.2	774.9	785.7	734.0	723.4	752.3	735.2
	C2	844.8	840.8	885.9	892.7	830.0	847.1	835.4	834.1
	C3	756.8	768.0	802.3	831.4	789.4	774.3	767.3	789.7
LSD(0.05)				1st. :7.6 2nd. : 4.8					
Effective grain filling period (ERFP) (days)									
B1	C1	36.37		36.43		36.10		36.18	
	C2	38.34		38.39		37.88		37.43	
	C3	37.48		37.29		37.09		37.14	
B2	C1	36.40		37.32		36.60		36.41	
	C2	39.01		40.06		38.32		38.89	
	C3	37.81		37.04		36.62		37.61	
B3	C1	35.91		36.60		35.98		36.10	
	C2	38.08		38.14		37.95		37.89	
	C3	37.14		37.48		36.74		37.23	
LSD(0.05)			1st. :0.41 2nd. : N.S.						

Notes: 1. (A) Irrigation intervals **2. (B) Wheat varieties.**
3. (C) Plant antitranspirants

effect between the three studied factors treatments. The highest mean value (40.6) was obtained by using 14- day + Sids 7 + Vapor gard treatment at the first season only. These results were in full agreement with those obtained by **Abd El-Gawad et al. (1993), Moselhy (1995) and Abd El-Maboud (1996).**

III. Effect of irrigation intervals, wheat varieties and plant antitranspiratns on yield and yield components:

1. Effect of irrigation intervals:

Results in Table (24) represent the effect of irrigation intervals, wheat varieties and plant antitranspirants on yield and yield components and their interaction, combined analysis of 1997/98 and 1998/99 growing seasons.

1.1. Plant height

Plant height of wheat at harvest significantly affected by increasing irrigation intervals from 7 – day to 14 – day and 21 – day. The tallest plant (107 cm) were found when irrigation was at 14 – day interval, whereas, the shortest plants (103.3) were obtained when irrigation was at 7– day interval. This result clarify the sutaple of water for cell division and cell enlargement in addition to its role in the physiological and biological activities which end up with optimum vegetative growth. Similar results were obtained by **Hassan, et al (1987), Talukder (1987), and Shalaby et al (1992).**

1.2. Number of spikes per one square meter

The effect of irrigation intervals on number of spikes /m^2 of wheat in the combined over 1997/98 and 1998/99 seasons are shown in Table (24). Bi-weekly irrigation (at 14 – day) produced the highest number of spikes/m^2 (220.5) and Tri – weekly irrigated

Table (24): Effect of irrigation intervals, wheat varieties and plant antitranspirants on yield and yield components as well as harvest index (combined analysis of 1996/97 and 1997/ 98 seasons).

Characters / Treatments	Yield components							Yields			
	plant height (cm.)	No. of spikes/ (m^2)	Spike length (cm.)	No. of spi kelets/ spike	No. of grains/ spike	Spike grain weight(g.)	1000-gr-ain weight (g.)	Grain yield (Ton/Fed)	Straw yield (Ton/Fed)	Biological yield (Ton/Fed)	Harvest index (%)
Irrigation intervals											
7 days	103.3	216.29	15.68	19.99	42.77	1.78	41.52	1.626	3.112	4.738	34.23
14 days	107.0	220.50	16.83	21.84	50.18	2.15	42.86	1.998	3.500	5.498	36.31
21 days	106.1	215.50	15.35	19.31	37.36	1.52	40.77	1.373	2.773	4.146	32.96
Common Irri-	105.2	217.10	16.03	21.29	47.50	2.08	42.11	1.824	3.334	5.158	35.43
LSD (0.05)	0.8	1.03	0.48	0.48	1.68	0.13	0.54	0.061	0.112	0.165	0.45
Varieties											
Sids 6	104.7	215.3	15.84	20.56	44.70	1.76	41.73	1.706	3.161	4.867	34.98
Sids 7	106.9	218.9	16.51	21.04	46.48	1.94	42.43	1.817	3.372	5.189	34.95
Sids 8	104.6	215.9	15.57	20.22	42.17	1.60	41.28	1.596	2.990	4.596	34.73
LSD (0.05)	0.6	N.S	0.45	0.41	1.43	0.14	0.41	0.050	0.110	0.149	N.S
Antitranspirants											
Tap water	102.0	215.4	14.65	20.14	42.87	1.62	40.55	1.583	2.984	4.567	34.66
Vapor gard	105.5	219.6	17.15	21.25	47.16	2.02	43.21	1.886	3.472	5.358	35.20
Nu-film	108.6	217.0	16.12	20.43	43.33	1.66	41.69	1.640	3.084	4.724	34.72
LSD (0.05)	0.4	0.6	0.24	0.23	1.00	0.13	0.20	0.035	0.081	0.110	0.19

(at 21 – day) gave the lowest numbers. However, the difference between the common irrigation and 7–day interval in the respective character was insignificant. Many workers found that prolonging the time elapsed between the subsequent irrigations caused significant continuous decrease in number of spikes/m^2 **Talukder (1987), and Shalaby et al (1992).**

1.3. Spike length (cm.).

Narrowing irrigation intervals caused a significant effect in spike length of the growing wheat varieties. The effect in spike length of wheat plants varied according to duration period of irrigation. As the irrigation intervals increased from 7 to 14–day, the increase in spike length was higher as compared with the increase in irrigation interval from 7 to 21 – day. This is because of the expected dry weather condition during the growing winter season of Ras – Sudr (Saini-Governorate). Similar results were also reported by **Ehdaie et al (1988), Shalaby et al (1992). El–Kalla et al (1994) and Ghanem et al (1994).**

1.4. Number of spikelets / spike

Results showed that number of spikelets per spike significantly increased as a result of applied the irrigation water at 14 – day interval (Table 24). On the other hand, prolonging the time between the subsequent (21-day interval) decreased number of spikelets/ spike compared with the other three irrigation systems.

It could be concluded that prolonging the time elapsed between the subsequent irrigations caused a significant decrease in dry matter content, spike length and number of spikelets/spike compared with the other three irrigation systems.

1.5. Number of grains / spike:

The results in Table (24) showed that prolonging the time elapsed between the sub-sequent irrigations more than 14 days caused a significant decrease in number of grains / spike. Such decreases in the same respective character may be due to decrease in dry matter content, spike length, and number of active spikelets/spike. On the other hand, the largest number of grains /spike (50.18) was obtained when irrigation was at 14 – day interval. This result confirm the role of water in increasing plant growth and dry matter content. Along the same concept, **Shalaby et al (1992), El–Kalla et al (1994) Ghanem et al (1994) and Semaikea et al (1994)** clarified the effect of adequate irrigation in increasing number of grains / spike.

1.6. Spike grains weight:

The highest grains weight of spike (2.15) was noticed at the irrigation interval of 14–day compared with the other three irrigation systems with significant differences in the combined data (Table, 24). Such increases in spike grain weight are very well expected since increase spike length, number of spikelets/spike and number of grains / spike and development needs adequate amounts of water through irrigation. The obtained results confirm those of **Shalaby et al (1992), El-Kalla (1994), Ghanem et al (1994) and Semaikea (1994).**

1.7. 1000 – grain weight

Results in Table (24) showed that the time elapsed between the subsequent irrigations increased from 7 to 14 – day, 1000 – grains weight of wheat significantly increased by 3.32%. On the other hand, 21- day interval significantly decreased the same respective character by 1.84% compared with 7–day interval. This result clarify the well known importance of water for cell division and cell enlargement in addition to its role in the physiological and biological activities which end up with an optimum vegetative growth, spike length, number of grains / spike, as well as spike grain weight. The obtained previously mentioned results for the effect of narrowing the irrigation intervals in increasing 1000 – grain weight and yield components of wheat plants are in agreement with those obtained by **Shalaby et al (1992), El– Kalla et al. (1994) and Ghanem et al (1994).**

1.8. Grain yield (Ton /fed)

Results of the effect of irrigation intervals on grain yield in the combined average of 1997/98 and 1998/99 seasons are presented in Table (24). Increasing irrigation interval from 7 – day to 14 – day or 21 – day caused a significant effect in grain yield of wheat. The obtained grain yield at 7, 14, and 21 day irrigation intervals was 1.626, 1.998, and 1.373 ton / fed, respectively. As the time elapsed between the subsequent irrigations increased from 7 to 14–day, grain yield of wheat increased by 22.88%. The corresponding reduction in grain yield when comparing between the effect of the shortest irrigation interval (7–day) and the longest one (21–day) was 18.4%. It could be noticed that prolonging the time elapsed between the subsequent irrigations caused a significant decrease in grain yield and its components of wheat. This result is very well accepted since it clarifies and manifests the role of water in plant growth, dissolving and absorbing nutrients, movement and distribution of plant metabolities and other requirements of growth, development and production. The obtained results confirm those of **Shalaby et al (1992), El – Kalla et al (1994), Ghanem et al (1994), and Semaikea (1994)** in wheat.

1.9. Straw yield (ton / fed)

Straw yield of wheat was almost similar to grain yield in its response to the applied irrigation intervals. The corresponding straw yield was 3.112, 3.500, and 2.773 Ton/fed. combined over the two growing seasons as shown in Table (24) with significant differences. The common irrigation produced 3.334 ton straw yield. In general, the highest straw yield of wheat due to the more frequent irrigation of the medium duration intervals of 14 – day was similar to that of grain yield previously presented. Similar results were also obtained by **Shalaby et al (1992), El-Kalla et al (1994) and Semaikea (1994).**

1.10. Biological yield (Ton /fed)

Biological yield of wheat as affected by increasing the duration period of irrigation from 7 to 14 and 21 – day are shown in Table (24). Bi-weekly irrigated (at 14–day interval) had the highest grain, straw and biological yield and Tri-weekly (at 21–day interval) gave the lowest yields.These results reconfirm the essential role of water in governing any of the biological and physiological activities as well as the mobilization of the metabolites responsible for growth and accumulation of dry matter content of the grown wheat varieties under Rus-Sudr conditions. **Shalaby et al (1992), El–Kalla et al (1994), Ghanem et al (1994) and Semaikea (1994)** found that prolonging the time elapsed between the sub-sequent irrigations caused a significant decrease in grain, straw, and biological yields / fed.

1.11 Harvest index (%):

Results in Table (24) showed significant differences and specific clear trend for effect of the applied irrigation intervals also grain and straw yield / fed. It is obviously clear that the largest harvest index (36.31%) was obtained when irrigation was at 14–day interval. Whereas, the smallest harvest index (32.96%) was obtained when irrigation was at 21 – day interval. This result confirm the role of water in increasing grain and straw yields. Along the same concept, **Shalaby et al (1992), El–Kalla et al**

(1994), Ghanem et al (1994) and Semaikea (1994) clarified the effect of adequate irrigation in increasing harvest index of wheat.

2. Effect of wheat varieties:

The effect of three wheat varieties on grain yield and yield components as combined analysis of 1997/98 and 1998/99 growing seasons are shown in Table (24).

2.1. Plant height (cm.):

The results showed that the evaluated cultivars could be classified into two groups the 1st. group included Sids 7 with average height of (106.9 cm) as the tallest cultivars, while the 2nd. group included Sids 6 and Sids 8 with average height of (104.7 cm.) and (104.6 cm.)

Also, the largest difference among the cultivars did not exceed 2.3 cm/plant. The differences found among the tested cultivars in plant height may be due to the differences in the genetical make up. The results reported by **Ali (1997), Abd el-All (1999) and Abou El-Ela (2001)** showed that wheat cultivars varied widely in plant height.

2.2. Number of spike per one square mater:

The three varieties evaluated in the present study showed insignificant differences in number of spikes/ m^2 in the combined average of 1997/98 and 1998/99 seasons (Table 24). Sids 7 produced the highest number of spikes/m^2 (218.9) and other varieties (Sids 6 and Sids 8) gave the lowest ones. The largest difference among the three cultivars did not exceed 5 spikes/ m^2. **Gomaa (1999)** stated with those named Sids (4-9) and characterized by poor tillering capacity as well as susceptibility to rust diseases.

Other investigators reported marked differences among wheat cultivars in number of spikes/m^2 **(Abo-Warda, 1997, Ali, 1997, Abd El-All, 1999 and Abou El-Ela 2001).**

2.3 Spike length: (cm):

Sids 7 variety recorded the longest spikes (16.51cm) whereas shortest spikes obtained from those of Sids 6 and Sids 8 without significant differences (Table 24). It could be concluded that Sids 7 surpassed Sids 6 and Sids 8 in this character.

2.4. Number of spikelets/spike:

The three cultivars evaluated in the present study showed significant differences in number of spikelets/ spike for the combined average of both seasons (Table 24). Sids 7 showed the highest number of fertile spikelets (21.04 spikelets/spike) followed by Sids 6 (20.56 spikelets/ spike) and Sids 8 (20.22 Spikelets/ spike). However, no significant difference was revealed between Sids 6 and Sids 8 varieties. Many investigators reported also considerable variations in the number of spikelets/ spike of the different wheat cultivars **(Ali, 1997, Abd El-All 1999, and Abou El-Ela, 2001).**

2.5. Number of grains / spike:

The results indicated highly significant differences among the three tested cultivars in number of grains/ spike for the average of both seasons (Table 24). Sids 7 scored significantly the highest number of grains/ spike (46.48), being followed by Sids 6 with moderate number (44.70) and Sids 8 was the least (42.17). Although the difference among the three cultivars did not exceed 5 grains/ spike, i.e. between Sids 7 (46.48) and Sids 8 (42.17). Such increases in number of grains/ spike in Sids 7 over Sids 6 and Sids 8 may be due to increase spike length and number of fertil spikelets/ spike. It could be concluded that Sids 7 is superior variety in number of grains/ spike and this character is considered as an important yield component character which among those governing grain yield of wheat. Similar results were also obtained by **Abo-Warda (1997), Ali (1997), Abd El- All (1999),** who found that wheat vrieties markedly varied in number of grains per spike.

2.6. Spike grains weight (g):

The results indicated significant differences in spike grain weight in the combined average of both seasons (Table 24). The highest grain yield/spike was 1.94g which was recorded by Sids 7, followed by Sids 6 (1.76 g.) and the lowest grain yield/ spike was 1.60 g recorded with Sids 8, which was significantly inferior compared with Sids 6 and Sids 7. Significant differences were observed between Sids 7 and each of Sids 6 and Sids 8 such increases in grain weight of spike in Sids 7 over Sids 6 and Sids 8 may be due to increase number of grains/ spike. Similar results were also obtained by **Abo- Warda (1997), Ali (1997), Abd El-All (1999) and Abo El-Ela, (2001)**. They found that wheat cultivars markedly varied in grain weight/ spike.

2.7. Weight of 1000- grains (g):

The results in Table (24) indicated significant differences among the three cultivars for the combined analysis of 1997/ 98 and 1998/99 growing seasons. The combined average over the two seasons were 42.43 g. for Sids 7 at the top in grain index, comparing with 41.73 g., 41. 28g/ 1000 grains for the other both cultivars. It could be concluded that, Sids 7 was superior in grain index compared with Sids 6 and Sids 8. These results effect the genetic background of Sids 7, which is one of the 1^{st}, generations of wheat is called long spike wheat cultivars, which is characterized by the long spike, higher number of kernels, heavier kernels and higher protein **(Gomma, 1999)**. The differences among wheat cultivars in grain index were also reported by **Abd El- Majeed, et al. (1988), Abd El-All (1998) and Abou El- Ela (2001).**

2.8 Grain yield/fed.

Results in Table (24) showed that Sids 7 was the best variety in grain yield per faddan production compared with the other wheat varieties (Sids 6 and Sids 8) with significant differences. Also, the differences in grain yield production between Sids 6 and Sids 8 was significant. It should be noted that Sids 7 was significantly higher in grain yield than Sids 6 and Sids 8 by 6.51 and 13.85%, respectively. These results reflect those achieved for yield components such as number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, spike grain weight and grain index, which put Sids 7 at the top, to be followed by Sids 6 and then Sids 8, respectively. The failure of Sids 8, through being among the 1st generation of what is called long spike wheats, may be attributed to its high susceptibility to resist diseases **(Gomaa, 1999)**, beside of being heat tolerant which prefer warmer conditions of middle Egypt, then those at Ras-Sidr. In the same line, **Abo-warda (1997)** evaluated Sids 7 with five other Sids long spike cultivars and Sakha 69 under new land sandy soil at Nubaria. He did not recommended growing long spike lines in sandy soils, supporting the fact that the Sids long spike cultivars favour hot conditions of middle Delta, rather than the mild climates of lower Egypt. In this respect, differences in yield potentialities of the grown wheat cultivars were very well accepted since such Sids cultivars varied in their interaction with the environmental conditions of the growing area.

Many investigators reported marked differences in the yielding ability of wheat varieties **(Abd El-Ghany, 1997, Ali, 1997, Azza Abd El-All 1999, and Sabah Abou El-Ela, 2001).**

2.9. Straw yield (Ton/fed.).

Straw yield (ton/fed) of the grown three wheat cultivars for combined over the two growing seasons are presented in Table (24). There were significant differences in straw yield between the three grown Sids cultivars. Also, the difference between Sids 6 and Sids 8 in straw yield was significant. It is very well noticed that Sids 7 was the highest in straw yield as compared with the other two wheat varieties. The obtained results in sure the variation between the three wheat cultivars in their plant height, dry matter content, growth analysis characters and straw yield productivity. This is due their differences in their genetical make up and its interaction with environmental conditions. A long the same line, **Abd El-Ghany (1997), Abo-Warda (1997), Abd El-All (1999) and Abou El-Ela (2001)**, reported differences in the straw yield per wheat plants among the tested wheat cultivars.

2.10 Biological yield (Ton/fed.)

Results in Table (24) showed that Sids 7 significantly increased grain, and straw yields as well as biological yield (Ton/fed) compared with Sids 6 and Sids 8 cultivars such increased in biological yield for Sids 7 over Sids 6 and Sids 8 were 6.6 and 13.1%, respectively. It could be generally noticed that Sids 7 was of the highest biological yield, followed by Sids 6, then Sids 8. In conclusion, the biological yield of the grown three wheat varieties could be ranked a following descend order: Sids 7 (5.189 ton/fed) > Sids 6 (4.867, ton/fed) > Sids 8 (4.586, ton/fed). Difference in biological yield of the three Sids cultivars were significant. This is due the differences in their genetical make up and its interaction with the environmental conditions in Ras-Sidr, region (Tables 2, 3 and 4). Results reported by **Abd El-Ghany (1997), Ali, (1997) and Abd El-All (1999) and Abou El-Ela (2001)** marked differences in the biological yield of the evaluated seven Sids wheat varieties.

2.11. Harvest index (HI)

Results in Table (24) showed no significant differences among the three Sids cultivars regarding harvest index. Results revealed the highest values were recorded for Sids 6 (34.98%) followed by Sids 7 (34.95%) and Sids 8 (34.73%). It is worth noting that results of harvest index were in parallel, with those of straw and grain yields/fed. indicating that increased vegetative growth caused proportional increase in grain yield. The same trend was obtained by **Abo-Warda (1997), Ali (1997), Abd El-Majeed et al. (1998), and Abou El-Ela (2001).**

3. Effect of plant antitranspirants:

The effect of antitranspirants on grain yield and its components for the combined average of 1997,98 and 1998/99 seasons are shown in Table (24).

3.1. Plant height:

The results presented in Table (24) indicated significant effects of Vapor gard and Nu-film spraying compared with control treatment on plant height for the combined data. Foliar application with the same respective materials significantly increased plant height over the control treatment by 3.43 and 6.47%. The maximum effect was about 6.6 cm (6.47%) at Nu-film application. The present results are in general agreement with those obtained by **Rao and Ghai (1986), Ibrahim et. al. (1993) and Maliwal et. al (1993)**.

3.2. Number of spikes per one sequare meter:

The results in Table (24) showed that foliar application with antitranspirants significantly affected number of spikes/$m^2$for the average of both seasons. The combined analysis over the two seasons, indicated significant effect for antitranspirants on number of spikes/m^2. Spraying Vapor gard and Nu-film treatments increased number of spikes/m^2 over the control by 1.95 and 0.74%, respectively. The results obtained by **Rao and Ghai (1986) and Ibrahim et. al. (1993)** indicated that antitranspirants spraying significantly increased number of spikes/m^2.

3.3. Spike length:

Results of spike length of the three wheat cultivars as affected by foliar application with antitranspirants for the combined average of 1997/98 and 1998/99 seasons are given in Table (24).Spike length significantly increased as a result of spraying Vapor gard and Nu- film. Such increases due to adding the same respective treatments over the untreated were 2.50cm and 1.47 cm, respectively. Many investigators reported that spraying antitranspirants increased spike length **Ibrahim et. al. (1993), Maliwal et. al. (1993) and Haggag et. al. (1994).**

3.4. Number of spikelest/ spike.

The results in Table (24) showed that the two seasons average indicated significant increases in spikelets number/ spike by foliar application with plant antitranspirants. Such increases in spikelets number/ spike due to adding Vapor gard and Nu-film over the check treatment were 5.51 and 1.44%, respectively. The increases due to antitranspirants spraying may be attributed to increase spike length. Many investigators reported the positive effects for antitranspirants application on spikelets number/spike wheat.

3.5. Number of grains/ spike:

Results presented in Table (24) showed that Vapor gard and Nu- film application significantly affected number of grains/ spike for the average of 1997/ 98and 1998/99 growing seasons. However, the difference between Nu- film and untreated was insignificant. Combined analysis showed that applying Vapor gard treatment accompanied by increased grains number with 10.01% over the control, supporting the results of both seasons, that Vapor gard sprying was the best recommendation. The encouraging effect of Vapor gard on grain number may be due to its effect the vegetative growth during spike initiation and extending period of anthesis and fertilization to improve seed set and seed formation, under climatic conditions in Wadi-Sudr. The positive effects of plant antitranspirants on number of kernels/spike were reported by many workes such as **Ibrahim et. al. (1993), Maliwal et. al. (1993) and Haggag et. al. (1994).**

3.6. Spike grain weight:

Foliar application with Vapor gard showed significant positive effects on spike grain weight of wheat in the combined average of both seasons. Table (24). Such increase in spike grain weight may be due to the positive effect of Vapor gard treatment on number of grains/ spike. The positive effect of plant antitranspirants on spike grain weight was detected also by **Ibrahim et. al. (1993), Haggag et. al.(1994) and Yadav and Pandey (1997).**

3.7. 1000-grain weight.

The results in Table (24) showed that applying Vapor gard and Nu-film treatment significantly increased 1000-grain weight by 6.56 and 2.81%, respectively. It was generally observed that the highest 1000-grain weight was obtained by Vapor gard spraying. The increase in 1000-grain weight resulting from Vapor gard spraying in mainly due to the positive effect of plant antitranspirants on vegetative growth and grain formation. Similar results were also obtained by **Ibrahim et. al. (1993), Haggag et. al. (1994) and Yadav and Pandey (1997).**

3.8. Grain yield (Ton/fed).

Foliar application with plant antitranspirants significantly increased grain yield in the combined data. The two seasons average indicates a more clear effect of Vapor gard and Nu-film treatments. Applying the same respective treatments significantly increased grain yield by 303 kg (19.14%) and 57 kg/fed (3.60%) compared with the check treatment. Thus, it could be recommended to use Vapor gard antitranspirant to get the highest performance in accordance with results achieved regarding grain yield as well as grain yield components such as number of spikes/ m^2, spike length, number of spikelets and grains/ spike, spike grain weight and 1000-grain weight. Also, a Vapor gard spraying increased vegetative growth and grain filling period, consequently, grain yield was increased. Under the conditions of the experiment a Vapor gard antitranspirant could be recommend on the overall average of the tested varieties. Similar results were also obtained by **Ibrahim et. al. (1993), Haggag et. al. (1994) and Yadav and Pandey (1997).**

3.9. Straw yield (Ton/fed):

The results in Table (24) showed that foliar application with Vapor gard and Nu-film treatments significantly increased straw yield of wheat/fed. in the combined average of 1997/ 98 and 1998/99 seasons. Vapor gard and Nu-film treatments significantly increased straw yield/fed over the check treatment by 488kg/fed (16.35%) and 100 kg/fed 3.35%, respectively. It could be concluded that Vapor gard antitranspirant was the best material for producing the highest straw yield. The increase in straw yield is mainly due to the effect of Vapor gard on plant height, number of spikes/ m^2, and the other component characters. Similars results were also reported by **Ibrahim et. al. (1993) and Haggag et. al. (1994).**

3-10. Biological yield (Ton/fed):

The results in Table (24) showed that biological yield significantly increased by plant antitranspirants spraying in the average of both seasons. Foliar application with Vapor gard and Nu- film treatments increased biological yield by 791kg (17.32%) and 157 kg (3.44%), respectively as compared with the control treatment. The increase in biological yield is mainly due to the effect of plant antitranspirants on vegetative growth and grain formation as well as yield components. The positive effects of plant antitranspirants on grain and straw yields as well as biological yield of wheat were reported by **Yadav and Pandey (1997).** It was generally observed that the highest grain, straw and biological yield in the two growing seasons was obtained by applying Vapor gard antitranspirants.

3. 11. Harvest index (%):

High significant differences in harvest index was detected due to Vapor gard spraying in the average of both seasons (Table, 24). It could be shown that Vapor gard was produced the highest harvest index 35.2%. However, the difference between Nu-film and tap water treatments was not significant in this character. Many investigators reported significant increasing effects for some plant antitranspirants spraying on wheat harvest index e.g. **Ibrahim et. al. (1993) and Haggag et. al. (1994).**

4. Interaction effect between irrigation intervals and wheat varieties

4.1. Plant height:

Results in Table (25) showed that the plant height at harvest was significantly affected by the interaction between irrigation intervals and wheat varieties in the second season only. The response of wheat plants to irrigation was greatly affected by wheat varieties applied. The tallest plant (108.1cm.) was obtained at 21-day + Sids 7 treatments and the shortest plants (102.7cm.) was produced at 7 day + Sids 6, treatment. Similar results were obtained by **Bhardwaj and Singh (1987), and Ehaid et al. (1988).**

4.2. Number of grain / spikelets:

Results for number of grains/ Spikelets as affected by the interaction between irrigation intervals and wheat varieties treatments in the first season only are shown in Table (25). The highest number of grains/ spikelets value (2.29) was obtained by adding 14-day + Sids 8 treatment. The observation are in confirmation with those obtained by **Ellen (1990), Harmati (1991), and Shalaby et al. (1992).**

4.3. Number of grains/ spike:

Results in Table (25) show that number of grains/ spike was significantly affected by the interaction between irrigation intervals and wheat varieties treatments in both seasons. The highest number of grains/spike (47.8) was obtained by using 14 days interval + Sids 8 treatment in the first season. While 54.50 grains/spike by irrigated after 14 day + Sids 7 in the second season respectively. Similar results were obtained by . **Ellen (1990), and El-Kalla et al. (1994).**

Table (25):Interaction effect between irrigation intervals and wheat varieties on yield and yield components in 1997/1998 and 1998 / 1999 growing seasons.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
plant height (cm.)								
Sids 6		102.7		105.6		105.5		104.7
Sids 7		104.9		107.3		108.1		107.6
Sids 8		103.8		103.8		105.3		104.5
LSD (0.05)	1st: N.S. 2nd : 0.7							
Number of grains / spikelet								
Sids 6	2.13		2.25		1.93		2.13	
Sids 7	2.01		2.22		2.03		2.23	
Sids 8	2.07		2.29		1.41		2.03	
LSD (0.05)	1st: 0.06 2nd : N.S							
Number of grains / spike								
Sids 6	40.80	45.57	47.59	52.32	35.79	41.20	40.21	50.24
Sids 7	38.36	48.31	47.67	54.50	38.26	45.83	47.03	51.94
Sids 8	39.48	44.19	47.88	51.13	25.32	37.80	41.61	49.95
LSD (0.05)	1st: 1.72 2nd : 1.21							
Spike grain weight (g.)								
Sids 6	1.69	1.88	2.02	2.23	1.47	1.67	1.85	2.11
Sids 7	1.62	2.03	2.07	2.38	1.57	1.89	2.00	2.22
Sids 8	1.62	1.86	2.02	2.17	1.02	1.51	1.73	2.08
LSD (0.05)	1st: 0.18 2nd : 0.06							

Table (25):cont .

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Grain yeld (Ton / fed) .								
Sids 6	1.540	1.709	1.889	2.047	1.341	1.502	1.718	1.917
Sids 7	1.491	1.858	1.852	2.213	1.458	1.714	1.852	2.014
Sids 8	1.473	1.684	1.876	1.995	0.926	1.340	1.586	1.875
LSD (0.05)	1^{st}: 0.062 2^{nd} : 0.051							
Straw yield (Ton / Fed).								
Sids 6		3.265		3.629		2.962		3.452
Sids 7		3.547		3.829		3.423		3.669
Sids 8		3.264		3.505		2.831		3.433
LSD (0.05)	1^{st}: N.S. 2^{nd} : 0.121							
	Biological yield (Ton / fed) .							
Sids 6	4.504		5.205		4.014		4.866	
Sids 7	4.353		5.348		4.388		5.202	
Sids 8	4.281		5.225		3.842		4.475	
LSD (0.05)	1^{st}: 0.176 2^{nd} : N.S							
Harvest index (%)								
Sids 6	34.31	34.21	36.15	36.03	33.25	33.70	35.20	35.57
Sids 7	34.24	34.32	36.51	36.64	33.23	33.32	35.58	35.46
Sids 8	34.26	33.94	35.89	36.18	32.38	32.19	35.31	35.34
LSD (0.05)	1^{st}: 0.03 2^{nd} : 0.37							

4.4. Spike grain weight:

Results showed that at irrigation intervals (14-day) significant effect of wheat variety (Sids 7) on spike grain weight was detected in both season. The highest weight of spike grain weight was obtained at 14-day + Sids7 treatment and the lowest on was obtained at 21- day + Sids 8 treatments in both seasons.

4.5. Grain yield (Ton/fed):

Results in Table (25) show that grain yield (Ton/fed) was significantly increased at the interaction treatments between irrigation intervals and wheat varieties in the first and second seasons. The highest grain yield values (1.889 and 2.213 ton/fed) were obtained by using 14-day + Sids 6 and Sids 7 treatments in 1997/98 and 1998/99 seasons respectively. These observations are in conformity with those obtained by **El-Kalla et al. (1994), Moselhy (1995), and Mostafa, et al. (1997)**

4.6. Straw yield (ton/fed):

Result in Table (25) show that straw yield (Ton/fed) was significantly affected by the interaction treatments between irrigation intervals and wheat varieties. Such results were true for the second season only. The highest straw yield (3.829 Ton/fed.) was grained by adding 14- day + Sids 7, treatment. These results are in good harmony with those obtained by **Shalaby et al. (1992), El-Kalla, et al. (1994), Ghanem et al. (1994), Moselhy (1995) and Khodier et al. (1999).**

4.7. Biological yield (ton/fed):

Results in Table (25) show that biological yield (Ton/fed) was significantly affected with the interaction treatments between irrigation intervals and wheat varieties in the first season only. The highest biological yield value (5.348 Ton/fed.) was obtained by adding 14-day +Sids 7 treatment. These results are in good harmony with those obtained by **Shalaby et. al. (1992), El-Kalla et al. (1994), Ghanem et al. (1994), and Moselhy (1995).**

4.8. Harvest index (%):

Results in Table (25) indicated that harvest index (%) was significantly affected by irrigation intervals and wheat varieties interaction. Such results were true in both seasons. The highest mean value (36.51 and 36.64%) were obtained by using 14-days + Sids 7 treatment in the first and second seasons respectively. The results observation are in formation with those obtained by **El-Kalla et al. (1994), Ghanem et al. (1994), Moselhy (1995) and Khodier et al. (1999).**

5. Interaction effect between irrigation intervals and plant antitranspirants

5.1. Plant height:

Results in Table (26) indicated that plant height was significantly affected by the interaction between irrigation intervals and antitranspirants in the first and second seasons. Maximum plant height 111.5cm. at 1^{st} and 110.9cm. at 2^{nd}, respectively of wheat plant received irrigated every 21-day + Nu- film treatment. The lowest values 100.1 at 1^{st}, 100.9 at 2^{nd} were obtained when irrigated wheat plants every 7 days without antitranspirant.

5.2. Number of spikes/m^2:

Data recorded in Table (26) indicated that number of spikes/ m^2 at the first season only was significantly affected by adding the interaction between irrigation intervals and antitranspirant treatments. The highest mean value (223.6) was achieved by using irrigated every 14-days + vapor gard treatment, These result are in harmony with those botained by **Ellen (1990), Shalaby et al. (1992), Moselhy (1995) and Abd El- Maboud (1996).**

Table (26): Interaction effect between irrigation intervals and plant antitranspirants on yield and yield components in 1997/1998 and 1998/1999 growing seasons.

Seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Plant height (cm.)								
Tap water	100.1	100.9	103.1	102.3	103.6	102.4	101.5	102.4
Vapor-gard	103.2	104.0	106.8	105.6	107.4	106.6	104.9	105.8
Nu-film	105.1	106.4	109.6	108.3	111.5	110.9	107.7	108.7
LSD(0.05%)	1st: 1.0 2nd: 1.2							
Number of spikes/ m^2								
Tap water	214.7		221.0		216.7		216.9	
Vapor-gard	219.9		223.6		218.6		221.1	
Nu-film	216.6		221.5		216.7		219.5	
LSD(0.05%)	1st: 0.94 2nd: N.S							
Spike length (cm.)								
Tap water	13.62		15.30		13.87		14.60	
Vapor-gard	16.53		17.60		16.47		16.71	
Nu-film	15.05		17.00		16.03		15.69	
LSD(0.05%)	1st: 0.62 2nd: N.S							
Number of spikelets / spike								
Tap water		20.09		21.56		19.86		21.44
Vapor-gard		21.72		23.48		20.77		22.62
Nu-film		20.91		22.63		20.03		21.59
LSD(0.05%)	1st: N.S 2nd: 0.48							
Spike grain weight (g.)								
Tap water	1.56	1.77	1.90	2.07	1.26	1.61	1.75	2.02
Vapor-gard	1.83	2.12	2.23	2.47	1.47	1.84	2.03	2.30
Nu-film	1.54	1.89	1.97	2.24	1.32	1.62	1.80	2.08
LSD(0.05%)	1st: 0.24 2nd: 0.12							

Table (26):Cont.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
1000- grain weight (g.)								
Tap water	40.46		41.40		39.97		40.60	
Vapor-gard	42.94		44.38		42.05		43.45	
Nu-film	41.62		42.52		40.52		42.12	
LSD(0.05%)	1st: 0.54 2nd : N.S							
Grain yield (Ton/Fed.)								
Tap water		1.585		1.884		1.432		1.803
Vapor-gard		1.942		2.308		1.674		2.114
Nu-film		1.701		2.062		1.456		1.872
LSD(0.05%)	1st: N.S 2nd : 0.05							
Straw yield (Ton/Fed.)								
Tap water	2.764		3.142		2.348		2.945	
Vapor-gard	3.196		3.669		2.709		3.486	
Nu-film	2.672		3.256		2.386		3.037	
LSD(0.05%)	1st: 0.11 2nd : N.S							
Biological yield (Ton/Fed.)								
Tap water		4.654		5.213		4.352		5.156
Vapor-gard		5.637		6.309		5.007		5.882
Nu-film		5.021		5.685		4.435		5.320
LSD(0.05%)	1st: N.S 2nd : 0.09							
Harvest index (%)								
Tap water		34.07		36.17		32.93		35.18
Vapor-gard		34.49		36.40		33.50		35.94
Nu-film		33.92		36.22		32.78		35.25
LSD(0.05%)	1st: N.S 2nd : 0.32							

5.3. Spike length:

Spike length was significantly affected by increasing the interaction treatments between irrigation intervals and antitranspirants. The highest mean value (17.6 cm) was obtained by using 14-day + vapor gard at the first season only. These results were in full agreement with those obtained by **Harmati (1991), El-Kalla et al. (1994) and Moselhy (1995).**

5.4. Number of spikelets/ spike:

Data collected in Table (26) showed that number of spikelets/ spike were positively affected by irrigation intervals and antitranspirants treatments. The highest mean value (23.48) was obtained by using 14-day + vapor gard treatment at the second season only. These results are in confirmaty with those obtained by **Ellen (1990), Harmati (1991), Shalaby et al. (1992), El-Kalla et al. (1994) and Abd El- Maboud (1996).**

5.5. Spike grain weight:

Spike grain weight significantly affect by the interaction between irrigation intervals and antitranspirants treatments in 1997/98 and 1998/99 seasons (Table 26). The highest number of grains/spike (2.23 and 2.47) were obtained by 14 day interval and Vapor gard in both seasons, respectively.

5.6. 1000-grain weight:

Results in Table (26) show that 1000- grain weight were significantly affected by the interaction between irrigation intervals and antitranspirant treatments. The highest mean value of 1000-grain weight (44.38g) was obtained by using 14-day + vapor gard treatment at the first season only. These results are in full agreement with those obtained by **Shalaby et al. (1992), Abd El-Gawad et al (1993) and Moselhy (1995).**

5.7. Grain yield (Ton/fed):

It could be noticed from results recorded in Table (26) that grain yield (ton/fed) were significantly affected with the interaction between irrigation intervals and antitranspirants in the second season only. The highest mean value of grain yield (2.308 Ton/fed) was obtained by adding 14-day+ vapor gard treatment. These observation are in confirmation with those obtained by **El- Kalla et al. (1994), Moselhy (1995) and Abd El-Maboud (1996).**

5.8. Straw yield (Ton/fed):

Data recorded in Table (26) indicated that straw yield (Ton/fed) was significantly affected by the interaction between irrigation intervals and antitranspirant treatments. The highest mean value (3.669 Ton/fed.) was achieved by using 14-day + vapor gard treatment at the first season only. Similar results were obtained by **Harmati (1991), El-Kalla et al. (1994) and Moselhy (1995).**

5.9. Biological yield (Ton/fed):

Data recorded in Table (26) indicated that biological yield (Ton/fed) was significantly affected by the interaction effect between irrigation intervals and antitranspirant treatments. The highest mean value (6.309) was obtained by using 14-day +vapor gard treatment at the second season only. Similar results were obtained by **Ellen (1990), El- Kalla et al. (1994) and Moselhy (1995).**

5.10. Harvest index (%):

Results in Table (26) show that harvest index (%) was significantly affected by the interaction between irrigation intervals and antitranspirant treatments. The highest mean value of harvest index (36.40%) was obtained by using 14-day + vapor gard treatment at the second season only. These results are in full agreement with those obtained by **El-Kalla et al. (1994), Ahmed (1995), Moselhy (1995) and Abd El- Maboud (1996).**

6. Interaction effect between wheat varieties and plant antitranspirants

6.1. Plant height:

Data collected in Table (27) showed that plant height was significantly affected by wheat varieties and antitranspirant treatments. Such results were true for both seasons. The highest values of plant height (110.35 and 111.05 cm.) were obtained by using Sids 7 + Nu film treatment in both seasons respectively. Similar results were obtained by **Shalaby et al. (1992), El-Kalla et al. (1994) and Khodier et al. (1999).**

6.2. Number of spikes/ m^2:

Results in Table (27) show that number of spikes/m^2 was significantly affected by the interaction between wheat varieites and antitranspirants treatments. The highest value of number of spikes/ (223.2 spike/m^2) was obtained by using Sids 7 + Vapor gard treatment at the first season only. These results are in harmony with those obtained by **Shalaby et al. (1992), El-Kalla et al.(1994) and Moselhy (1995).**

6.3. Spike grain weight:

Data reported in Table (27) indicated that spike grain weight was significantly affected by the interaction between wheat varieties and antitranspirant treatments. Such results were true for both seasons. The highest mean values (1.99 and 2.32 g./spike) were obtained by using Sids 7 + Vapor gard treatment at the both seasons respectively.

6.4. Grain yield (ton/fed):

It could be noticed from results recorded in Table (27) that grain yield (ton/fed) was significantly affected by increasing the

Table (27):Interaction effect between wheat varieties and plant antitranspirants on yield and yield components in 1997/1998 and 1998/1999 growing seasons.

seasons	Sids 6		Sids 7		Sdis 8	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Plant height (cm.)						
Tap water	97.84	101.64	102.84	103.14	101.86	101.42
Vapor-gard	104.52	104.93	107.07	106.85	105.24	104.78
Nu-film	107.57	108.17	110.35	111.05	107.63	106.92
LSD(0.05%)	1st : 1.11 2nd :1.43					
Number of spikes / m^2						
Tap water	217.5		218.7		215.8	
Vapor-gard	220.6		223.2		218.6	
Nu-film	218.6		219.8		217.4	
LSD(0.05%)	1st : 1.6 2nd : N.S					
Spike grain weight (g.)						
Tap water	1.67	1.86	1.68	1.97	1.52	1.78
Vapor-gard	1.92	2.15	1.99	2.31	1.77	2.08
Nu-film	1.69	1.91	1.78	2.11	1.50	1.85
LSD(0.05%)	1st : 0.14 2nd : 0.10					
Grain yield (Ton/ Fed.)						
Tap water		1.664		1.780		1.594
Vapor-gard		1.975		2.143		1.906
Nu-film		1.726		1.928		1.667
LSD(0.05%)	1st : N.S 2nd :0.054					

interaction between wheat varieties and antitranspirants treatments in the second season only. The highest grain yield (2.43 Ton/fed.) was obtained by planting Sids 7 + Vapor gard treatments. Similar results were obtained by **El-Kalla et al. (1994), Moselhy (1995), and Abd El-Maboud (1996).**

7. Interaction effect between the three studied factors.

7.1. Plant height:

Data recorded in Table (28) indicated that plant height was significantly affected by the interaction between the three studied factors treatments. The highest value (113.6cm.) was achieved by using 21-day + Sids 7 + Nu-film treatments at the second season only. These results were in full agreement with those obtained by **Ellen (1990), El- Kalla et al. (1994), Moselhy (1995) and Abd El-Maboud (1996).**

7.2. Number of spikes/m^2

Data reported in Table (28) indicated that number of spikes/m^2 significantly affected by the interaction between the three studied factor treatments. The highest mean value (226.8) achieved by using 14-day + Sids 7 + Vapor gard treatment at the first season only Similar results were obtained by **Harmati (1991), El-Kalla et al. (1994) and Abd El-Maboud (1996).**

7.3. Spike length:

Results in Table (28) show that spike length significantly affected with the interaction between the three studied factor treatments. The highest value (19.49) was achieved by adding 14-day + Sids 7 + Vapor gard treatments at the second season only. These results are in confirmation with those obtained by **Ellen (1990) Shalaby et al. (1992) and El-Kalla et al. (1994).**

Table (28):Interaction effect between the three studied factors on yield and yield components in 1997/98 and 1998/99 growing seasons.

seasons		A1(1)		A2		A3		A4	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Plant height. (cm.)									
B1(2)	C1(3)		100.3		102.7		101.8		102.1
	C2		102.5		105.5		107.0		104.6
	C3		105.3		109.0		110.7		107.5
B2	C1		101.7		103.3		103.8		103.7
	C2		104.9		107.4		106.8		108.1
	C3		108.1		111.2		113.6		111.1
B3	C1		100.9		101.5		101.6		101.6
	C2		104.5		104.0		105.8		104.6
	C3		106.0		105.8		108.4		107.3
LSD(0.05)			1st. :N.S 2nd. : 0.9						
Number of spikes/m^2									
B1	C1	214.4		220.5		217.2		217.2	
	C2	221.0		222.3		217.9		217.9	
	C3	217.1		221.0		215.0		215.0	
B2	C1	216.3		221.4		219.6		219.6	
	C2	221.8		226.8		221.1		221.1	
	C3	216.6		223.0		219.1		219.1	
B3	C1	213.4		221.3		213.4		213.4	
	C2	216.9		221.7		216.8		216.8	
	C3	216.1		220.6		216.1		216.1	
LSD(0.05)			1st. :1.2 2nd. : N.S						

Notes: 1. (A) Irrigation intervals 2. (B) Wheat varieties.
3. (C) Plant antitranspirants

Table (28):Cont.

seasons		A1		A2		A3		A4	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd
Spike length (cm.)									
B1	C1		14.18		15.96		14.40		14.93
	C2		16.72		17.84		16.46		17.71
	C3		15.79		16.82		15.44		16.62
B2	C1		14.86		15.93		16.12		15.08
	C2		17.38		19.49		17.31		18.47
	C3		16.17		18.07		16.09		17.05
B3	C1		13.72		15.05		14.17		15.13
	C2		16.53		17.71		17.45		16.62
	C3		15.54		16.58		15.63		16.08
LSD(0.05)			1st. :N.S 2nd. : 0.43						
Spike grain weight (g.)									
B1	C1	1.67		2.89		1.34		1.76	
	C2	1.85		2.18		1.60		2.04	
	C3	1.55		1.99		1.46		1.75	
B2	C1	1.48		1.92		1.46		1.85	
	C2	1.85		2.28		1.69		2.13	
	C3	1.54		2.02		1.57		2.01	
B3	C1	1.54		1.90		1.00		1.65	
	C2	1.79		2.24		1.13		1.92	
	C3	1.54		1.91		0.92		1.63	
LSD(0.05)		1st. :0.16 2nd. : N.S.							

7.4. Spike grain weight:

Data collected in Table (28) showed that spike grain weight was positively affected by the interaction between the three studied factor treatments. The highest mean values (2.89) was obtained by using 14- day + Sids 6 + tap water treatment at the first season only. Similar results were obtained by **Ellen (1990), Harmati (1991) , El- Kalla et al. (1994) and Moselhy (1995).**

IV. Effect of irrigation intervals, wheat varieties and plant antitranspirants on chemical contents and some technological properties:

1. Effect of irrigation intervals.

Results in Table (29) showed the effect of irrigation intervals and plant antitranspirants on chemical content in grain and straw and technological properties of three wheat varieties combined over the two growing seasons.

1.1. Nitrogen Content (%)

Results in Table (29) showed no significant differences in N% in both grain and straw of wheat according to the applied four irrigation treatments. However, there was a slight tendency for the medium irrigation interval (14–day) to produce slightly higher N% than other irrigation treatments. The very slight differences in N% of the obtained grain or straw wheat due to the applied irrigation intervals are questionable. This could be due to the inaccurate sampling procedures, variation in chemical impurities in appropriate chemical analysis with its wide varieties of errors, and with its or the minimal effect of the applied irrigation intervals on N content of the grown wheat varieties. More accurate sampling and chemical analysis as well as a frequent irrigation intervals are very well needed to be under future experimentation. This could exert more difference and specific trends in such studied parameter.

Table (29): Effect of irrigation intervals, wheat varieties and plant antitranspirants on chemical content in grain and straw as well as technological properties in grain (combined analysis of 1996/97 and 1997/ 98 seasons).

Characters / Treatments	Grain nitrogen content (%)	Straw nitrogen content (%)	Grain phosphoras content (%)	Straw phosphoras content (%)	Grain potassium content (%)	Straw potassium content (%)	Grain sodium content (%)	Straw sodium content (%)	Grain total carboharate content (%)	wheat flour wet glutein (%)	wheat flour dry glutein (%)
Irrigation intervals											
7 days	2.26	0.589	0.276	0.153	0.355	3.49	0.147	0.280	69.89	32.27	13.59
14 days	2.39	0.615	0.285	0.160	0.358	3.57	0.156	0.283	70.72	32.99	13.99
21 days	2.26	0.600	0.272	0.151	0.354	3.51	0.151	0.278	69.77	32.05	13.52
Common Irri-	2.29	0.612	0.275	0.155	0.360	3.54	0.150	0.280	70.30	32.33	13.61
LSD (0.05)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	0.36	0.11
Varieties											
Sids 6	2.27	0.601	0.278	0.153	0.356	3.51	0.150	0.280	70.18	32.51	13.62
Sids 7	2.39	0.620	0.283	0.158	0.359	3.57	0.154	0.283	70.55	32.75	13.99
Sids 8	2.25	0.592	0.270	0.151	0.353	3.51	0.148	0.278	69.77	31.98	13.43
LSD (0.05)	0.11	0.014	0.010	0.002	0.002	0.03	0.004	0.002	0.31	0.29	N.S
Antitranspirants											
Tap water	2.03	0.495	0.256	0.139	0.340	3.38	0.135	0.274	68.83	31.34	12.84
Vapor gard	2.67	0.685	0.296	0.167	0.369	3.65	0.163	0.286	71.30	33.48	14.51
Nu-film	2.20	0.633	0.279	0.158	0.360	3.58	0.155	0.281	70.37	32.42	13.68
LSD (0.05)	0.11	0.012	0.004	0.002	0.001	0.02	0.002	0.001	0.26	0.18	0.18

1.2. Phosphorus content (%):

Content of P for the grown wheat varieties was slightly increased in response to increasing irrigation duration interval from 7 to 14–day as it is clear from Table (29). The highest P% was obtained at 14–day interval and the lowest P% was obtained at 21–day interval. This was true in grain and straw of wheat plants. Similar results were also reported by **Abo El-Seud (1987), Gasic et al (1993), Mohamed (1994), and El-Tilib et al (1995).**

1.3. Potassium content (%):

Potassium content of the grown wheat varieties was slightly increased as the irrigation intervals increased from 7 to 14 – day, then slightly decreased with the longest duration of irrigation (Table, 29).

1.4. Sodium content (%):

Relatively highest Na% was obtained at the moderate irrigation intervals (14 – day), where it was almost the same at the lowest (7 – day) and the longest (21–day) irrigation intervals with very slight differences (Table, 29). This was true in grain and straw wheat plants.

1.5. Total carbohydrate content

Results in Table (29) showed that as irrigation intervals increased from 7 to 14 day interval caused very slight increase in total carbohydrate content in grain, then slight decrease at 21 – day interval. The highest total carbohydrate (70. 72%) was obtained at 14 – day interval and the lowest percentage (69.77%) was gave at 21 – day interval. However, the differences among the four irrigation systems could be too small to be ignored. Similar results were also obtained by **Abo-El-Seud (1987), Gasic et al (1993), Mohamed (1994) and El-Tilib et al (1995).**

1.6. Wheat flour wet and dry glutein:

Results in Table (29) represent the effect of the applied irrigation intervals on glutein content in wheat flour, combined over 1997/98 and 1998/99 growing seasons. Glutein% in wet and dry wheat flour significantly affected by increasing irrigation interval from 7 – day to 14 – day. The highest glutein content (wet and dry) (32.99% & 13.99%) was obtained when irrigation was at 14 – day interval. Whereas, the lowest content (32.05% & 13.52) was obtained when irrigation was at 21 – day interval. This result confirm grain content from glutein. Along the same line, **Abo- El-Seud (1987), Gasic et al (1993), Mohamed (1994) and El-Tilib et al. (1995),** clarified the effect of adequate irrigation interval in increasing grain yield and glutein content in wheat flour.

Conclusions and comments

From the obtained data and. the previously following conclusion under Ras- Sudr conditions should be clarified: The highest plant growth, grain yield, yield components and glutein content in flour of wheat were obtained when irrigation was at 14-day interval, whereas, the lowest values was found when irrigation was at 21 – day interval. Difference in the analysed chemical constituents were slight small this could be generally due to the in appropriate analysis and or due to a narrow range of irrigation treatments in winter seasons. However, the trend was some wheat clear as presented previously (at 14–day).

2. Effect of wheat varieties on:

The tested varities varied markedly in chemical content in grain and straw as well as some technological properties combined over 1997/98 and 1998/99 growing seasons (Table 29).

2.1. Nitrogen content (%)

The results indicated significant differences among the three tested varieties in their content of N in grain and straw as the combined of two seasons average. The differences in N% reached the level of significance. The highest N % in both grain and straw was recorded with Sids 7 (2.39% & 0.62%) and the lowest N content was observed with Sids 8 (2.25% & 0.592%). However, no significant differences was found between Sids 6 and Sids 8. It could be concluded that Sids 7 was superior in N% in grain and straw and surpassed significantly the other Sids 6 and Sids 8.The results obtained mainly due to the genetical make up of the tested varieties. Similar results were also obtained by **Ellen (1990)** who reported significant variations in N% of the different wheat varieties. The same trend was obtained by **Abd El-All (1999); Gomaa (1999) and Abou El-Ela, (2001).**

2.2. Phosphorus content (%)

The combined average of both seasons indicated significant differences in P percentage in grain and straw of the three tested varieties (Table 29). The results showed that the highest P% was 0.283% in grain and 0.158% in straw which was recorded with Sids 7 and the lowest P content was 0.270% in grain and 0.151 % in straw which was obtained by Sids 8. No significant differences between Sids 6 and Sids 8 in their P content in grain or straw. The differences among wheat cultivars in P content in grain or straw were also reported by **Abd El-Maged et al. (1998), Abd El-All (1999); Gomma (1999); Sabry et al. (1999) and Abou El-Ela, (2001).**

2.3. Potassium content (%):

The two seasons average indicated significant differences in K% in grain and straw of the tested varieties (Table 29). The evaluated varieties could be arranged in regard to K% in grain and straw in a descending order as follows: Sids 7 (0.359% , 3.57%), Sids 6 (0.356%, 3.51%) and Sids 8 (0.353%, 3.51%). Sids 7 was significantly superior compared with Sids 6 or Sids 8. Also, no significant difference was found between Sids 6 and Sids 8, in the straw.

2.4. Sodium content (%)

The results showed significant differences among Sids 6, Sids 7, and Sids 8 cultivars in their Na% of grain or straw of the combined data (Table 29). Sids 7 produced the highest Na % in grain or straw (0.154% & 0.283%) which significantly surpassed the 2 remaining varieties. This variety was followed by Sids 6 (0.150% & 0.280%) and Sids 8 (0.148% & 0.278%) as one group without significant difference between them. The superiority of Sids 7 in NPK and Na contents in grain and straw is mainly due to its higher roots and plant growth as well as higher biological yield. Similar results were also obtained by **Abd El-Majeed et al. (1998), Abd El All (1999), Gomaa (1999) Sabry et al. (1999) and Abou El-Ela (2001).**

2.5. Total carbohydrate content : (%)

The results showed that significant differences were found in total carbohydrate in grain of the evaluated varieties in combined average in 1997/98 and 1998/99 seasons (Table 29). Two varieties Sids 7 and Sids 6 could be considered as one group showing no significant difference in total carbohydrate was obtained by Sids 8 (69.77%). The difference among wheat varieties in total carbohydrate were also reported by **Abd El-Majeed et al. (1998), Abd El-All (1999), Gomaa (1999) and Abou El-Ela (2001).**

2.6. Wheat flour wet and dry glutein content:

The results in Table (29) showed significant differences in wheat flour wet glutein in the combined data. The highest value in this character was recorded by Sids 7 (32.75%), followed by Sids 6 (32.51%). The lowest value was (31.98%) recorded with Sids 8, which was significantly inferior compared with Sids 7 or Sids 6.

Regarding wheat flour dry glutein % the combined average of the two seasons, showed no significant differences among the three evaluated wheat varieties in their flour, dry glutein %. It could be concluded that under the experimental conditions Sids 7 is the highest grain, straw and biological yield, NPK and Na percentages in grain and straw as well as total carbohydrate and flour wet glutein content in grain.

3. Effect of plant antitranspirants:

The effect of plant antitranspirants (zero, Vapor gard, and Nu- film treatments) on the chemical content of grain and straw and technological properties of wheat grains in the average of 1997/98 and 1998/99 growing seasons are presented in Table (29).

3.1. Nitrogen content in grain and straw (%)

Results of the effect of plant antitranspirants on N content in grain and straw in combined data are shown in Table (29). Plant antitranspirant treatments significantly increased N% in grain and straw. Application of Vapor gard treatment resulted in the highest mean values of N% which were 2.67 and 0.685% in grain and straw, respectively. It seem that applying Vapor gard was significantly superior in stimulation N abosorption from the soil. A good supply of plant antitranspirants will lead to more better root growth and more metabolic activity in plants leading in tern to a high N% in grain or straw. Similar results were also obtained by **Reddy and Misra (1986), Ibrahim et. al. (1993) and Haggag et. al. (1994).**

3.2. Phosphorus content in grain and straw (%):

Phosphorus % in grain and straw wheat significantly increased as a result of foliar application of plant antitranspirants treatments in the average of both seasons (Table, 29). Vapor gard spraying produced the highest P% in grain and straw (0.296, 0.167%) and the control treatment gave the lowest ones (0.256, 0.139%). The present results indicate clearly the important role of plant antitranspirants in plant production and its contribution in increasing the yield and NP percentages of wheat plant under Wadi-sudr conditions. Similar results were also reported by **Ibrahim et. al. (1993) and Haggag et. al. (1994).**

3.3. Potassium content in grain and straw (%):

The results showed that K percentage in grain and straw wheat in the combined data significantly increased by spraying Vapor gard and Nu-film treatments (Table, 29). The highest response was recorded at Vapor gard treatment in grain and straw wheat, which were 0.369 and 3.65%, respectively. While the lowest values were obtained by the check treatment (0.340, 3.38%).

3.4. Sodium content in grain and straw (%):

The result in Table (29) indicated that foilar application of Vapor gard and Nu-film treatments significantly increased Na percentages in grain and straw of wheat plants in the two seasons. The highest Na % was 0.163% in grain of the Vapor gard application and the lowest Na % was 0.135% of the check treatment. The same trend was obtained in wheat straw. The present results are agree with those obtained by **Ibrahim et al. (1993) and**

Haggag et al. (1994) who found that application of plant antitranspirants significantly increased mineral contents in wheat plants.

3.5. Total carbohydrate content (%) in grain:

It is clear from Table (29) that plant antitranspirants significantly affected on total carbohydrate % in grain in the combined data. Spraying Vapor gard treatment produced the highest value of total carbohydrate in grain (71.03%) and the check treatment gave the lowest value (68.83%).

3.6. Glutein wet and dry % in wheat flour:

Glutein % (wet and dry) in wheat flour significantly increased as a result of spraying plant antitranspirants are shown in Table (29). The combined data of both seasons clear that, Vapor gard significantly increased wet and dry glutein percentage in wheat flour compared with the check and Nu- film treatments. Spraying Vapor gard had the highest values of wet and dry glutein percentages (33.48, 14.51%). The lowest values were obtained by the check treatment. This results are in line with those obtained by **Ibrahim et al. (1993) and Haggag et al. (1994)**.

It could be concluded that spraying Vapor gard produced the highest values of vegetative growth, growth analysis, total chlorophyll, praline content, stomata area and size, grain filling rate, effective grain filling period, grain yield, yield components, chemical grain contents as well as technological properties wheat grain under Wadi-Sudr conditions.

4. The interaction effect between irrigation intervals and wheat varieties.

4.1. Straw nitrogen content:

Result in Table (30) show that straw nitrogen content (%) was significantly affected by the interaction between irrigation

Table (30):Interaction effect between irrigation intervals and wheat varieties on element chemical and technological properties in 1997/1998 and 1998/1999 growing seasons.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Straw nitrogen content (%)								
Sids 6	0.567	0.593	0.590	0.601	0.621	0.610	0.610	0.622
Sids 7	0.607	0.621	0.642	0.637	0.600	0.606	0.617	0.630
Sids 8	0.554	0.608	0.583	0.607	0.579	0.617	0.612	0.575
LSD (0.05)	1st 0.013 2nd : 0.011							
Straw potassium content (%)								
Sids 6	3.426		3.557		3.506		3.524	
Sids 7	3.534		3.628		3.522		3.532	
Sids 8	3.490		3.514		3.473		3.495	
LSD (0.05)	1st : 0.038 2nd : N.S							
Grain sodium content (%)								
Sids 6		0.144		0.154		0.154		0.155
Sids 7		0.149		0.160		0.151		0.155
Sids 8		0.152		0.153		0.151		0.147
LSD (0.05)	1st: N.S 2nd : 0.004							
Grain total carbohydrate content (%)								
Sids 6		69.76		70.56		70.29		70.00
Sids 7		69.83		71.29		70.38		70.44
Sids 8		69.05		70.43		68.90		70.27
LSD (0.05)	1st N.S 2nd : 0.28							

intervals and wheat varieties. Such results were true for the both seasons. The highest values of straw nitrogen contents (0.642 and 0.637 %) were obtained by adding 14-day + Sids 7 treatments. These results are in full agreement with those obtained by **Mahmoud et al. (1993), Haggag et al. (1994), and Ahmed (1995).**

4.2. Straw Potassium content (%):

Data recorded in Table (30) indicated that straw potassium content (%) at the first season only was significantly affected by the interaction between irrigation intervals and wheat varieties treatments. The highest mean content (3.628%) was achieved by using 14-day +Sids 7 treatment. These results are in harmony with those obtained by **Haggae et al. (1994), Ahmed (1995), and Moselhy (1995).**

4.3. Grain sodium content (%):

Data recorded in Table (30) indicated that grain sodium content was significantly affected by the interaction between irrigation intervals and wheat varieties. Such results were true for the second season only. The highest mean content (0.160%) was achieved by using 14-day + Sids 7 treatment. The results are in agreement with those finding by **Gasic et al. (1993), Mahmoud et al. (1993) and Haggag et al. (1994).**

4.4. Grain total carbohydrate content (%):

Results summarized in Table (30) showed that irrigation intervals and wheat varieties treatments significantly affected total carbohydrate content in grain in the second season only. The highest mean value (71.29%) was obtained by using 14-day + Sids 7 treatment. The results are in harmony with those obtained by **Haggag et al. (1994), Ahmed (1995), Arya and Sharma (1996), and El-Bagoury et al. (1998).**

5. The interaction effect between irrigation intervals and plant antitranspirants.

5.1. Sraw nitrogen content:

Results in Table (31) show that straw nitrogen content significantly affected with the interaction between irrigation intervals and antitranspirant treatments. The highest mean value of straw nitrogen content (0.68%) was obtained by common irrigation + Vapor gard treatment at the first season only. Similar results were obtained by **Gasic et al. (1993) Mahmoud et al. (1993), Haggag et al. (1994) and Moselhy (1995).**

5.2. Grain potassium content:

It can be noticed from results in Table (31) that grain potassium content were significantly affected by the interaction effects of irrigation intervals and antitranspirant treatment. The highest mean value (0.317) was achieved by using 14-day + Vapor gard treatment at the first season only. Similar results were obtained by **Gasic et al. (1993), Mahmoud et al. (1993) and Ahmed (1995).**

5.3. Straw potassium content (%):

Data recorded in Table (31) indicated that straw potassium content at the first season only was significantly affected by the interaction between irrigation intervals and antitranspirant treatments. The highest content (3.697%) was achieved by using 14-day + Vapor gard treatment. These results are in hamony with those obtained by **Mahmoud et al. (1993), Haggag et al. (1994), Ahmed (1995) and Moselhy (1995).**

5.4. Wheat flour dry glutein content (%):

Results in Table (31) showed that wheat flour dry glutein content significantly affected by the interaction between irrigation intervals and antitranspirant treatments. The highest mean value of

Table (31):Interaction effect between irrigation intervals and plant antitranspirants on chemical content in grain and strand and technological properties in grain of wheat in 1997/1998 and 1998/1999 growing seasons.

seasons	Irrigate every 7 days		Irrigate every 14 days		Irrigate every 21 days		Common irrigation	
	1st season	2nd season	1st season	2nd season	1st	2nd	1st	2nd
Straw nitrogen content (%)								
Tap water	0.482		0.499		0.507		0.492	
Vapor-gard	0.660		0.680		0.639		0.692	
Nu-film	0.602		0.635		0.623		0.656	
LSD(0.05%)	1st : 0.021 2nd : N.S							
Grain potassium content (%)								
Tap water	0.339		0.340		0.340		0.340	
Vapor-gard	0.368		0.371		0.366		0.367	
Nu-film	0.359		0.364		0.355		0.362	
LSD(0.05%)	1st: 0.014 2nd : N.S							
Straw potassium content (%)								
Tap water	3.332		3.354		3.335		3.321	
Vapor-gard	3.607		3.697		3.637		3.635	
Nu-film	3.512		3.635		3.533		3.587	
LSD(0.05%)	1st : 0.039 2nd : N.S							
Wheat flour dry glutein content (%)								
Tap water		12.53		13.24		12.92		13.12
Vapor-gard		14.57		15.06		14.29		14.69
Nu-film		13.82		13.98		13.70		13.73
LSD(0.05%)	1st N.S 2nd : 0.24							

wheat flour dry glutein (15.06) was obtained by using 14- day + Vapor gard treatment at the second season only. These results are in agreement with those obtained by **Mahmoud et al. (1993), Haggag et al. (1994), Ahmed (1995, Moselhy (1995) and El- Bagoury et al. (1998).**

6. Interaction effect between wheat varieties and plant antitranspirants.

6.1 Grain phosphorus content (%):

Data recorded in Table (32) indicated that grain phosphrus content was significantly affected by the interaction between wheat varieties and antitranspirant treatments. The highest mean value (0.310%) was achieved by using Sids 7+ Vapor gard treatment at the first season only.

6.2. Straw sodium content:

Results in Table (32) show that straw sodium content significantly affected by the interaction between wheat varieties and antitranspirant treatments. The highest mean values (0.291 and 0.289) were achieved by adding Sids 7+ Vapor gard treatment at the first and second seasons respectively. Similar results were obtained by **Gasic et al. (1993) Haggag et al. (1994), Ahmed (1995) and El-Bagoury et al. (1998).**

Table (32):Interaction effect between wheat varieties and plant antitranspirants on chemical contents in grain and straw in 1997/1998 and 1998/1999 growing seasons.

seasons	Sids 6		Sids 7		Sids 8	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Grain phosphorus content (%)						
Tap water	0.257		0.260		0.251	
Vapor gard	0.298		0.310		0.282	
Nu-film	0.281		0.287		0.269	
LSD (0.05%)	1st : 0.009 2nd : N.S					
Straw sodium content (%)						
Tap water	0.274	0.274	0.277	0.274	0.275	0.274
Vapor gard	0.288	0.285	0.291	0.289	0.282	0.283
Nu-film	0.283	0.279	0.286	0.284	0.280	0.277
LSD (0.05%)	1st : 0.006 2nd :0.008					