RESULTS AND DISCUSSION

The major weed species associated with wheat crop during the two growing seasons were : *Phalaris minor, Phalaris canariensis, Medicago polymorpha, Rumex dentatus* L. *Anagallis arvensis. Ammi sp.* and *Melilotus indica* L. All.

The number, fresh weight, dry weight per square meter and leaf area index were used as reliable indicators for weed distribution in wheat plots.

A. Weeds:

1. Effect of seasons:

The effect of seasons on weed characters presented in Table (3) showed that the seasonal effects were clear with weed distribution and growth measurements. The number of total weeds per m^2 in the first sample and third sample and dry weight in the second sample, showed insignificant seasonal effect. Number, fresh weight, dry weight of broad leaved weeds in the three samples, LAI in the first and second samples of the broad leaved weeds, the mean values were significantly higher in the first season. Also, fresh weight of total weeds in the three samples and dry weight of total weeds in the third sample gave significantly higher values in the first season. On the other hand, the other traites had significantly higher mean values in the second one.

2. Varietal effects:

Data presented in Table (4a)showed the effect of three wheat cultivars on population, fresh weight, dry weight and leaf area index of weeds at 60, 90 and 120 days after sowing as combined data over the two seasons.

Table (3) : The average values of seasonal effect on some of growth measurements of weeds in 1994/95 and 1995/96 seasons.

Season	Measurements											
	Number. of weed per m^2			Fresh weight per m^2 (g)			Dry weight per m^2 (g)			Leaf area index		
	Grasses	Broad leaved	Total weeds	Grasses	Broad leaved	Total weeds	Grasses	Broad leaved	Total weeds	Grasses	Broad leaved	Total Weeds
60 days after sowing												
1994/95	6.22 b	31.72 a	37.93 a	7.51 b	26.54 a	34.05 a	0.64 b	1.34 a	1.98 b	0.01 b	0.036 a	0.047 b
1995/96	19.98 a	18.66 b	38.65 a	17.65 a	12.42 b	30.07 b	2.12 a	0.63 b	2.83 a	0.035 a	0.013 b	0.048 a
90 days after sowing												
1994/95	5.62 b	14.46 a	20.08 b	313.22 b	367.72 a	680.94 a	50.79 b	36.82 a	87.61a	0.458 b	0.532 a	0.990 a
1995/96	14.84 a	11.46 b	26.32 a	408.95 a	190.70 b	599.65 b	66.92 a	21.25 b	88.17 a	0.565 a	0.342 b	0.907 b
120 days after sowing												
1994/95	6.65 b	10.31 a	16.96 a	479.73 b	532.94 a	1012.67 a	86.80 b	47.58 a	134.38 a	-	-	-
1995/96	11.11 a	5.92 b	17.03 a	596.29 a	275.08 b	871.37 b	103.76 a	24.71 b	128.47 b	-	-	-

The results clearly indicated that all studied characters were significantly affected by wheat cultivars in all samples.

Concerning weed populations, Sakha 8 cultivar greatly reduced grassy, broad leaved and total weed numbers at the three sampling dates compared to the other two cultivars. Giza 163 wheat cultivar was the least one in weed populations suppression while Sakha 61 was moderate in this respect. The superiority of Sakha 8 cultivar in reduction of weed populations may be due to its ability to produce larger number of trillers and greater light interception especially at early growth stage as mentioned by **Valenti and Wicks (1992)**. They attributed the ability of Centurk 78 winter wheat cultivar to suppress annual grasses density to its greater calm density and its taller plants which intercepted more light compared to other cultivars.

It is obvious from Table (4a) that fresh weight/m^2 of grassy, broad leaved and total weed values were significantly decreased by Sakha 8 wheat cultivar compared to Sakha 61 and Giza 163. This trend was true at the three different stages of wheat growth. Giza 163 cultivar had the heaviest fresh weights of weeds while Sakha 61 had the moderate weights for grassy, broad leaved and total weeds at the three sampling dates. The high effectiveness of Sakha 8 wheat cultivar in decreasing weed fresh weight values may be attributed to the low population of weeds occurred with this cultivar that reflects the high competitive ability with the associated weeds. The same trend was obtained by **Valanti and Wicks (1992)**.

Regarding dry weight of grassy, broad leaved and total weeds, data in Table (4b) reveal that the varietal behaviour had a great effect in this respect. Sakha 8 cultivar recorded the lowest dry weight values of weeds

Table (4a): The average values of number and fresh weight of weeds as affected by wheat cultivars (combined data of 1994/95 and 1995/96 seasons).

Weed Character	Wheat cultivar			
	Sakha 8	Sakha 61	Giza 163	F-test CV X S*
60 days after sowing				
Number of grasses / m^2	9.17 c	13.72 b	16.40 a	S
Number of broad leaved / m^2	18.18 c	25.31 b	32.08 a	NS
Number of total annuals/m^2	27.35 c	39.03 b	48.48 a	NS
Fresh wt. of grasses (g) / m^2	8.48 c	13.66 b	15.61 a	S
Fresh wt. of broad leaved (g) / m^2	15.30 c	19.45 b	23.68 a	NS
Fresh wt. of total annuals (g) / m^2	23.78 c	33.11 b	39.29 a	S
90 days after sowing				
Number of grasses / m^2	7.32 c	10.64 b	12.74 a	S
Number of broad leaved / m^2	8.68 c	14.10 b	16.11 a	S
Number of total annuals / m^2	16.00 c	24.74 b	28.85 a	S
Fresh wt. of grasses (g) / m^2	266.08 c	360.24 b	456.93 a	NS
Fresh wt. of broad leaved (g) / m^2	204.98 c	281.29 b	351.35 a	NS
Fresh wt. of total annuals (g) / m^2	471.06 c	641.53 b	808.28 a	NS
120 days after sowing				
Number of grasses / m^2	6.32 c	9.28 b	11.04 a	NS
Number of broad leaved / m^2	5.15 c	8.88 b	10.32 a	NS
Number of total annuals / m^2	11.47 c	18.16 b	21.36 a	S
Fresh wt. of grasses (g) / m^2	391.41 c	556.31 b	666.32 a	S
Fresh wt. of broad leaved (g) / m^2	314.05 b	425.74 a	472.24 a	NS
Fresh wt. of total annuals (g) / m^2	705.46 c	982.05 b	1138.56a	NS

CV = Cultivar S* = Seasons

S: Significant difference NS: Not significant

while Giza 163 exhibited the highest magnitudes. However, Sakha 61 cultivar showed a moderate ranking for weed dry weight depression. In addition, the same trend for the varietal behaviour against weed dry weight was obtained at the three sampling dates.

Data in Table (4b) indicated that leaf area index for grassy, broad leaved and total weeds at 60 and 90 days after wheat sowing were significantly affected by cultivars effect. Sakha 8 cultivar showed an efficient role in the suppression of leaf area index for weeds during the first and second samples followed by Sakha 61 while Giza 163 was the least efficient variety in this connection. The varietal potention in weed biomass and leaf area depression my be correlated with ground cover and plant height of the cultivar in the early stage of development as reported by **Niemann (1990)**. Moreover, the retarded growth, less population, reduced fresh and dry weight accumulation by weeds associated with the more competitive cultivar resulted in a declined leaved area index .

The effect of interaction between wheat cultivar and seasons is shown in Tables (4a and b). Significant effect of interaction between cultivar and season was detected for number of grasses/m^2 in the first and second samples, fresh weight of grasses/m^2 in the first and third samples, fresh weight of total weeds in the first sample, number of broad leaved in the second samples and total weeds number/m^2 in the second and third samples. In addition, significant effect of interaction between cultivar and season was detected for dry weight and leaved area index of both grasses and broad leaved weeds in the first sample, dry weight of grassy weeds, leaf area index for broad leaved and total weeds in the second sample. These results indicate that the performance of these characters differed from season to season. On the other hand, insignificant effect of interaction between cultivar and season was detected in the rest measurements

Table (4 b): The average values of dry weight and leaf area index of weeds as affected by wheat cultivars (combined data of 1994/95 and 1995/96 seasons).

Weed Character	Wheat cultivar			
	Sakha 8	Sakha 61	Giza 163	F-test CV X S*
60 days after sowing				
Dry wt. of grasses (g) / m^2	0.97 c	1.42 b	1.75 a	S
Dry wt. of broad leaved (g) / m^2	0.73 c	1.07 b	1.25 a	S
Dry wt. of total annuals (g) / m^2	1.70 c	2.49 b	3.00 a	S
Leaf area index of grasses	0.015 c	0.023 b	0.020 a	S
Leaf area index of broad leaved	0.014 c	0.021 b	0.039a	S
Leaf area index of total annuals	0.029 c	0.044 b	0.069 a	S
90 days after sowing				
Dry wt. of grasses (g) / m^2	42.95 c	58.04 b	75.57 a	S
Dry wt. of broad leaved (g) / m^2	22.11 c	29.41 b	35.58 a	NS
Dry wt. of total annuals (g) / m^2	65.06c	87.45 b	111.15 a	NS
Leaf area index of grasses	0.381 c	0.517 b	0.636 a	NS
Leaf area index of broad leaved	0.328 c	0.457 b	0.526 a	S
Leaf area index of total annuals	0.709 c	0.974 b	1.162 a	S
120 days after sowing				
Dry wt. of grasses (g) / m^2	74.38 c	95.11 b	116.36 a	NS
Dry wt. of broad leaved (g) / m^2	28.45 c	37.76 b	42.22 a	NS
Dry wt. of total annuals (g) / m^2	102.83 c	132.87 b	158.58 a	NS

CV = Cultivar
S* = Seasons
S=Significant difference
NS: Not significant

reflecting the constant behaviour of these measurements from season to another.

3. Effect of seeding rate:

Data in Table (5) show the effect of three seeding rates on number, fresh weight, dry weight and leaf area index of weeds at 60, 90 and 120 days after sowing as combined data of the two seasons.

It was observed that densities of grassy, broad leaved and total weeds considerably decreased as wheat seeding rate increased. The lowest numbers of grassy, broad leaved and total weeds per m^2 resulted by the highest seeding rate of wheat (70 kg/fed.). These values were significantly lower than the other seeding rates (40 and 55 kg/fed.). The reduction in weed population under the highest seeding rate was true at the three sampling dates for grassy, broad leaved and total weeds. The negative effect of seeding rate on weed population may be related to the more crop competitive ability for place and light especially during early growth stage which may affect weed germination and occurrence. Such findings and explanating were reported by **Marwat *et al.* (1989), Dover and Eeast (1990) who**found that there was a trend for greater weed suppression at the higher seeding rate of wheat.

As shown in Table (5), fresh weight of grassy, broad leaved and total annual weeds was markedly reduced by increasing wheat seeding rate. The same trend was constantly clear during all growth stages of wheat crop. The declined fresh weight of weeds associated with raising seeding rate could be related to the reduced weed population and the increased depletion of water by wheat plants under denser crop populations. In addition, the higher crop density may intercept more light and increase the crop ability to compete for soil nutrients.

Table (5): The average values of number and fresh weight of weeds as affected by wheat seeding rate (combined data of 1994/95 and 1995/96 seasons).

Weed Character	Seeding rates (kg/fed.)			
	40	55	70	F-test SR X S*
60 days after sowing				
Number of grasses / m^2	16.78 a	12.53 b	9.99 c	S
Number of broad leaved / m^2	29.92 a	25.72 b	19.93 c	NS
Number of total annuals / m^2	46.70 a	38.25 b	29.92 c	NS
Fresh wt. of grasses (g) / m^2	17.33 a	11.34 b	9.08 c	S
Fresh wt. of broad leaved (g) / m^2	26.08 a	17.87 b	14.48 c	NS
Fresh wt. of total annuals (g) / m^2	43.41 a	29.21 b	23.56 c	NS
90 days after sowing				
Number of grasses / m^2	13.00 a	10.14 b	7.56 c	S
Number of broad leaved / m^2	16.22 a	12.64 b	10.03 c	NS
Number of total annuals / m^2	29.23 a	22.78 b	17.59 c	NS
Fresh wt. of grasses (g) / m^2	441.93 a	351.31 b	290.01 c	S
Fresh wt. of broad leaved (g) / m^2	338.35 a	282.50 b	216.78 c	NS
Fresh wt. of total annuals (g) /	780.28 a	633.81 b	506.79 c	NS
120 days after sowing				
Number of grasses / m^2	11.19 a	8.81 b	6.64 c	S
Number of broad leaved / m^2	10.00 a	7.79 b	6.56 c	NS
Number of total annuals / m^2	21.19 a	16.60 b	13.20 c	S
Fresh wt. of grasses (g) / m^2	669.35 a	556.21 b	388.48 c	S
Fresh wt. of broad leaved (g) / m^2	473.59 a	413.94 b	324.50 c	NS
Fresh wt. of total annuals (g) / m^2	1142.94 a	970.15 b	712.98 c	S

SR = Seeding rate S = Season

*S: Significant difference NS: Not significant

Satorre and Snaydon (1992) suggested that competition for soil resources, particularly nitrogen, was more severe than for aerial resources. Similar trends were obtained by **Roshdy (1988), Ghanem and El-Khawaga (1991), Tahoon (1994) and Zaher (1996).**

The dry weight of grassy, broad leaved and total annual weeds are presented in Table (6). It is clear that weed dry weight values progressively decreased as seeding rate of wheat increased from 40 to 55 or 70 kg/fed. The reduction in dry weight of grassy, broad leaved and total weeds was significant and true at the three sampling dates. Additionally, it could be observed that at the early growth stage (60 DAS), increasing seeding rate strongly reduced dry weight of grassy, broad leaved and total weeds than at later stages. The minimizing of weed dry weight by increasing crop seeding rate could be dependent on the lower number, lower fresh weight and less available light and nutrient for weed plants. **Tanji *et al.* (1997)** stated that an alternative method to minimize weed competition in wheat would be to increase the competitive ability of wheat through increasing crop density. These results are confirmed by those reported by **Roshdy (1988), Ghanem and El-Khawaga (1991), Tahoon (1994) and Zaher (1996).**

In respect of leaf area index (LAI) of weeds Table (6) shows the mean value of LAI of grassy, broad leaved and total annual weeds as affected by seeding rate of wheat. It is observed that increasing seeding rate significantly decreased leaf area index (LAI) of weeds by increasing seeding rate was clear at both first (60 DAS) and second (90 DAS) sampling dates. The lower leaf area of weeds under the highest wheat seeding rate could be attributed to the taller plants and larger leaf area in addition to the larger number of culms for the crop. These factors may

Table (6): The average values of dry weight and leaf area index of weeds as affected by wheat seeding rate (combined data of 1994/95 and 1995/96 seasons).

Weed Character	Seeding rate (kg/fed)			
	40	55	70	F-test CR X S*
60 days after sowing				
Dry wt. of grasses (g) / m^2	1.90 a	1.26 b	0.98 c	S
Dry wt. of broad leaved (g) / m^2	1.26 a	0.99 b	0.80 c	S
Dry wt. of total annuals (g) / m^2	3.16 a	2.25 b	1.78 c	S
Leaf area index of grasses	0.032 a	0.022 b	0.014 c	S
Leaf area index of broad leaved	0.032 a	0.024 b	0.019 c	S
Leaf area index of total annuals	0.064 a	0.046 b	0.033 c	NS
90 days after sowing				
Dry wt. of grasses (g) / m^2	72.08 a	57.68 b	46.80 c	S
Dry wt. of broad leaved (g) / m^2	35.03 a	29.21 b	22.85 c	NS
Dry wt. of total annuals (g) / m^2	107.11 a	86.89 b	69.65 c	S
Leaf area index of grasses	0.629 a	0.502 b	0.404 c	NS
Leaf area index of broad leaved	0.517 a	0.442 b	0.351 c	NS
Leaf area index of total annuals	1.146 a	0.944 b	0.755 c	S
120 days after sowing				
Dry wt. of grasses (g) / m^2	116.54 a	94.06 b	75.25 c	S
Dry wt. of broad leaved (g) / m^2	41.92 a	36.73 b	29.78 c	NS
Dry wt. of total annuals (g) / m^2	158.46 a	130.79 b	105.02 c	S

SR = Seeding rate S* = Seasons

S : Significant difference NS: Not significant enable the crop to be dominant with larger photothynthetic area, and able to reduce incoming photosynthically active radiation on weeds. Similar explanation was mentioned by **Blackshaw (1993a), Ferrero *et al.* (1994) and Anten and Werger (1996)**.

The results for the effect of interaction between seeding rates and seasons are shown in Table (5 and 6) .The data revealed that the effect of this interaction was statistically significant for number and fresh weight of grassy weeds at first, second and third samples. Also, it was significant for number and fresh weight of total annual weeds at the third sample, dry weight of grasses in the second sample dry weight of grassy, broad leaved and total weeds at the first sample, dry weight of total weight of annual weeds at second and third samples, leaf area index for grassy and broad leaved weeds during the first sample and for leaf area index for total annuals in the third sample. This indicates that the effect of seeding rate on the previous characters was unconstant from season to another. However, this effect was constant for the rest measurements which showed a non significant response to seeding rate x season interaction.

4. Effects of weed control treatments:

The mean values of populations, fresh and dry weights and leaf area index for grassy, broad leaved and total weeds at 60, 90 and 120 days from sowing in the combined analysis of the two seasons are presented in Table (7).

The effects of weed control treatments were statistically significant on all measurements at the three sampling dates. Both chemical and mechanical methods resulted in minimizing values of weed characters under study.

Table (7): The average values of number and fresh weight of weeds as affected by some weed control treatments (combined data of 1994/95 and 1995/96 seasons).

Weed Character	Weed control treatment			
	Arelon	Hand weeding	Weedy Check	F-test WCTX S*
60 days after sowing				
Number of grasses / m^2	0.46 b	0.68 b	38.16 a	S
Number of broad leaved / m^2	0.72 b	0.31 b	74.54 a	S
Number of total annuals / m^2	1.18 b	0.99 b	112.70 a	NS
Fresh wt. of grasses (g) / m^2	0.63 b	0.95 b	36.17 a	S
Fresh wt. of broad leaved (g) / m^2	0.98 b	0.35 b	57.10 a	S
Fresh wt. of total annuals (g) / m^2	1.61 b	1.30 b	93.27 a	S
90 days after sowing				
Number of grasses / m^2	1.49 b	2.17 b	27.04 a	S
Number of broad leaf / m^2	5.16 b	4.24 b	29.48 a	S
Number of total annuals / m^2	6.66 b	6.41 b	56.53 a	S
Fresh wt. of grasses (g) / m^2	57.76 c	99.71 b	925.78 a	S
Fresh wt. of broad leaved (g) / m^2	53.96 b	50.27 b	733.40 a	S
Fresh wt. of total annuals (g) /	111.72 c	149.98 b	1659.18 a	NS
120 days after sowing				
Number of grasses / m^2	2.79 c	4.63 b	19.04 a	S
Number of broad leaved / m^2	4.47 b	3.41 b	16.47 a	NS
Number of total annuals / m^2	7.45 b	8.03 b	35.51 a	S
Fresh wt. of grasses (g) / m^2	134.48 c	253.34 b	1226.23 a	S
Fresh wt. of broad leaved (g) / m^2	112.57 b	104.41 b	995.04 a	S
Fresh wt. of total annuals (g) / m^2	247.05 c	357.75 b	2221.27 a	NS

WCT = Weed control treatment S* = Season
S: Significant difference NS: Not significant

Concerning number of weeds/m^2, as shown in Table (7), it is clear that there were significant reductions in the number per m^2 of grassy, broad leaved and total annual weeds by using Arelon or hand weeding as compared to the weedy check plots. The reductions for the three measurements due to Arelon or hand weeding for weed control were significant during the three sampling dates. No significant differences between hand weeding and Arelon treatments in number of grassy, broad leaved and total annual weeds in the three samples with exception of grasses/m^2 at 120 DAS, Arelon exceeded hand weeding in controlling weeds. This may be resulted from escaping some grassy weeds from hand weeding control because its similarity to wheat plants. Under weedy check treatments, it could be detectable that grassy, broad leaved and total weeds decreased at the late growth stages (90 and 120 DAS) compared to early growth stage (60 DAS). This may be due to the mortality of individual weed plants resulting from the severe competition under weedy check plots. However, under both the chemical and manual weed control, the population of weeds increased at the late stages than those at early stage of wheat growth. These results are in agreement with those obtained by **Rastogi *et al.* (1984), Sidhu *et al.* (1988), Varshney and Singh (1990) and Balian *et al.* (1994) and Hooda and Agarwai (1995).**

Data given in Table (7) indicated considerable effects of weed control treatments on fresh weight of grassy, broad leaved and total weeds. The effects were significant and true during the three samples. The application of Arelon at 1.25 L/fed. or hand weeding twice (30 and 45 DAS) significantly reduced the fresh weight of grassy, broad leaved and total weeds during the three stages of growth. The effectiveness of controlling all weed fresh weights were higher at early growth stage (60 DAS) than at later. There were insignificant differences between the chemical and manual weed control in fresh weights of grassy, broad leaved and total weeds during all growth stages except with fresh weights of grassy and total weeds at 90 and 120 DAS. In this case, Arelon significantly exceeded hand weeding twice in reducing fresh weights of weeds. These results showed the lower efficiency of hand weeding in controlling grassy weeds which are similar to wheat plants. Additionally, Arelon can reduce the coming flushes of weeds because its effect through the soil after application on weeds that will emerge as mentioned by **Thomson ((1983)**. Moreover, **Yadav *et al.* (1995)** indicated that pre-emergence spraying of isoproturon (Arelon 50%) effectively controlled small canary grass (*Phalaris minor*) and other 6 annual broad leaved weeds in wheat. Similar results were obtained by **Zaher (1996)** who reported that Arelon herbicide at the rate of 1.25 L/fed. surpassed Brominal at the rate of 1.0 L/fed. in controlling the total fresh weight of weeds at the early stage of wheat growth. However, **Al-Marsafy *et al.* (1992)** indicated that hand weeding excelled all other herbicidal treatments-from the view of weed control-Arelon (1.7 L/fed.) to control *Avena spp.* and *Phalaris minor*, and Brominal (1.0 L/fed.) for broad leaved weeds.

Mean values of dry weight/m^2 of grassy, broad leaved and total annual weeds as affected by weed control treatment in the combined data are given in Table (8).

As shown in this Table, both Arelon 50% and hand weeding twice significantly depressed dry weight of grassy, broad leaved and total weeds at all sampling dates (60, 90 and 120 DAS). At the early growth stage of wheat (60 DAS), Arelon at 1.25 L/fed. and hand weeding were not significantly different while both greatly reduced dry weight of weeds (grassy, broad leaved and total annuals) comparing to the weedy check.

Table (8): The average values of dry weight and leaf area index of weeds as affected by some weed control treatments (combined data of 1994/95 and 1995/96 seasons).

Weed Character	Weed control treatment			
	Arelon	Hand weeding	Weedy Check	F-test WCTX S*
60 days after sowing				
Dry wt. of grasses (g) / m^2	0.06 b	0.08 b	4.00 a	S
Dry wt. of broad leaved (g) / m^2	0.05 b	0.02 b	2.98 a	S
Dry wt. of total annuals (g) / m^2	0.11 b	0.10 b	6.98 a	S
Leaf area index of grasses	0.0010 b	0.0015 b	0.0654 a	S
Leaf area index of broad leaved	0.0013 b	0.0006 b	0.0724 a	S
Leaf area index of total annuals	0.0023 b	0.0021 b	0.1378 a	S
90 days after sowing				
Dry wt. of grasses (g) / m^2	8.19 c	13.66 b	154.72 a	S
Dry wt. of broad leaved (g) / m^2	5.15 b	4.61 b	77.34 a	S
Dry wt. of total annuals (g) / m^2	13.34 c	18.27 b	232.06 a	S
Leaf area index of grasses	0.087 c	0.156 b	1.293 a	S
Leaf area index of broad leaved	0.067 c	0.062 b	1.182 a	S
Leaf area index of total annuals	0.154 c	0.218 b	2.475 a	S
120 days after sowing				
Dry wt. of grasses (g) / m^2	21.97 c	38.85 b	252.02 a	S
Dry wt. of broad leaved (g) / m^2	10.10 b	9.28 b	89.05 a	S
Dry wt. of total annuals (g) / m^2	32.07 c	48.13 b	314.07 a	S

WCT = Weed control treatment S* = Seasons
S : Significant difference NS: Not significant

However, at the later growth stages (90 and 120 DAS), the application of Arelon treatment significantly exceeded hand weeding in reducing the dry weight of grassy and total weeds. On the other hand, the chemical and manual weed control showed insignificant difference with each other for dry weight of broad leaved during the second and third stages of wheat growth. The superiority of Arelon application in controlling grassy and total weeds than hand weeding might be attributed to its ability for killing the growing weeds and suppressing weed germination. On the other hand, grassy weeds are not obviously distinguished for hand weeding in wheat. Rather more, in general, hand weeding treatment was more effective with non significant differences in suppressing dry weights of broad leaved weeds. In this respect, **Varshney and Singh (1990)** reported that application of Arelon at 0.75 kg/ha reduced weed dry matter by 82%. **Yaduraju and Ahuja (1990)** stated that isoproturon applied at spraying was the best treatment which recorded significant reduction in dry weight of weeds compared to the unweeded check.

As the data in Table (8) reveal, leaf area index (LAI) of grassy, broad leaved and total weeds were significantly affected by weed control treatments at 60 and 90 sampling dates in the combined analysis over two seasons. Arelon and hand weeding twice greatly decreased the LAI of grassy, broad leaved and total weeds during the first and second growth stages as compared to the weedy check plots. In the early stages, insignificant differences between the chemical and manual weed control in the reduction of the three measurements. However, at the second growth stage, Arelon treatment significantly exceeded hand weeding in depressing LAI of grassy, broad leaved and total weeds. The excellent efficacy of Arelon (isoproturon 50%) in reducing leaf area index (LAI) of weeds may be related to its highly exhausting effect on plant metabolism in weeds.

Table (9): The average values of dry weight leaf area index and fresh weight (FWT) of weeds as affected by (wheat cultivars x seeding rates) interaction. (Combined data of 1994/95 and 1995/96 seasons).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test (CV. x SR.) x S*
Seeding rate (kg/fed.)	40	55	70	40	55	70	40	55	70	
60 days after sowing										
Dry weight of grassy weeds (g)/ m^2	1.40 ce	0.90 f	0.62 g	1.86 b	1.34 e	1.06 f	2.43 a	1.55 c	1.28 e	S
Leaf area index of grassy weeds	0.023 d	0.013 f	0.009 g	0.033 b	0.023 d	0.014 f	0.041 a	0.028 c	0.020 e	S
Leaf area index of broad leaved weeds	0.019 e	0.013 fg	0.011 g	0.030 d	0.018 efg	0.015 efg	0.046 a	0.039 b	0.031 c	S
Leaf area index of total annuals	0.042 d	0.026 e	0.020 f	0.063 b	0.041 d	0.029 e	0.087 a	0.067 b	0.051 c	S
120 days after sowing										
FWT of grassy weeds (g)//m^2	545.79 c	456.75 d	171.69 e	686.58 b	538.88 c	443.46 d	775.67 a	673.00	550.29 c	S

CV = **Cultivars** SR = Seeding rate

*S = Seasons S = Significant difference NS = Not significant difference

measures which enabled the crop competitiveness against weeds In general, Sakha 8 cultivars suppressed LAI of grassy, broadleaved, and total weeds (significantly more) than other. The largest leaf area index values for grassy, broadleaved and total weeds were recorded by Giza 163 cultivar when seeded by 40 kg/fed. Meanwhile, the least values of these measurements were achieved by using Sakha 8 cultivar seeded with 70 kg/fed.

In the respect of fresh weight of grassy weeds/m^2 at 120 days after sowing, Table (9) indicated that this measurement considerably declined by increasing seeding rates of wheat. This trend was obtained under the three tested cultivars. On the other hand, Sakha 8 cultivar caused the highest suppression in fresh weights of grassy weeds at 120 DAS comparing to other two cultivars under all seeding rates. In general, the highest fresh weight of grassy weeds was observed with Giza 163 cultivar under seeding rate of 40 kg/fed. However, the lowest weight of grassy weeds was recorded by Sakha 8 cultivar sown by 70 g sees/fed. These results may exceplane the higher crop competitive ability under denser sowing and more competitor cultivars.

Concerning the cultivars x seeding rates x seasons interaction, Table (9) shows that this interaction had significant effects on all presented measurements in the combined analysis. This means that the effect of cultivars x seeding rates interaction was not constant from season to another for these traits.

6. Effect of the interaction between wheat cultivars x weed control treatments:

The cultivar and weed control treatments interaction over the two seasons had significant effects on all populations and fresh weights of weeds at the three samples (Table 10).

The results indicated that under three cultivars used, both Arelon and hand weeding significantly reduced all studied measurements of weeds comparing to the untreated plots during all sampling dates.

Data in Table (10) revealed that number of grassy, broad leaved and total weeds/m^2 were greatly reduced by the application of Arelon 50% or hand weeding for weed control. These reductions were true at 60, 90 and 120 DAS. In general, no considerable differences between Arelon or hand weeding treatments in controlling weed populations under Sakha 8, Sakha 61 and Giza 163 wheat cultivars. This trend was constant during the early (60 DAS) and second (90 DAS) growth stages. However at the late growth stage (120 DAS), both Arelon and hand weeding treatments showed no significant efficacious in controlling populations of grassy, broad leaved and total weeds in Sakha 8 cultivar. On the other hand, under weedy check plots, Sakha 8 showed the highest suppressive effect on number of grassy, broad leaved and total weed followed by Sakha 61 and Giza 163 was the least in reducing population of weeds. The same trend was constantly occurred in all studied growth stages. These findings may confirm the higher competitiveness of Sakha 8 cultivar than both Sakha 61 and Giza 163 not only for weeds in the untreated plots, but also for increasing the efficiency of chemical and manual weed control at the late stage of wheat growth. Such varietal competitiveness against weeds in wheat are suggested by **Valenti and Wicks (1992) and Niemann (1990)**.

Concerning weed fresh weights, it is clear from Table (10) that both Arelon, 50% and hand weeding significantly reduced fresh weights of grassy, broad leaved and total weeds as compared to the unweeded check. The same trend was obtained under the three wheat cultivars (Sakha 8, Sakha 61 and Giza 163) during three sampling dates. On the other side,

Table (10): The average values of number and fresh weight of weeds as affected by interaction effect between (wheat cultivars and weed control. (Combined data of 1994/95 and 1995/96).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test
Weed control treatment	Arelon	weeding	Weedy check	Arelon	weeding	Weedy check	Arelon	weeding	Weedy check	(CV. x WCT) x S*
60 days after sowing										
Number of grasses/m^2	0.38 d	0.50 d	26.63 c	0.42 d	0.67 d	40.08 b	0.58 d	0.89 d	47.75 a	S
Number of broad leaved/m^2	0.54 d	0.21 d	53.79 c	0.58 d	0.25 d	75.08 b	1.04 d	0.46 d	94.75 a	NS
Number of total annuals/m^2	0.92 d	0.71 d	80.42 c	1.00 d	0.92 d	115.16 b	0.76 b	01.35 d	142.51 a	NS
Fresh wt. of grasses (g)/m^2	0.54 d	0.74 d	24.14 c	0.59 d	0.93 d	39.46 b	0.7 d	1.18d d	44.90 a	S
Fresh wt. of broadleaved (g)/m^2	0.90 d	0.24 d	44.77 c	0.93 d	0.33 d	57.08 b	1.11 d	0.49 d	69.45	NS
Fresh wt. of total annuals (g)/m^2	1.44 d	0.98 d	68.91 c	1.52 d	1.26 d	96.54 b	1.87 d	1.67 d	114.35 a	S
90 days after sowing										
Number of grasses/m^2	1.25 e	2.04 de	18.67 c	1.75 de	2.42 d	27.75 b	1.46 e	2.04 de	34.71 a	S
Number of broad leaved/m^2	3.83 e	3.38 e	18.83 c	6.83 d	4.88 e	30.58 b	4.83 e	4.46 e	39.04 a	S
Number of total annuals/m^2	5.09 f	5.42 ef	37.50 c	8.59 d	7.30 de	58.33 b	6.31 ef	6.50 ef	73.75 a	S
Fresh wt. of grasses (g)/m^2	44.59 f	74.52 e	679.13 c	57.72 ef	100.59 d	922.42 b	70.97 e	124.03 d	1175.79 a	S
Fresh wt. of broad leaved (g)/m^2	40.93 d	45.47 d	528.54 c	58.48 d	51.40 d	734.00 b	62.46 d	53.93 d	937.67 a	NS
Fresh wt. of total annuals (g)/m^2	85.52 f	119.99 ef	1207.67 c	116.20 ef	151.95 de	1656.42 b	133.43 e	177.99 d	2113.46 a	S
120 days after sowing										
Number of grasses/m^2	2.17 e	3.51 e	13.29 c	3.42 de	4.38 d	20.04 b	3.33 de	6.00 c	23.79 a	S
Number of broad leaved/m^2	2.83 e	2.46 e	10.17 c	5.50 d	3.96 de	17.17 b	5.08 d	3.79 de	22.08 a	NS
Number of total annuals/m^2	5.00 e	5.97 e	23.46 c	8.92 d	8.34 d	37.21 b	8.41 d	9.79 d	45.87 a	S
Fresh wt. of grasses (g)/m^2	119.96 f	215.13 e	839.15 c	134.00 ef	258.25 de	1276.67 b	149.42 f	286.67 d	1562.88 a	S
Fresh wt. of broad leaved (g)/m^2	85.05 e	92.97 de	764.13 c	111.73 de	110.66 de	1054.83 b	140.95 d	109.61 de	1166.17 a	S
Fresh wt. of total annuals (g)/m2	205.01 f	308.10 e	1603.28 c	245.73 e	368.91 d	2331.50 b	290.37 e	396.28 d	2729.05 a	S

CV = Cultivars   WCT = Weed control treatment

*S = Seasons   S = Significant difference   NS = Not significant difference

under the untreated plots, fresh weights of grassy, broad-leaved and total weeds differed significantly among the three wheat cultivar. The lowest fresh weights of weeds were found in Sakha 8 wheat plots followed by those in Sakha 61 cultivar while Giza 161 had the highest fresh weights of grassy and broad leaved and total weeds. Moreover, the trend of varietal behaviour against fresh weights of weeds was constant under three growth stages of wheat (60, 90 and 120 DAS). The lowest values for number of grasses and fresh weight of grasses, in three sample stages, total fresh weight in two growth stages of wheat (90 and 120 DAS, were obtained by Sakha 8 with Aleron treatment. However, with the other measurements Sakha 8 with weeding treatment gave the lowest one. On the other hand, the highest values were obtained by Giza 163 with weedy check. The superiority of Sakha 8 wheat cultivar than others against fresh weight of weeds might be attributed to its higher ability in extracting water from soil due to its figor growth and larger leaf area index as obtained in this study.

In the respect of the effect of interaction between varieties, weed control treatments and season, Table (10) indicates that this effect was not significant on number of broad leaved /m^2 in the first and third samples, number of total annuals/m^2 in the first sample and fresh weight of broad leaved weeds in the first and second samples. This indicated that the effect of the interaction of varieties and weed control treatments was constant on these measurements from season to another. However for the rest measurements, the effect of interaction between varieties, weed control treatments and seasons was significant revealing the unconstant effect of this interaction (varieties x weed control treatments) from season to season.

Table (11) shows the average values of dry weight and leaf area index of grassy, broad leaved and total annual weeds as affected by the interaction between wheat cultivars and weed control treatments. The combined analysis showed that all measurements studied were significantly affected by weed control treatments under the three tested wheat cultivars. The lowest values for all measurements were obtained by Arelon and hand weeding twice during three samples.

Regarding to dry weight of weeds, the data in Table (11) cleared that Sakha 8, Sakha 61 and Giza 163, with both Arelon 50% and hand weeding twice greatly reduced dry weight of grassy, broad leaved and total weeds as compared to the untreated plots. The reduction in weed dry weights was significant during three growth stages (60, 90 and 120 DAS). On the other hand, under weedy check plots of the three tested cultivars, Sakha 8 considerably reduced dry weights of grassy, broad leaved and total weeds than both Giza 163 or Sakha 61.

Moreover, the highly reduction in dry weight of grassy, broad leaved and total weeds by Sakha 8 cultivar in the untreated plots were true during first, second and third samples comparing to the untreated plots of other two varieties. The high potential of Sakha 8 variety in weed dry weight suppression may be refereed to it high competitiveness for soil nutrients which might reduce dry weight accumulation by weeds as reported by **Satorre and Snaydon (1992)**.

Data in Table (11) revealed that both Arelon 50% and hand weeding twice significantly decreased leaf area index (LAI) in 60 and 90 days of sowing in comparison of weedy check plots. The higher efficiency of both chemical and manual weed control in leaf area index of grassy, broad leaved and total annual weeds was significant under the three cultivars. On the other hand, with the untreated check plots, Sakha 8 cultivar greatly reduced leaf area index of grassy, broad leaved and total weeds during the

Table (11): The average values of dry weight and leaf area index (LAI) of weeds as affected by (wheat cultivars x weed control treatments). (Combined data and 1994/95 and 1995/96).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test
Weed control treatment	Arelon	weeding	Weedy check	Arelon	weeding	Weedy check	Arelon	weeding	Weedy check	(C.V x WCT) x S*
60 days after sowing										
Dry wt. of grasses (g)/m^2	0.05 d	0. 07 d	2.80 c	0.05 d	0.09 d	4.11 b	0.07 d	0.10 d	5.09 a	S
Dry wt. of broad leaved (g)/m^2	0.05 d	0.01 d	2.13 c	0.05 d	0.01 d	3.15 b	0.06 d	0.03 d	3.67 a	S
Dry wt. of total annuals (g)/m^2	0.10 d	0.08 d	4.93 c	0.10 d	0.10 d	7.26 b	0.13 d	0.13 d	8.73 a	S
Leaf area index of grasses	0.001 d	0.001 d	0.042 c	0.001 d	0.002 d	0.068 b	0.001 d	0.002 d	0.086 a	S
Leaf area index of broad leaved	0.001 d	0.0002 d	0.42 c	0.0014 d	0.0005 d	0.062 b	0.0019 d	0.0009 d	0.114 a	S
Leaf area index of total annuals	0.002 d	0.0012 d	0.084 c	0.0024 d	0.0025 d	0.130 b	0.0029 d	0.0029 d	0.200 a	S
90 days after sowing										
Dry wt. of grasses (g)/m^2	6.53 g	11.25 ef	111.08 c	8.46 g	13.13 de	152.53 b	9.58 fg	16.59 d	200.54 a	S
Dry wt. of broad leaved (g)/m^2	3.97 d	4.21 d	58.17 c	5.65 d	4.63 d	77.94 b	5.83 d	4.99 d	95.91 a	S
Dry wt. of total annuals (g)/m^2	10.50 f	15.46 ef	169.25 c	14.11 ef	17.76 de	230.47 b	15.41 ef	21.58 d	296.45 a	S
Leaf area index. Of grasses	0.073 f	0.134 e	0.937 c	0.086 f	0.150 de	1.316 b	0.101 ef	0.183 d	1.625 a	S
Leaf area index of broad leaved	0.058 d	0.065 d	0.862 c	0.072 d	0.062 d	1.238 b	0.070 d	0.060 d	1.447 a	S
Leaf area index of total annuals	0.131 h	0.199 ef	1.799 c	0.158 gh	0.212 de	2.554 b	0.171 fg	0.243 d	3.072 a	S
120 days after sowing										
Dry wt. of grasses (g)/m^2	19.98 f	33.60 e	169.55 c	22.25 f	39.37 de	223.70 b	23.68 f	43.59 d	281.81 a	NS
Dry wt. of broad leaved (g)/m^2	7.42 e	8.38 de	69.55 c	9.88 de	9.68 de	93.72 b	13.02 d	9.78 de	103.87 a	S
Dry wt. of total annuals (g)/m^2	27.40 f	41.98 de	239.10 c	32.13 ef	49.05 d	317.42 b	36.70 e	53.37 d	385.68 a	NS

CV = Cultivars
WCT = Weed control treatment

*S = Seasons
S = Significant difference
NS = Not significant difference

two samples (60 and 90 DAS) as compared to Sakha 61 and Giza 163 cultivars. The minimizing effect of Sakha 8 variety on leaf area index of weeds could be attributed to its larger plant height, leaf area index and other growth characters of this variety. These findings are confirmed by those mentioned by **Dunan and Zimdahl (1991).**

Table (11) shows that the interaction between wheat cultivars, weed control treatments and seasons was insignificant for dry weights of grassy and total annual weeds at 120 days of sowing. However, the effects of this interaction on other rest measurements were significant. This finding means that the effects of cultivars x weed control treatments were unconstant over seasons for most of these measurements.

7. Effect of the interaction between wheat seeding rates x weed control treatments:

Data in Table (12) showed that wheat seeding rates and weed control interaction had significant effects on number and fresh weight of grassy, broad leaved and total weeds at the three growth stages. In general, under the used seeding rates, Arelon and hand weeding significantly depressed populations and fresh weights of grassy, broad leaved and total weeds as compared to the untreated plots.

Regarding the data in Table (12), the lowest values for number of grassy weeds, number of total annuals weeds, fresh weight of grassy weight and fresh weight of total annuals weeds were detected from 70 kg seeds/fed. with Arelon treatments. Also, the lowest values for other measurements were obtained by 70 kg seeds/fed. and hand weeding. On the other hand, the highest values were showed from 40 kg/fed.(lowest seeding rate) with weedy check (Table 12).

Table (12) : The average values of number and fresh weight of weeds as affected by (wheat seeding rate x weed control treatments). (Combined data of 1994/95 and 1995/96).

Seeding rate	40 kg/fed.			55 kg/fed.			70 kg/fed.			F. test
Weed control treatment	Arelon	Hand weeding	Weedy check	Arelon	Hand weeding	Weedy check	Arelon	Hand weeding	Weedy check	SR x WCT x S*
60 days after sowing										
Number of grasses/m²	0.589d	0.75 d	49.01 a	0.54 d	0.67 d	36.38 b	0.25 d	0.63 d	29.08 c	s
Number of broad-leafed/m²	0.91 d	0.43 d	88.42 a	0.87 d	0.42 d	75.88 b	0.38 d	0.08 d	59.33 c	NS
Number of total annuals/m²	1.50 d	1.18 d	137.42 a	1.42 d	1.09 d	112.26 b	0.63 d	0.71 d	88.41 c	S
Fresh wt. of grasses (g)/m²	0.75 d	1.17 d	50.08 a	0.78 d	0.86 d	32.37 b	0.36 d	0.82 d	26.05 c	S
Fresh weight of broad leaved (g)/m²	1.27 d	0.45 d	76.51 a	1.13 d	0.49 d	51.99 b	0.54 d	0.13 d	42.78 c	S
Fresh weight of total annuals (g)/m²	2.02 d	1.62 d	126.59 a	1.91d d	1.35 d	84.36 b	0.90 d	0.95 d	68.83 c	NS
90 days after sowing										
Number of grasses/m²	1.96 de	2.58 d	34.46	1.29 e	2.25 d	26.88 b	1.21 e	1.67 de	19.79 c	S
Number of broad-leafed/m²	7.00 de	5.38 ef	36.29 a	4.50 ef	3.79	29.63 b	4.00 f	3.54 f	22.54 c	S
Number of total annuals/m²	8.96 c	7.96 cd	70.77 a	5.79 e	6.04 de	56.51 b	5.21 e	5.23 e	42.33 c	S
Fresh wt. of grasses (g)/m²	77.78 e	127.52 d	1120.50 a	53.07 ef	102.23 d	898.63 b	42.42 f	69.40 e	758.21 c	S
Fresh weight of broad leaved (g)/m²	65.18 d	58.62 d	891.25 a	50.85 d	50.55 d	746.08 b	45.84 d	41.63 d	562.88 c	NS
Fresh weight of total annuals (g)/m²	142.96 ef	186.14 d	2011.75 a	103.92 g	152.78 de	1644.71 b	88.17 g	111.03 fg	1321.09 c	S
120 days after sowing										
Number of grasses/m²	3.38 ef	6.08 d	24.13 a	2.88 f	4.38 e	19.17 b	2.67 f	3.42 ef	13.83 c	S
Number of broad-leafed/m²	5.79 d	4.46 de	19.75 a	3.92 de	2.88 e	16.58 b	3.71 e	2.88 e	13.080 c	NS
Number of total annuals/m²	9.17 d	10.54d	43.88 a	6.80 e	7.26 de	35.75 b	6.38 e	6.30 e	26.910 c	S
Fresh wt. of grasses (g)/m²	167.83 fg	325.67 d	1514.54 a	140.50 fg	247.67 e	1280.46 b	95.04 g	186.71 ef	883.69 c	S
Fresh weight of broad leaved (g)/m²	133.30 d	119.08 d	1168.38 a	108.12 d	102.83 d	1030.88 b	96.30 d	91.32 d	785.88 c	NS
Fresh weight of total annuals g)/m²	301.13 ef	444.75 d	2682.92 a	248.62 f	350.50 de	2311.34 b	191.34 g	278.03 f	1669.57 c	S

SR = Seeding rate WCT = Weed control treatment

*S = Seasons S = Significant difference NS = Not significant difference

The declined weed populations and fresh weights under the denser seeding rate of the untreated plots may reflect the higher competitiveness ability of wheat seeded at higher densities. This is similar to the results of **Harrison and Beuerlein (1989)** where under field conditions, higher densities of wheat gave a competitive advantage over annual weeds compared to low wheat density.

It is clear from Table (12) that the interaction between seeding rates, weed control treatments and seasons insignificantly affected no. of broad leaved weeds and fresh weight of total annuals at 60 days after sowing, fresh weight of broad leaved weeds at 90 days after sowing, in addition to the number and fresh weight of broad leaved weeds at 120 days after sowing. On the other hand, with the excluding of the above mentioned measurements, all-rest characters were significantly affected by the interaction between seeding rates, weed control treatments and seasons.

The effect of interaction between seeding rate and weed control treatments was significant on dry weight and LAI of grassy and, broad leaved and total annual weeds at the three samples stages (Table 13). The lowest values for dry weight of grassy weeds and total annuals, LAI of grassy weeds and LAI of total annual weeds were detected from applied 70 kg/fed. with Arelon 50% at the three sampling stages. Also, with the rest measurements, the lowest values were obtained by applying 70 kg/fed. (highest seeding rate) and hand weeding. On the other hand, the highest values for all measurements were obtained from 40 kg/fed. and weed check.

Data presented in Table (13) also indicated that leaf area index of weeds at 60 and 90 DAS was significantly influenced by seeding rates x weed control treatments interaction. Under 40, 55 and 70 kg/fed. seeding rates, Arelon 50% and hand weeding caused remarkable reductions in leaf area index of grassy, broad leaved and total annuals as compared with the unweeded plots. Whereas, under the weedy check plots, the lowest leaf are index accompanied the highest seeding rate (70 kg/fed.) while the lowest seeding rate gave the greatest leaf area indexes for grassy, broad leaved and total annuals. The same trend was recorded at 60 and 90 days after sowing.

In general, the depressions in dry weight and leaf area index under the higher seeding rate of wheat may be due to maximizing of crop competition and minimizing the weed competition at the same time as mentioned by **Harrison and Beuerlein (1989) and Tanji *et al.* (1997)**.

As indicated in Table (13), the interaction of seeding rates, weed control treatments and seasons had no significant effects on dry weight of broad leaved weeds at 60 and 120 days after sowing, dry weight of total annuals at 60 days after sowing, leaf area index of total annuals at 60 days after sowing and leaf area index of broad leaved weeds at 90 days after sowing. On the other hand, the effects of the previous interaction were significant for the other measurements, revealing the unconstant effect of this intreaction on this traits from season to another.

The Effects of the interaction between wheat cultivars, seeding rates and weed control on all measurements were not significant and consequently the data were excluded.

B. Wheat growth:

1. Effect of season:

Data in Table (14) showed that the seasons had significant effect on wheat growth measurements during the two sampling dates (60 and 120

Table (14): The average values of seasonal effect on some growth characters of wheat in 1994/95 and 1995/96 seasons.

Season	Character				
	Plant height (cm)	Number of tiller/m^2	Fresh weight of plants (g) / m^2	Dry weight of plants (g) / m^2	Leaf area index
60 days after sowing					
1994/95	40.23 a	1525.32 a	1261.82 a	116.86 a	2.004 a
1995/96	35.30 b	1258.32 b	1346.99 a	95.34 b	1.691 b
120 days after sowing					
1994/95	114.66 a	432.91 a	3713.18 a	1052.08 a	-
1995/96	102.31 b	381.81 b	3336.16 b	906.29 b	-

after sowing). All the studied growth characters of wheat recorded significantly higher mean values during the first season in both samples.

2. Varietal performance:

The average values of plant height, number of tillers/m^2 fresh weight/m^2, dry weight/m^2 at 60 and 120 days after wheat sowing and leaf area index for wheat at 60 days after sowing as affected by wheat cultivars in the combined analysis over the two seasons are presented in Table (15). The results show that varietal role had significant effects on all investigated characters in the first and second samples. The highest values of all characters at the two growth stages were achieved by Sakha 8 wheat cultivar.

Concerning plant height, data indicated that Sakha 8 wheat cultivar had the tallest plants followed by Sakha 69 and Giza 163 recorded the shortest plant height at 60 days after sowing. At the late growth stage (120 days) Sakha 8 and Giza 163 plants were approximately equaled in plant height while Sakha 61 recorded the shortest plants. The differences between wheat cultivars may be attributed to genetical factors as mentioned by **Verschwele and Niemann (1994b)** who reported that differences in growth habit and growth rate of cereal cultivars are controlled genetically. On the other hand, the superiority of Sakha 8 cultivar in plant height during the early growth stage may confirm its higher ability to compete weeds during the critical period. Moreover, the taller plants of Sakha 61 cultivar during the first growth stage increased its competitive ability for weeds than Giza 163 cultivar in spite of its taller plants at late growth stage than Sakha 61. **Niemann (1990)** stated that weed suppression seems to be mostly correlated with cover and plant height of cultivar in the early growth stage of development and not for instance with the final height.

Table (15): The average values of wheat growth measurements as affected by cultivars (combined data of 1994/95 and 1995/96 seasons).

Growth Character	Wheat cultivar			
	Sakha 8	Sakha 61	Giza 163	F-test CV X S*
60 days after sowing				
Plant height (cm)	41.08 a	36.53 b	35.68 c	S
Number of tillers/m^2	1477.07 a	1303.20 c	1395.20 b	S
Fresh weight of plants (g) / m^2	1262.58 a	1153.72 b	1121.91 c	NS
Dry weight of plants (g) / m^2	116.64 a	102.99 b	98.67 c	S
Leaf area index (LAI)	2.07 a	1.79 b	1.68 c	S
120 days after sowing				
Plant height (cm)	111.51 a	102.89 b	111.04 a	S
Number of tillers/m^2	521.97 a	335.60 c	365.6 b	S
Fresh weight of plants (g) / m^2	4285.28 a	3131.90 b	3156.84 b	NS
Dry weight of plants (g) / m^2	1140.38 a	922.31 b	874.87 c	S

CV = Cultivar
S* = Season
S= Significant difference
NS: Not significant

As shown in Table (15), number of tillers/m^2 significantly differed due to varietal effects. Sakha 8 cultivar recorded the largest number of tillers/m^2 in both early and late growth stages followed by Giza 163. Meanwhile Giza 163 exceeded Sakha 61 in number of tillers/m^2 during the two growth stages. The differences in tillers number/m^2 between varieties is due to genitical reasons. On the other hand, the higher tillering ability of Sakha 8 cultivar during the early growth stage may enhance weed suppression potential by this cultivar than others as mentioned by **Valenti and Wicks (1992)**.

It is evident from Table (15) that cultivars had markedly affected fresh weight of wheat plants/m^2 in the first and second samples. The highest values of fresh weight were obtained by Sakha 8 wheat cultivar in both early and late growth stages. Meanwhile Sakha 61 exceedéd Giza 163 cultivar in fresh weight during the early growth but not at the late growth stage of wheat. The higher fresh weight of Sakha 8 plants may reflect its heigher ability in water depletion from the soil profile that may increase its competitiveness with associated weeds. On the other hand, the inferiority of Giza 163 cultivar in fresh weight may be associated by its less plant height and less competition ability with weeds. **Mason and Madin (1996)** found that weeds reduced vegetative yield of wheat. Moreover, **Buchanan and McLaghlin, (1975)** stated that crop grown in competition with weeds can be adversely affected by loss of nutrients and water to unwanted plants (weeds).

Results in Table (15) clear that dry weight/m^2 of wheat plants was significantly affected by cultivars in the first and second samples. The highest magnitude was recorded by Sakha 8 cultivar during both early and late growth stages while Sakha 61 ranked the second for dry weigh during early growth stage and equaled Giza 163 during the late growth stage in this respect. The highest dry weight of Sakha 8 plants may be associated with its tallest plants, largest number of tillers, heaviest fresh weight, and larger leaf area index at the early growth stage. The superiority of this cultivar in all these characters may increase the dry matter accumulation by wheat plants in Sakha 8 cultivar than the others.

Concerning leaf area index, it is clear from Table (15) that this measurement was significantly affected by wheat cultivars. Sakha 8 was superior to the other two cultivars in leaf area index during the early growth stage (60 DAS) followed by Sakha 61 wheat cultivar while Giza 163 had the least leaf area index. The highest value of leaf area index with Sakha 8 cultivar may confirm its competitive ability against weeds during the early growth stage. On the other hand, the lowest value of this character with Giza 163 may reduce its competitiveness with weeds during the early growth stage.

In respect of the effect of interaction between cultivar and season, It is evident from Table (15) that fresh weights for wheat plants/m^2 at the first and second sampling dates showed non significant response to the interaction between cultivars and seasons. On the other hand, the effect of this interaction was significant for all rest measurements, revealing that the effect of cultivars in this respect was fluctuated from season to season.

3. Effect of seeding rate:

The mean values of plant height, tillers number/m^2, fresh weight, m^2, dry weight/m^2 at 60 and 120 days after sowing and leaf area index (LAI) for wheat at 60 days after sowing as affected by seeding rate in the combined analysis of the two seasons are presented in Table (16).

Table (16): The average values of wheat growth measurements as affected by seeding rate (combined data of 1994/95 and 1995/96 seasons).

Growth Character	Seeding rate (kg/fed.)			
	40	55	70	F-test SR X S*
60 days after sowing				
Plant height (cm)	35.89 c	37.85 b	39.55 a	S
Number of tillers / m^2	1241.20 c	1413.40 b	1520.86 a	S
Fresh weight of plants (g) / m^2	1001.03 c	1171.03 b	1366.16 a	NS
Dry weight of plants (g) / m^2	91.80 c	103.89 b	122.61a	S
Leaf area index (LAI)	1.51 c	1.82 b	2.21 a	S
120 days after so wing				
Plant height (cm)	106.22 c	108.42 b	110.81 a	S
Number of tillers / m^2	358.34 c	407.74 b	456.00 a	NS
Fresh weight of plants (g) / m^2	3127.04 c	3508.76 b	3938.21 a	NS
Dry weight of plants (g) / m^2	863.32 c	980.20 b	1094.03 a	NS

SR = Seeding rate *S = Season

S: Significant difference NS: Not significant

The effect of seeding rate was statistically significant on all growth characters under study during the early and late growth stages. The highest values were obtained at 70 kg seed/fed.

Concerning plant height, it is observed that increasing seeding rate significantly increased plant height of wheat. The increment in plant height by increasing seeding rate occurred at early and late stages of wheat growth (60 and 120 DAS respectively). The taller plants of wheat under higher seeding rate might be attributed to the crowding crop plants and more tillers per unit area that may push the competition for light and stem elongation more than at lower crop density. Similar trend was obtained by **Mahmoud (1988), Roshdy (1988b), El-Moursy (1989), Ghanem and El-Khawaga (1991), Shehab El-Din (1993a) and Zaher (1996).** They recorded increases in plant height of wheat as affected by seeding rate. On the other hand, **El-Bana and Basha (1994)** indicated that plant height of wheat was not affected by seeding rates.

The results in Table (16) cleared that the number of tillers/m^2 was markedly increased by increasing seeding rate. The significant increases in tillers number were associated with the higher seeding rates during both early and late growth stages. The application of 70 kg seeds/fed. resulted in the largest number of tillers/m^2 at the two sampling dates followed by 55 kg seeds/fed. The positive responses of tillers number of wheat to increasing seeding rate may be related to raising crop plants population, having lower weed densities and resulting in more competition against weeds. In this respect, **Ponce and Salas (1990)** stated that weed competition with wheat was higher than the competition of wheat itself. These results are confirmed by those obtained by **El-Bana and Basha (1994)** who reported that raising seeding rate from 45 to 75 kg/fed.

significantly increased the number of tillers/m^2. Additionally, **Zaher (1996)** recorded a significant increase in tillers number per m^2 from increasing seeding rate of wheat from 45 to 60 kg/fed. However, **Assey and Ibrahim (1976)** found that increasing seeding rate of wheat caused a reduction in number of bearing tillers.

It is evident from the data in Table (16) that the application of 55 and 70 kg/fed. for wheat seeding showed considerable increases in fresh weight/m^2 comparing to the lowest seed rate (40 kg/fed.). This trend was obtained during both early and late growth stages. At the two sampling dates, using 70 kg seeds/fed. produced significantly heavier fresh weight per unit area than other rates. The increased fresh weight/m^2 from higher seeding rates might be resulted from producing taller plants and larger tiller number per unit area. Consequently, raising the competitiveness for soil resources of the crop over the lower population and biomass of weeds growing under this condition as mentioned in this work. On the other hand, the reduction in fresh weight of wheat/m^2 under the lower seeding rate may be related to the shorter plants, lower tillers/m^2 and severe competition by weeds. This may be resulted from the larger weed population and weed biomass accompanied with the lower seeding rate. These results and explanation are confirmed by **Kirkland (1993)**.

As shown in Table (16), seeding rate had a remarkable effect on dry weight of wheat/m^2 during the early and late growth stages. The highest seeding rate (70 kg/fed.) produced significantly dry weight of wheat more than those obtained from 40 or 55 kg seeds/fed. This manner was true at the first and second sampling dates. It could be said that the positive effect of increasing seeding rate on dry weight/m^2 of wheat plants might be attributed to the increased crop density, fresh weight and leaf area index as will be mentioned later and less weed competition. These factors may beneficially help the crop for soil resources depletion, more light interception and dry matter accumulation during both early and late growth stages. **Tanji *et al.* (1997)** concluded that the dense wheat canopy obtained with high rates reduced the availability of light, nutrients and moisture to weeds (rigid rye grass and cowcockle).

Concerning leaf area index of wheat as affected by seeding rate, data in Table (16) showed that leaf area index (LAI) of wheat was significantly affected by seeding rate at 60 days after sowing. The largest leaf area was produced by using 70 kg seeds/fed. followed by 55 kg while 40 kg seeds/fed. had the least LAI value. Such increase in LAI for wheat under higher seeding rate may be related to maximizing leaves number from the dense crop population and taller wheat plants under this condition. **Tanji *et al.* (1997)** stated that the large dry weight accumulation and leaf area of wheat from the onset of emergence enables wheat to compete strongly and limits weed (rigid rye grass and cowcockle) growth.

Table (16) shows the effect of interaction between seeding rates and seasons. Data indicated that there was a statistical significant effect of the interaction on plant height during early and late growth stages, number of tillers/m^2, dry weight/m^2 and leaf area index during the early growth stage. The significant effect of this interaction on the previous characters indicated that the effect of seeding rate on these measurements was unconstant from season to season. However, the insignificant effect for seeding rate x season interaction for the rest measurements revealed the constant effect of seeding rate on such characters during the two seasons.

4. Effect of weed control treatments:

The mean values of wheat growth traits as affected by weed control treatments at two growth stages are given in Table (17).

Table (17): The average values of wheat growth measurements as affected by weed control treatment (combined data of 1994/95 and 1995/96 seasons).

Growth Character	Weed control treatment			
	Arelon	Hand Weeding	Weedy Check	F-test WCTX S*
60 days after sowing				
Plant height (cm)	39.18 a	37.90 b	36.21c	NS
Number of tillers/m^2	1615.43 a	1426.71 b	1133.32 c	S
Fresh weight of plants (g) / m^2	1486.37 a	1214.26 b	837.58 c	- NS
Dry weight of plants (g) / m^2	131.01 a	110.10 b	77.19 c	S
leaf area index (LAI)	2.50 a	1.83 b	1.22 c	S
120 days after sowing				
Plant height (cm)	110.34 a	108.96 b	106.15 c	S
Number of tillers / m^2	500.45 a	412.89 b	308.75 c	S
Fresh weight of plants (g) / m^2	4386.59 a	3709.90 b	2477.52 c	NS
Dry weight of plants (g) / m^2	1215.59 a	1027.90 b	694.07 c	NS

WCT = Weed control treatment — *S = Season

S: Significant difference — NS: Not significant

The obtained results indicate observable effects of weed control treatment on all growth contributes. Both Arelon and hand weeding twice recorded values significantly larger than the weedy check. During the early and late growth stages, Arelon significantly exceeded hand weeding in all values of all measurements.

With regard to plant height of wheat, data in Table (17) revealed that there were significant increases by controlling weeds as compared to the untreated check. The application of Arelon during 2-4 leaf stage gave taller wheat plants than the hand weeded plots with a significant difference. The same trend occurred during the early or late growth stages of wheat. The increase in height of wheat plants under Arelon treatment is mainly attributed to the exhaustive effect of this treatment on weed population and growth. Moreover the higher density of tillers under this treatment may consequently increased plant height. On the other hand, the reduction in plant height under weedy check plots probably was due to the higher weed population and growth attributes which increased the specific competition against wheat plants. **El-Moursy (1990) and El-Metwaly (1994)** found that plant height was increased by chemical weed control as well as hand weeding treatments.

Data on the number of tillers/m^2 as affected by weed control are presented in Table (17). It is obvious from the results that number of tillers/m^2 was significantly higher under both Arelon and hand weeding as compared to the unweeded check. The chemical weed control by Arelon resulted in increasing tillers number of wheat significantly more than hand weeding. The same trends were constant during the first and second growth stages. The superiority of Arelon in increasing wheat tillers number/m^2 is expected due to the lower weed population and consequently the lower specific competition during the two stages of growth. These results were in agreement with those reported by **El-Moursy (1989), Khalil (1989) and Ghanem and El-Khawaga (1991)** who reported that controlling weeds by hand weeding or herbicides increased the number of tillers/m^2 as compared to the weedy check plots.

As shown in Table (17), fresh weight of wheat/m^2 was greatly affected by weed control at both early and late growth stages. Both Arelon and hand weeding significantly increased fresh weights of wheat in the first and second samples as compared with the untreated checks. It is noticeable that Arelon application significantly increased the fresh weights of wheat more than those obtained by hand weeding treatment. The same trend was recorded during early and late growth stages of wheat. This positive effects of Arelon in raising fresh weight may be attributed to its higher efficacy in eliminating weeds and the safe action on wheat growth with the used dose. **Dhawan (1995)** indicated that isoproturon stopped photosynthesis activities of *Phalaris minor* and *Avena ludovician* during 7 days while wheat treated plants were not affected. Additionally, **Prasad and Singh (1995)** pointed out that isoproturon treatment as post-emergence minimized weed density, dry weight, and nutrients uptake of weeds. They added that this treatment improved the nutrients uptake by wheat plants.

It is obvious from Table (17) that Arelon and hand weeding twice had significant effects on dry weight of wheat/m^2 during early and late stages of growth. Apparently, Arelon gave the heaviest wheat plants/m^2 followed by hand weeding twice treatment, while the lowest dry weight was given by the untreated weedy check. The previous trend was true at the first and second sampling dates. This result might be due to limiting of weed population, depression of weed competition and enhancement of nutrients uptake by wheat as mentioned by **Dhawan, Gogol and Kalita (1995), Prasad and Singh (1995)**.

The data on leaf area index (LAI) of wheat plants are shown in Table (17). It is clear that weed control treatment had remarkable effects on leaf area index at 60 DAS. Both Arelon and hand weeding twice achieved significant increases in leaf area index of wheat at the early growth stage. The largest leaf area index was recorded by the application of Arelon followed by hand weeding while the weedy check plots gave the least value. These findings could be associated with excluding weed competition from Arelon treated plots more effectively, which turned in more tillers, more leaves and larger LAI. On the other hand, wheat plants in weedy check plots suffered from severe competition by weeds for light and soil resources, in turn, had a declined LAI. These finding and discussion are confirmed by those recorded by **Kirkland (1993), Blackshaw (1994) and Gafoor and Shad (1995)**. Moreover, **Tahoon (1994)** found that the unweeded check treatment gave the lowest dry weight of leaves/plant while controlling weeds chemically or mechanically significantly increased this character.

As shown in Table (17), the interaction between weed control treatments and seasons had non significant effects on plant height and fresh weight/m^2 at the early growth stage, in addition to fresh and dry weight/m^2 during the late stage of wheat growth. This reveals the constant effect of weed control on these characters during the two seasons. However, the effects of this interaction on the rest measurements during the two growth stages were significant.

the largest number of tillers/m^2 and significantly exceeding the other cultivars in this respect. The differences between cultivars in tillering ability during early stage may be due to genetic factors as reported by **Menshawy (1996)**. On the other hand, no significant differences were obtained by the interaction between cultivars and seeding rates during the late growth stage (120 DAS) for tillers per m^2.

Regarding the fresh weight of wheat/m^2 Table (18) revealed that fresh weight was affected by the interaction between wheat varieties and seeding rates. The effect was significant only at the late stage of growth (120 DAS). The highest value of fresh weight/m^2 was produced by Sakha 8 cultivar with the highest seeding rate (70 kg/fed.) However the lowest one was recorded by Giza 163 when 40 kg seeds/fed. was used. The heavier fresh weight of Sakha 8 cultivar might be related to its larger number of tillers than other used varieties as obtained in this study.

Concerning dry weight of wheat/m^2, the data presented in Table (18) indicated that this character was considerably affected by the interaction between cultivars and seeding rates of wheat. The data show that under all tested verities, increasing wheat seeding rates significantly increased the value of dry weight/m^2. The differences were significant at 60 and 120 days after sowing. The highest values of dry weight were obtained by applying the highest rate for seeding (70 kg/fed.) under the three cultivars used. On the other hand, Sakha 8 cultivar recorded the heaviest dry weights under 40, 60 and 70 kg seeding rates than Sakha 61 or Giza 163 cultivars. Raising dry weight/m^2 for cultivar such Sakha 8 under the higher seeding rate may be correlated with maximizing fresh weight and dry matter accumulation by this variety.

Table (18) : The average values of wheat growth measurements as affected by (cultivars x seeding rates) interaction. (Combined data of 1994/95 and 1995/96 seasons).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test
Seeding rate (kg/fed.)	40	55	70	40	55	70	40	55	70	(CV. x SR.) x S*
60 days after sowing										
Plant height (cm)	39.03 c	41.08 b	43.13 a	34.78 f	36.70 e	38.10 d	33.87 g	35.77 ef	37.41 de	NS
Number of tillers/m^2	1366.04 d	1486.21 b	1578.96 a	1172.00 f	1316.79 e	1420.79 c	1185.54 f	1437.21 c	1562.83 a	S
Fresh weight (g)/m^2	1068.01 a	1242.79 a	1476.96 a	975.37 a	1151.35 a	1334.45	959.72 a	1118.94 a	1287.07 a	S
Dry weight (g)//m^2	96.88 f	113.07 c	139.96 a	90.45 g	100.76 e	117.77 b	88.08 g	97.83 ef	110.09 d	S
Leaf area index (LAI)	1.63 f	2.20 b	2.58 a	1.49 g	1.74 d	2.13 b	1.40 g	1.52 e	1.93 c	S
120 days after sowing										
Plant height (cm)	109.77 c	111.44 b	113.33 a	100.36 g	102.63 f	105.69 e	108.53 d	111.19 b	113.40 a	S
Number of tillers/m^2	473.08	512.50	580.33	285.21 a	347.33 a	372.63	316.75 a	363.38 a	415.04 a	NS
Fresh weight (g)/m^2	3858.31 c	4215.88 b	4781.65 a	2778.40 f	3164.20 e	3453.09 de	2744.40 f	13146.20 e	3579.90 cd	S
Dry weight (g)/m^2	994.99 c	1137.64 b	1288.51 a	824.65 f	936.46 d	1005.80 c	770.32 g	866.50 e	987.78 c	S

CV = Cultivars SR = Seeding rate

S* = Seasons S = Significant difference NS = Not significant difference

5. **Effect of interaction between wheat cultivars and seeding rates:**

As shown in Table (18), wheat cultivars x seeding rates interaction significantly affected plant height for early and late growth stage, number of tillers/m^2 at early growth stage, fresh weight/m^2 at the late growth stage, dry weight/m^2 at the early and late growth stage on leaf area index at (60 days after sowing).

Concerning plant height, data in Table (18) revealed that increasing seeding rate significantly increased plant height of Sakha 8, Sakha 61 and Giza 163 cultivars during the early and late growth stage. Seeding rate of 70 kg/fed. produced the tallest plants compared to 40 or 55 kg/fed. seeding rates. Except for Giza 163 cultivar, the highest seed rate (70 kg/fed.) significantly exceeded the moderate one (55 kg/fed.) in plant height during the early growth stage. However, at the late growth stage, the tallest plants were produced from the highest seeding rate under the three cultivars. With varietal comparison, especially at early growth stage, Sakha 8 cultivar showed its superiority in plant height under all seeding rates. However, with growth season progressing, Giza 163 reached the same plant height of Sakha 8. The superiority of Sakha 8 cultivar in plant height during the early stage may be attributed to possessing the gene for increasing stem elongation at the early growth stage. **Menshawy (1996)** found that Giza 163 cultivar possesses most decreasing genes for stem elongation than Sakha 61 variety.

Referring the results of Table (18), it is clear that the number of tillers/m^2 was affected greatly by seeding rates under the three used cultivars during early growth stage. Under 70 kg/fed. (high seeding rate), Sakha 8 and Giza 163 exceeded Sakha 61 in number of tillers/m^2. However, with lower seeding rates (40 and 55 kg/fed.), Sakha 8 produced

Results in Table (18) cle r d that during the early stage of growth (60 DAS), the effect of interaction between wheat cultivars and seeding rates was significant on leaf area index of wheat. Generally, leaf area index of all tested cultivars was positively affected by increasing wheat seeding rates. The highest leaf area index value was obtained by Sakha 8 cultivar compared to Sakha 61 and Giza 163 under the same seeding rate. Moreover, the largest (LAI) value was recorded by Sakha 8 cultivar by using 70 kg seeds/fed. However the lowest (LAI) was produced from Giza 163 when 40 kg seeds/fed. was used. The reduction in (LAI) of Giza 163 and Sakha 61 cultivars under the lowest seeding rate resulted from the less number of leaves per unit area under this treatment.

The data given in Table (18) indicate that the interaction between cultivars, wheat seeding rates and seasons had significant effects on all studied characters except with plant height at 60 days after sowing and the number of tillers/m^2 at 120 days after sowing. The significant effect of this interaction shows the unconstant measurements from season to season.

6. Effect of interaction between wheat cultivars and weed control treatments:

Data presnted in Table (19) indicated that the effect of interaction between wheat cultivars and weed control treatments was significant for all growth measurements of the crop in the combined data over the two seasons.

As shown in Table (19) plant height of wheat was greatly affected by weed control treatments at 60 and 120 days after sowing. Arelon treatment caused significant increases in plant height compared to hand weeding while weedy check plots produced the shortest plants. The same trend obtained during the early (60 DAS) and late (120 DAS) growth

Table (19): The average values of wheat growth measurements as affected by (cultivars x weed -control treatments) interaction. (Combined data and 1994/95 and 1995/96).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test
Weed control treatment	Arelon	Hand weeding	Weedy check	Arelon	Hand weeding	Weedy check	Arelon	Hand Weeding	Weedy check	(CV. x WCT) xS*
60 days after sowing										
Plant height (cm)	42.32 a	41.13 b	39.79 c	38.03 d	36.73 f	34.81 h	37.20 e	35.83 g	34.01 i	NS
Number of tillers/m^2	1659.50 b	1483.50 c	1288.21 d	1480.29 c	1309.00 d	1120.29 e	1706.50 a	1487.63 c	991.46 f	S
Fresh weight (g)/m^2	1566.09 a	1272.36 c	949.30 f	1434.57 b	1198.53 d	828.07 g	1458.45 b	1171.86 e	735.41 h	S
Dry weight (g)/m^2	141.45 a	112.93 c	92.40 g	125.71 b	108.53 e	74.74 h	109.22 de	105.70 f	64.42 i	S
Leaf area index (LAI)	2.89 a	1.96 b	1.35 d	2.31 b	1.83 c	1.23 e	2.30 b	1.69 c	1.07 f	S
120 days after sowing										
Plant height (cm)	112.81 a	111.71 b	110.01 c	105.07 e	103.28 f	100.34 g	113.13 a	111.88 b	108.11 d	S
Number of tillers/m^2	617.13 a	528.38 b	420.42 d	415.38 d	335.08 f	254.71 g	468.83 c	375.21 e	251.13 g	S
Fresh weight (g)/m^2	5192.13 a	4449.85 b	3213.85 f	3810.04 d	3342.93 e	2242.72 g	4157.58 c	3336.94 e	1975.99 h	NS
Dry weight (g)/m^2	1371.50 a	1172.25 b	877.40 e	1122.14 c	1002.95 d	641.83 f	1153.13 bc	908.49 e	562.98 g	NS

CV = Cultivars WCT = Weed control treatment

*S = Seasons S = Significant difference NS = Not significant difference

stages. On the other hand, Sakha 8 cultivar had the tallest plants during the early growth stage followed by Sakha 61 while Giza 163 ranked the least in this respect. Moreover, at the late growth stage, Sakha 8 and Giza 163 were statistically similar in plant height under Arelon and hand-weeding treatments, and both exceeded Sakha 8 cultivar.

The superiority of Sakha 8 cultivar in plant height at the early growth stage might be due to genetic factors resulted in a rapid growth at the early stage than both Sakha 61 and Giza 163 cultivars. **Menshawy (1996)** obtained significant differences between Sakha 61 and Giza 163 cultivars during tillering period. Sakha 61 had higher plants and reached the stem elongation period rapidly than Giza 163. Farther, it is observed from the data that under weedy check treatments Sakha 8 had the tallest plants at the early and late growth stages compared to the other cultivars and this confirms its higher competitive ability against weeds.

The results in Table (19) cleared that number of tillers/m^2 greatly increased by both Arelon and hand-weeding treatments compared with the untreated cheeks. The application of Arelon 50% resulted in number of tillers/m^2 significantly higher than hand-weeding under the three tested cultivars. This trend was achieved in both early and late growth stages from the combined data over the two seasons. On the other hand, under the weeded check plots, Sakha 8 gave the largest number of tillers/m^2 than those given by Sakha 61 and Giza 163 at 60 days after sowing. Moreover, Giza 163 cultivar with weedy check had the lowest number of tillers/m^2 during both early and late growth stages. The least number of tillers per unit area for Giza 163 under weedy check plots may be attributed to its less competitiveness against weeds due to its shorter plants and longer tillering period as mentioned by **Menshawy (1996)**.

Data presented in Table (19) cleared that the fresh weight of wheat/m^2 significantly increased by using both chemical and mechanical methods for controlling weeds. Arelon 50% treatment exceeded hand weeding in fresh weight/m^2 while the untreated plots had the lowest fresh weight. In addition, the same trend occurred at both 60 and 120 DAS. Moreover, under weedy check plots, Sakha 8 showed its superiority in fresh weight than Sakha 61 and Giza 163 cultivars. This finding is expected because of the taller plants and larger number of tillers for Sakha 8 cultivar than the others under weedy check plots as obtained in this study. On the other hand, the inferiority of Giza 163 in fresh weight of under weedy check plots may be refereed to the severe weed competition resulting in high depletion of soil moisture and nutrients as mentioned by **Khera *et al.* (1995)**.

As it is clear in Table (19), dry weight of wheat/m^2 was considerably increased under Arelon 50% or hand weeding treatments compared to the weedy check plots. This trend was true under the three tested cultivars during both early (60 DAS) and late (120 DAS) growth stages. On the other hand, under the untreated check plots, Sakha 8 cultivar gave significantly heavier dry weight than those given by Giza 163 or Sakha 61 cultivars during the early and late growth stages. The higher dry weight of Sakha 8 plant than Giza 163 and Sakha 61 may be due to its higher competitive ability against weeds. This might be resulted from its high ability in capture moisture and nutrients, having more tillers/m^2 and fresh weight at both early and late stages of growth as obtained in this work. **Donan and Zimdahl (1991)** stated that the greater dry weight and leaved area from the beginning of the growing season created barley's competitive ability against *Avena fatua* L.

The results shown in Table (19) indicate that leaf area index (LAI) was significantly higher under chemical and manual weed control treatments at 60 days after sowing as compared to the unweeded checks. The same finding was obtained with the three tested cultivars. Moreover, Sakha 8 exceeded both Sakha 61 and Giza 163 in LAI under Arelon 50%, hand weeding and also, with untreated check plots. The increases of LAI with Sakha 8 cultivar could be related to its larger values of plant height, tillers/m^2 that may give more leaves per unit area as mentioned in this study. This raising in LAI of Sakha 8 cultivar than others created its competitive ability against weeds as concluded by **Dunan and Zimdahl (1991)**.

Concerning the interaction between cultivars, weed control treatments and seasons, Table (19) showed that this interaction had significant effects for all studied measurements except for plant height at 60 DAS, fresh weight/m^2 and dry weight wheat/m^2 at 120 DAD. This finding indicates that the effect of interaction between cultivars x weed control was unconstant for most of the studied measurements.

7. Effect of interaction between seeding rates and weed control treatments:

Regarding the interaction between seeding rates and weed control, data in Table (20) showed that this interaction had no significant effects on plant height of wheat at 60 or 120 days after sowing and fresh weight of wheat at 120 days after sowing. On the other hand, the previous interaction effect was significant for all other growth measurements of wheat during both early and late stages of growth.

In the respect of number of tillers/m^2, data presented in Table (20) cleared that under all seeding rates used, the application of Arelon 50% or

Table (20) : The average values of wheat growth measurements as affected by seeding rates x weed control treatments interaction. (Combined data of 1994/95 and 1995/96 seasons).

Seeding rate	40 kg/fed.			55 kg/fed.			70 kg/fed.			F. test
Weed control Treatment	Arelon	Hand weeding	Weedy check	Arelon	Hand weeding	Weedy check	Arelon	Hand weeding	Weedy check	SR x WCT x S*
60 days after sowing										
Plant height (cm)	37.31 a	35.99 a	34.37 a	39.25 a	37.92 a	36.38 a	40.99 a	39.78 a	37.88 a	NS
Number of tillers/m^2	1497.13 d	1267.29 f	959.17 h	1613.75 b	1451.46 e	1175.00 g	1735.42 a	1561.38 c	1265.79 f	S
Fresh weight (g)/m^2	1240.99 d	1048.69 f	713.4 i	1479.87 b	1198.34 e	834.87 h	1738.26 a	1395.75 c	964.47 g	S
Dry weight (g)/m^2	112.35 c	96.55 d	66.50 g	126.25 b	109.06 c	76.35 f	154.43 a	124.68 b	88.73 e	S
Leaf area index (LAI)	2.01 d	1.54 f	0.98 i	2.43 b	1.76 e	1.28 h	3.06 a	2.18 c	1.39	S
120 days after sowing										
Plant height (cm)	108.07	106.75 a	103.84 a	110.11 a	108.91 a	106.25 a	112.83 a	111.21 a	108.38 a	NS
Number of tillers/m^2	441.63 c	366.71 e	266.71 g	495.33 b	413.50 d	314.38 f	564.38 a	458.46 c	345.17 e	NS
Fresh weight (g)/m^2	3905.92 a	3358.27 a	2116.92 a	4451.53 a	3636.36 a	2438.40 a	4802.31 a	4135.08 a	2877.25 a	NS
Dry weight (g)/m^2	1075.38 d	923.13 f	591.46 i	1218.53 b	1028.90 e	693.18 h	1352.86 a	1131.67 c	797.57 g	NS

SR = Seeding rate   WCT = Weed control treatment

*S = Seasons   S = Significant difference   NS = Not significant difference

hand weeding twice significantly increased the number of wheat tillers as compared with the untreated checks. The largest values of number of tillers/m^2 were produced by wheat plots treated by Arelon 50% followed by the hand-weeded plots, while the unweeded checks were the least in this respect. Additionally, Arelon 50% treatment under the highest seeding rate (70 kg/fed.) showed its superiority in tillers number than the same treatment under both 40 and 55 kg seeds/fed. Also, hand weeded plots resulted in tillers number/m^2 significantly higher under 70 kg/fed. than those produced from 40 or 55 kg seeds/fed. On the other hand, the untreated plots of wheat seeded by 70 kg/fed. achieved number of tillers markedly more than those seeded by 40 or 55 kg seeds/fed. Generally, the same trend is recorded at both early and late growth stages of wheat. The superiority of Arelon 50%, hand weeding and even with the weedy checks in tillers number under the dense seeding rate might account to the increment of the crop population and the more efficient weed control as reported by **Vanova *et al.* (1995)**.

Data presented in Table (20) revealed that fresh weight of wheat/m^2 at 60 DAS markedly increased by using Arelon or hand weeding in controlling weeds comparing to the unweeded plots. Arelon treatment recorded fresh weight significantly higher than hand weeding under all used seeding rats (40, 55 and 70 kg/fed.). On the other hand, using higher seeding rate of wheat increased significantly fresh weight than the lower rate. The increases were true even with the untreated plots seeded by 70 or 55 kg/fed. The increment in fresh weight of wheat/m^2 with all treated and untreated plots for weed control under the higher seeding rate could be related to the higher competitiveness ability for wheat and the reduction in weeds population and growth under this conditions. Similar results were obtained by **Tanji *et al.* (1997)**.

With regard to dry weight of wheat, the data in Table (20) revealed that this trait was greatly influenced by the interaction between seeding rate and weed control treatment. The dry weight of wheat significantly increased with controlling weeds by Arelon 50% or hand weeding twice as compared to the weedy check under all seeding rates used. Arelon treatment exceeded hand weeding in wheat dry weight. On the other hand, Arelon, hand weeding and weedy checks in plots seeded by 70 kg/fed. recorded significantly higher dry weights than those obtained from 40 or 55 kg seeds/fed. application. The same trend was recorded during early and late growth stages.

Concerning leaf are index (LAI), data in Table (20) revealed that this trait at 60 DAS was considerably affected by the effect of interaction between seeding rate and weed control treatments. Both Arelon 50% and hand weeding significantly increased LAI comparing to the untreated plots. The trend was constant under 40, 55 and 70 kg/fed. The largest value of LAI was recorded by using Arelon 50% and seeding rate of 70 kg/fed. Whereas the lowest value resulted by the untreated plots under 40 kg seeds/fed.

In the respect of seeding rates x weed control x seasons interaction as mentioned in Table (20), this interaction was insignificant for plant height at 60 and 120 DAS, number of tillers /m^2, fresh weight/m^2 and dry weight of /m^2 at 120 DAS, indicating the constant effect of seeding rats x weed control on these traits from season to season. On the other hand, the effects of the previous interaction were significant for the rest measurements.

Effects of wheat cultivars, seeding rates and weed control interaction was obtained for all trails, consequently the data were excluded.

c. Yield and its components:

1. Effect of season:

Result in Table (21) present averages of seasonal effect of the studied traits. It is evident that spike length, number of spikelets per spike and biological yield mean values were significantly higher in the first season. Additionally, spikes per m^2, 1000-grain weight and grain yield recorded the higher values in the second season. However, no significant seasonal differences were detected in grains weight per spike and spike weight of wheat.

2. Varietal performance:

The mean values of spikes per square meter, spike length, spikelets per spike, grains per spike, weight of grains per spike, 1000-grain weight, grain yield and biological wheat yield as affected by wheat cultivars in the combined data over the two growing seasons are presented in Table (22). The results revealed that varietal performance significantly differed in all yield contributing characters and wheat grain and biological yield/fed.

Regarding number of spikes/m^2, it is clear that Sakha 8 cultivar greatly exceeded both Sakha 61 and Giza 163 cultivars in this traits. While, the difference between the two cultivars (Sakha 61 and Giza 163) was not significant. The large number of spikes per m^2 achieved by Sakha 8 cultivar is due to its larger number of tillers and heaviest fresh and dry weight of wheat plants/m^2 . While the other two cultivars were inferior to Sakha 8 in this connection. Additionally, such findings may be due to genotype effect as mentioned by **Varga (1980), Felicio (1984), Kalita**

Table (21) : The average values of seasonal effect on yield and yield components of wheat in 1994/95 and 1995/96 seasons.

Season	Characters								
	Number of spikes/m^2	spike length (cm)	Number of spikelets /spike	Number of grains/ spike	Spike weight (g)	Weight of grains/ spike (g)	1000-grain weight (g)	Grain yield (kg/fed.)	Biological Yield (kg/fed.)
1994/95	281.57 b	14.75 a	20.09 a	41.63 a	2.84 a	1.80 a	42.43 b	1973.99 b	6500.67 a
1995/96	317.50 a	12.74 b	16.09 b	33.46 b	2.92 a	1.86 a	48.08 a	2116.97 a	6251.77 b

and Choudhury (1984), Hagras (1985), Khokhar *et al.* (1985) who recorded significant differences due to varietal effect of wheat cultivars in spikes number/m^2.

Regarding spike length, the results revealed that spike length was significantly different among the wheat cultivars. However, Giza 163 gave the shortest spikes, while Sakha 61 cultivar gave the tallest spikes and Sakha 8 was moderate in this respect. These differences in spike length between cultivars could be attributed to genotype effect. The reduction in spike length also may be associated with the large number of spikes/m^2 produced by Sakha 8 cultivar. These findings are in agreement with those obtained by **Eissa (1979) and Felicio (1994)**.

The results showed considerable differences in number of spikelets per spike among the three tested cultivars. Sakha 8 cultivar was inferior to both Sakha 61 and Giza 163 in spikelets/spike, meanwhile there was no significant difference between these two varieties in this respect. The increment of spikelets/spike in both Sakha 61 and Giza 163 could be due to the lowest number of spikes per unit area associated with both cultivars as mentioned in this study. Moreover, these differences may be correlated with genotype effect. These results are confirmed by those obtained by **Eissa (1979), Koraiem *et al.* (1979), Mahmoud (1988), Sharshar (1989) and Essa (1990).**

Data in Table (22) indicated that number of grains/spike was significantly affected by wheat cultivars. The highest number of grains per spike was obtained by using Sakha 8 cultivars followeed by Giza 163 and Sakha 61 variety recorded the least. The superiority of Sakha 8 in number of grains/spike may be accompanied with higher fresh weight, leaf area index and more dry matter accumulation which in turn may enhance pollen

Table (22): The average values of yield and its components of wheat as affected by wheat cultivar (combined data of 1994/95 and 1995/96 seasons).

Growth Character	Wheat cultivar			
	Sakha 8	Sakha 61	Giza 163	F-test CV X S *
Number of spikes/m^2	350.63 a	271.79 b	276.19 b	NS
Spike length (cm)	13.14 b	15.19 a	12.90 c	NS
Number of spikelets/spike	17.90 b	18.20 a	18.17 a	NS
Number of grains/spike	39.63 a	35.79 c	37.21 b	S
Spike weight (g)	2.79 c	2.96 a	2.89 a	NS
Weight of grains/spike (g)	1.75 c	1.92 a	1.83 a	S
1000-grain weight (g)	42.8 c	50.39 a	43.49 b	NS
Grain yield (kg/fed.)	2294.44 a	1991.11 b	1851.11 c	NS
Biological yield (kg/fed.)	6948.67 a	6276.67 b	59.3.33 c	S

CV = Cultivar *S = Season

S: Significant difference NS: Not significant

grains germination and fertilization of florists. In addition, differences in number of kernels per spike due to varietal effect in wheat were reported by **Eissa (1979), Hussein *et al.* (1978), Varga (1980), Osman and Mahmoud (1981), Felicio (1984), Kalita and Choudhury (1984) and Sharshar (1989)**. Moreover Essa **(1990)** recorded a significant increase in number of grains/spike from Sakha 8 compared to Sakha 69 cultivar.

It is clear from the results that value of spike weight produced by the three cultivars significantly differed among the wheat cultivars. Sakha 8 gave spike weight significantly lower than both other varieties. While Sakha 61 and Giza 163 recorded higher weights with insignificant difference between them in this character. The magnitude of spike weight produced by Sakha 61 and Giza 163 may be due to the lower number of spikes/m^2 and lighter 1000-grain weight associated with these two cultivars. The differences between cultivars in spike weight could be attributed to genotype effect as mentioned by **Eissa (1979) and Mahmoud (1988)**.

As shown in Table (22), wheat varieties greatly affected weight of grains per spike. The heavier grains per spike were obtained from both Sakha 61 and Giza 163 cultivars with insignificant difference. On the other hand, Sakha 8 was inferior to both others in weight of grains per spike. The Inferiority of Sakha 8 in weight of grains per spike may be associated with the lower 1000-grain weight of this cultivar than the others. Also, such findings may be due to genitical behaviour as found by **Assey and Ibrahim (1976), Hussein *et al.* (1978), Mahmoud (1988) and Sharshar (1989)**.

Concerning 1000-grain weight as affected by wheat cultivars, as shown in Table (22), it is obvious that 1000-grain weight significantly differed among the three cultivars. Sakha 61 greatly exceeded other cultivars in 1000-grain weight followed by Giza 163 and Sakha 8 cultivar. The heavier grains produced by Sakha 61 could be due to its lowest number of grains/spike as pointed out previously in this study. Additionally, the differences in 1000-grain weight between different cultivars may be refereed to genetic factors. Such findings are confirmed by **Khokher *et al.* (1985), Mahmoud (1988), Sharshar (1989) and Essa (1990)**.

In the respect of grain yield it is clear from date shown in Table (22) that grain yield of wheat was greatly affected by different cultivars. Among the tested cultivars, Sakha 8 outyielded the other cultivars, while Sakha 61 ranked second and Giza 163 recorded the least grain yield of wheat. The superiority of Sakha 8 cultivars in grain yield could be attributed to the magnitude of growth characters such as taller plants, larger tillers number/m^2, higher fresh weight and leaf area index which enabled this cultivar to compete weeds early and accumulate more dry matter than other cultivars. Additionally, Sakha 61 recorded the largest number of spikes/m^2 and grains/spike which resulted in increasing grain yield than other cultivars. On the other hand, the inferiority of Giza 163 cultivar in grain yield resulted from the declined plant height, tiller number/m^2, fresh weight, leaf area index which caused more weed competition, producing less dry matter accumulation, low number of spikes/m^2, and 1000-grain weight and finally low grain yield. **Kirkland (1993)** obtained reductions in culms number./m^2, fresh weight and grain yield of wheat and the reduction was increased by increasing weed population and period of competition. Moreover, differences due to genetic factors in wheat grain yield were reported by **Assey and Ibrahim (1976), Eissa (1979), Koraiem *et al.* (1979), Varga (1980), Hussein *et*** *al.* (1981), **Osman and Mahmoud (1981), Abd El-Gawad (1984), Felicio (1984), Kalita and Choudhury (1984), Sharshar (1989) and Essa (1990).**

Regarding the effect of wheat cultivar on biological yield data in Table (22) cleared significant differences between wheat cultivars in biological yield. The highest biological yield was obtained by using Sakha 8 cultivar while the lowest one was produced by Giza 163 cultivar and Sakha 61 was intermediate in this respect The increase in biological yield produced from Sakha 8 resulted from the increase in growth measurements as mentioned before in addition to less weed competition and higher grain yield recorded by this variety. On the other hand, the differences in this character between cultivars may be encountered by genotype effect as mentioned by **Hussein *et al.* (1981) and Osman and Mahmoud (1981), and Abd El-Gawad (1984).**

The effect of interaction between wheat cultivars and seasons is shown in Table (22). The results indicated that there was an insignificant effect of this interaction on all characters except number of grains/spike, weight of grains/spike and biological yield, revealing that the effect of varietal use was constant from season to another in this respect, with exception of the three mentioned measurements which showed unconstant responses for this effect.

3. Effect of seeding rates:

Table (23) shows the mean values of number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, spike weight, weight of grains/spike, 1000-grain weight, grain yield/fed. and biological yield/fed. as affected by seeding rates of wheat in the combined analysis over the two seasons. Seeding rate showed significant effects on all studied characters for yield and its components of wheat.

Regarding number of spikes/m^2, it is clear that this trait significantly increased as the seeding rate increase in the combined analysis. The highest value of spikes/m^2 was obtained by seeding rate of 70 kg/fed. while using 40 kg seeds/fed. gave the lowest number of spikes per square meter. The increase of spikes number per unit area with the higher seeding rate may be attributed to the increased growth attributes. Additionally, more dry matter accumulation and larger leaf area index under this condition beside the lower weed competition during growth stages as mentioned before in this study, may positively affect spikes/m^2. On the other hand, the lower number of spikes per unit area may be correlated with the declined growth attributes and more competition from weeds under the low crop densities. **Panton *et al.* (1989)** concluded that the number of heads/plant was the most important yield component of wheat determining grain yield and weed competition negatively affected this character. Moreover, **Essa (1990), Shehab El-Din (1993a) and Zaher (1996)** recorded significant increases in spikes/m^2 due to increasing seeding rates of wheat.

The data presented in Table (23) reveal that spike length was significantly affected by seeding rates. The mean values of spike length in combined analysis tended to decrease progressively with the increase in the rates of wheat seeding. This trend may be explained due to the larger number of spikes per unit area under high crop density. In this respect, **Gomaa *et al.* (1977), Eissa (1979), Mazurek (1984), Abd El-Latif and El-Tuhamy (1986), Mahmoud (1988) and Essa (1990)** recorded that spike length negatively responded to the increase of wheat seeding rates.

Table (23): The average values of yield and its components of wheat as affected by wheat seeding rates (combined data of 1994/95 and 1995/96 seasons).

Growth Character	Seeding rate (kg/fed.)			
	40	50	70	F-test SR X S*
Number of spikes / m^2	259.72 c	295.99 b	342.90 a	NS
Spike length (cm)	14.25 a	13.76 b	13.23 c	NS
Number of spikelets/spike	18.54 a	18.06 b	17.66 c	NS
Number of grains/spike	39.23 a	37.39 b	36.02 c	S
Spike weight (g)	3.07 a	2.86 b	2.72 c	NS
Weight of grains/spike (g)	1.99 a	1.79 b	1.71 c	NS
1000-grain weight (g)	47.25 a	45.36 b	43.16 c	NS
Grain yield (kg/fed.)	1879.10 c	2057.99 b	2199.56 a	NS
Biological yield (kg/fed.)	6027.78 c	6.376 b	6724.66 a	NS

SR = Seeding rate *S = Season

S: Significant difference NS: Not significant

Considering the number of spikelets/spike, the results in Table (23) indicate that this trait was markedly affected by seeding rates. Increasing seeding rate from 40 to 70 kg/fed. significantly decreased number of spikelets per spike. The reduction in spikelets per spike with increasing crop population might be due to the denser and shorter spikes produced in such conditions. **Gomaa** ***et al.*** **(1977), Eissa (1979), Osman and Mahmoud (1981), Hegazi** ***et al.*** **(1982) and Mahmoud (1988)** reported that increasing seeding rate of wheat significantly decreased number of spikelets/spike.

With regard to the effect of seeding rates on number of grains per spike (Table 23), it is obvious that this trait was significantly affected by seeding rate of wheat. Corresponding decreases were associated with increasing seeding rate. The largest number of grains per spike was obtained from the lowest seeding rate (40 kg/fed.) while the highest rate (70 kg/fed.) gave the least. It could be concluded that the inferiority of the higher seeding rate in the number of grains/spike resulted from the increased interspecific competition especially at reproductive stage. This may reduce fertile kernels/spike. Similar, results were obtained by **Mahmoud (1988), El-Moursy (1989), Essa (1990), Shehab El-Din (1993a), Gouda** ***et al.*** **(1994) and Zaher (1996).**

Mean values of spike weight as affected by wheat seeding rate in combined analysis of the two seasons are given in Table (23). The data showed that increasing seeding rate tended to decrease the weight of spike. Application of 70 kg/fed. gave the least value of spike weight. However, the heaviest spikes were obtained from applying 40 kg seeds/fed. The reduction in spike weight under the higher seeding rate could be attributed to the adversely effect of high crop population on spike length, number of grains and 1000-grain weight as the present study pointed out. These results are confirmed by those found by **Mahmoud (1988) and El-Moursy (1989)**.

The effect of seeding rates on the average grains per spike are presented in Table (23). It is clear that increasing seeding rate produced corresponding decrease in weight of grains per spike. Thus the heaviest kernels weight per spike was achieved at the lowest seeding rate (40 kg/fed.), while the lowest weight was recorded by the highest seeding rate. The decreased weight of grains per spike under the higher crop density may be attributed to the competition between the large number of spikes per unit area and the few grains/spike under this condition. These results are in harmony with those recorded by **El-Moursy (1989), Essa (1990) and Shehab El-Din (1993a)**. However, **Zaher (1996)** recorded that the decreases in grains weight due to increasing seeding rates (45, 60 and 75 kg/fed.) were not significant.

Data in Table (23) revealed that 1000-grain weight was significantly reduced by increasing seeding rate from 40 to 70 kg/fed. This reduction in 1000-grain weight under higher crop density could be related to the high competition between crowded plants and large number of spikes per m^2. This may retard the proportion of synthesized products translocated and finally received by individual grains under higher crop density. The previous explanation is confirmed with that stated by **Radosevich and Holt (1984) and Tanji *et al.* (1997)**. Moreover, **El-Moursy (1989), Essa (1990), Shehab El-Din (1993) and Gouda *et al.* (1994)** reported that increasing wheat seeding rate significantly decreased 1000-grain weight.

Data on grain yield/fed. (kg) as influenced by seeding rates of wheat are shown in Table (23). It is evident that the effect of seeding rate on the grain yield of wheat was significant in the combined data over the two seasons. It is observed that the average grain yield markedly increased by the gradually increasing seeding rates from 40 to 55 and up to 70 kg per feddan. The highest grain yield of wheat was produced by using the highest seeding rate (70 kg/fed.). It could be detected that, although the reduction in all components of grain yield except spike number/m^2, grain yield increased under higher seeding rate. This finding can explain the important role of spikes density per unit area in compensation of all reductions for other components of grain yield under this study. Moreover, because wheat plants under dense population faced less weed competition as mentioned before, which may help in maximizing spikes number to compensate the reduction of other components. **Panton *et al.* (1989)** mentioned that wheat heads/plant was the most effective component determining grain yield/plant. Similar results were obtained by **Fredrick and Marshal (1985), Shehab El-Din (1993) and Gouda *et al.* (1994).**

Table (23) shows the effect of seeding rates on biological yield in combined data over the two seasons. Biological yield was significantly increased responding to the increasing seeding rate. The highest biological yield/fed. resulted from 70 kg seeds/fed. Such increase in biological yield per feddan might be refereed to the increase of plant height, tillers number/m^2, fresh and dry weight/m^2 in addition to the increase in grain yield under higher seeding rate as observed in this study. These results are in harmony with those obtained by **Ghanem and El-Khawaga (1991)** who found that the higher seeding rate (70 kg/fed.) significantly increased biological yield/fed. compared to lower seeding rate (60 and 50 kg/fed.). Similar findings were reported by **Mosalem (1993) and El-Bana and Basha (1994).** However, **Zaher (1996)** recorded that seeding rate had no significant effect on biological yield/fed. of wheat.

Table (23) shows that the effect of the interaction between seeding rate and seasons was statistically significant for the number of grains per spike. On the other hand, there is insignificant effects from this interaction on all characters of yield and its components of wheat. This finding reveals the constant effect of seeding rate on these traits during the two seasons.

4. Effect of weed control treatments:

Data in Table (24) show the average values of wheat yield and yield components as affected by weed control treatments in the combined analysis of two seasons. The results reveal considerable effects of weed control treatment on all studied characters in the combined data over the two seasons. It is observed that both Arelon and hand weeding twice significantly increased all traits under study.

Data presented in Table (24) demonstrated that the number of spikes/m^2 was greatly increased by both Arelon and hand weeding as compared to the untreated check. Additionally, the application of Arelon treatment significantly increased spikes number/m^2 than hand weeding treatments. The increment in number of spikes/m^2 with eliminating weeds by Arelon herbicide or by hand weeding could be referred to the great reduction of weed competition for light and soil resources. In addition, both treatments gave larger number of tillers, fresh weight, dry weight/m^2 and higher leaf area index for wheat as obtained in this work. Similar results were obtained by **Assey *et al.*(1983a), Gabr (1983) and Laila Aboushoba *et al.* (1986)**. However, **Roshdy (1988b) and Zaher (1996)** indicated that number of spikes/m^2 increased by controlling weeds but these increments were not great enough to reach the 5% level of significance.

Table (24): The average values of yield and its components as affected by weed control treatments in wheat (combined data of 1994/95 and 1995/96 seasons).

Yield Character	Wed control treatment (WC)			
	Arelon	Hand weeding	Weedy Check	F-test WCT X S*
Number of spikes/m^2	364.85 a	306.47 b	227.29 c	S
Spike length (cm)	13.85 b	14.34 a	13.04 c	NS
Number of spikelets/spike	18.11 b	19.15 a	17.01 c	NS
Number of grains/spike	37.82 b	49.70 a	34.12 c	NS
Spike weight (gm)	2.85 b	3.36 a	2.44 c	NS
Weight of grains/spike (g)	1.87 b	2.07 a	1.58 c	S
1000-grain weight (g)	47.72 a	45.23 b	42.82 c	NS
Grain yield (kg/fed.)	2568.22 a	2246.22 b	1322.22 c	S
Biological yield (kg/fed.)	7009.33 a	6486.67 b	5632.67 c	NS

WCT = Weed control treatment *S = Season
S: Significant difference NS: Not significant

The results in Table (24) reveal that both manual and chemical weed control greatly increased length of spike as compared to the weedy check plots.

In addition, the hand weeded wheat plots produced spikes significantly taller than those obtained from Arelon treated plots. This may be due to the lower number of spikes/m^2 which may give sufficient recourses for individual spike growth. On the other hand, the reduction of spike length under the weedy check plots could be referred to the severe competition of weeds to wheat plants under this condition. Similar results were reported by **Ghanem and El-Khawaga (1991)** who found that chemical weed control increased significantly spike length compared to the unweeded treatment. Moreover, **El-Metwaly (1994)** recorded significant increases in spike length in wheat treated by Brominal at 1.0 L/fed., Lontril at 0.6 L/fed. and Arelon at 1.25 L./fed. as well as hand weeding for weed control. However, **Zaher (1996)** reported that Arelon, hand weeding increased spike length by insignificant increases comparing to the weedy check treatment.

As given in Table (24), it is obvious that the number of spikelets/spike highly increased with the two methods for weed control (Arelon or hand weeding) in comparison to weedy check. Hand weeding treatment resulted in higher number of spikelets than Arelon. This increment in spikelets number /spike in the hand weeded plots might be due to the lower number of spikes/m^2 and the longer spike than Arelon treated plots as mentioned in this study. However, the severe weed competition in weedy check plots may exhaust nutrients and soil moisture which adversely affected growth and formation of spikelets and florets as mentioned by **Blackshaw (1993a)**. He stated that weeds not only compete with wheat during the vegetative stages but also during reproductive stages. Moreover, **Tahoon (1994)** found that chemical and mechanical weed control significantly increased number of spikelets/spike comparing to the untreated weedy check.

Concerning the number of grains per spike, Table (24) indicates the mean values of number of grains per spike as affected by weed control treatments. The combined data for the two seasons revealed that grains number/spike was significantly increased by hand weeding twice or Arelon treatment compared to weedy check treatment. Also, hand weeding treatment caused a number of grains/spike greatly larger than that produced from Arelon application for weed control. The higher number of grains/spike under hand weeding treatment could be attributed to the lower number of spikes/m^2, longer spikes and larger number of spikelets/spike than with Arelon treatment as found in this study. On the other hand, the lowest number of grains under weedy check plots might be referred to the reduction in spike length, number of spikelets/spike resulting from weed competition. In addition, severe weed competition to wheat prior to heading could limit the number of kernel formation as reported by **Blackshaw (1993a)**. These results are in agreement with those found by **Assey *et al.* (1983a), Tahoon (1994)**. In addition, **Zaher (1996)** recorded that the number of grains/spike increased by controlling weeds but these increments were not significant.

It is clear from data in Table (24) that both mechanical and chemical weed control (hand weeding or Arelon) greatly increased the weight of spike of wheat as compared with the untreated checks. Additionally, controlling weeds by hand weeding in wheat gave heavier spikes than those given by wheat treated by Arelon. This finding resulted from longest spikes, larger number and weight of grains per spike as obtained in this study. On the other side, weights of spikes produced under weed competition of the weed check plots recorded the least weights. This might due to the reductions of spike length, number of grains/spike and weight of grain/spike as mentioned in this investigation.

Regarding the influence of weed control on weight of grains/spike, it is clear from Table (24) that there were significant effect for weed control treatments on weight of grains/spike. Hand weeding twice and Arelon application significantly increased the weight of grains/spike than those given by weedy check. In addition, hand weeding exceeded Arelon treatment in weight of grains/spike. This may be referred mainly to the larger number of grains/spike under the hand weeded plots as mentioned before in this study. Similar, trends were obtained by **Assey *et al.* (1983a)**. However, **Roshdy (1988b) and Zaher (1996)** reported that mechanical and chemical controlling of weeds increased weight of grains/spike insignificantly.

Data concerning 1000-grain weight as affected by weed control treatments are shown in Table (24). According to the combined data, it is clear that 1000-grain weight was considerably affected by weed control treatments. The two used methods for weed control increased 1000-grain weight compared to untreated check plots. Arelon exceeded hand weeding treatment in the 1000-grain weight. This might be referred to the more available nutrients and moisture, lower number of grains per spike, which in turn declined the interspecific competition and increased the weight of individual grains. On the other hand, the declined 1000-grain weight under the weedy check treatment could be resulted effect from the avidity of the competing weeds for water and nutrients depletion and competition for light at reproductive stage as mentioned by **Blackshaw (1993a)**. Similar, results were recorded by **El-Deepah (1989) and Barhoma *et al.* (1990)**

who reported that chemical weed control as well as hand weeding significantly increased the 1000-grain weight. On the other hand, **Roshdy (1988) and Zaher (1996)** found that weed control treatments had no significant effect on 1000-grain weight.

In respect of grain yield/fed. data presented in Table (24) indicated that there is a significant effect for weed control treatments on grain yield/fed. The obtained results showed that grain yield (kg)/fed. was greatly increased by both Arelon 50% at 1.25 L/fed. and hand weeding twice in comparing with untreated checks. Arelon treatment showed its superiority in raising grain yield of wheat than hand weeding treatments. The superiority of Arelon treatment in maximizing grain yield of wheat may be due to the less weed competition, taller plants, more tillers number/m^2, heavier fresh and dry weight and larger LAI during growth and reproductive stages. Also, this treatment achieved the largest number of spikes/m^2 which had the main proportion in raising grain yield of wheat/fed. in this study. However the reduction in grain yield under weedy check plots may be due to the severe weed competition during vegetative and reproductive stages. This reduced all yield components which in turn decreased grain yield/fed. In this respect, **Blackshaw (1993a)** reported that wheat seed yield reductions were often greater than biomass reductions due to weed competition during vegetative and reproductive stages. Moreover, weed competition prior to heading could limit grain yield by reducing number of kernels initiated, or limiting nutrients and water available for subsequent kernel formation. In turn that would reduce grain yield. The previous results were confirmed by those obtained by **Rastogi *et al.* (1984), Prasad (1985), El-Deek and Abo El-Kheer (1986a), Raghuwanshi *et al.* (1990), Varshney and Singh (1990) and Romex and Dzienia (1994).**

Concerning the biological yield (kg/fed.), the results in Table (24) revealed that the biological yield was significantly affected by weed control treatments. The data according to combined analysis cleared that the biological yield/fed. increased greatly by Arelon and hand weeding treatments. Arelon application was superior to hand weeding in increasing biological yield/fed. The positive response of biological yield to Arelon treatment may be dependent on the higher values of the components such as plant height, tillers number/m^2, fresh and dry weights/m^2 as well as grain yield/fed. However, the reduction in biological yield in the highly infesting and severely competition by weeds led to reductions in the previously mentioned components. Moreover the reductions in wheat grain and biological yield might be due to allelopathic effects as a result to weeds presence as reported by **Qasem (1995)** who reported that incorporation of extracts of dried shoots of 9 weeds in the soil greatly reduced germination and growth of wheat plants. The previous results are in harmony with those obtained by **El-Deebah (1989), Khalil (1989)**. However **Zaher (1996)** reported non significant increases in biological yield due to chemical and mechanical weed control.

Table (24) shows the interaction between weed control treatments and seasons. Insignificant effect of interaction was detected for all traits except for number of spikes/m^2, weight of grains/spike and grain yield per fed. This findings reveal the constant effect of the weed control on most of yield and yield components during the two seasons.

5. Effect of interaction between cultivars and seeding rats:

Data in Table (25) demonstrated that the interaction between cultivars and wheat seeding rates had significant effects on weight of

Table (25): The average values of spike weight, weight of grains per spike and grain yield as affected by (cultivars x seeding rates) interaction. (Combined data of 1994/95 and 1995/96 seasons).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test
Seeding rate	40	55	70	40	55	70	40	55	70	CV x SR x S*
Spike weight (g)	2.96 bc	2.82 cd	2.61 e	3.07 ab	2.95 bc	2.86 c	3.18 a	2.82 cd	2.68 de	S
Weight of grains/spike (g)	1.89 b	1.72 de	1.65 e	2.03 a	1.90 b	1.82 bc	2.06 a	1.75 cd	1.67 de	S
Gain yield (kg/fed.)	2100.00 c	2268.00 b	2515.33 a	1857.33 e	2020.67 d	2095.33 c	1680.00 f	1890.00 e	1983.33 d	S

CV = Cultivars SR = Seeding rage

S* = Seasons S = Significant difference NS = Not significant difference grains/spike, spike weight and wheat grain yield/fed. However, all other measurements were insignificantly affected by this interaction.

Concerning weight of grains/spike, the combined data over two seasons showed that increasing seeding rates of all wheat cultivars significantly decreased the weight of grains/spike. Thus the higher weights of grains spike were obtained from the application of 40 kg seed/fed. Additionally, no significant differences were found between 55 and 70 kg/fed. in seeds weight/spike for Sakha 8, Sakha 61 or Giza 163 cultivars. The highest value was recorded from Giza 163 with 40 kg seed/fed.

As shown in Table (25), spike weight (g) was considerably affected by the interaction effect of wheat cultivars and seeding rates. The obtained results showed that increasing seeding rate of Sakha 8, Sakha 61 and Giza 163 cultivars decreased spike weight. The highest value of spike weight was obtained from Giza 163 when seeded by 40 kg/fed. However the lowest spike weight was recorded by Sakha 8 cultivar under 70 kg/fed. seeding rate. The reduction in spike weight under the higher seeding rate may be due to the larger number of spikes per unit area under dense cultivation. Similar results were obtained by **Roshdy (1988)** who reported that increasing seeding rate from 30 up to 70 kg/fed. decreased spike weight. Moreover, **Ghanem and El-Khawaga (1991)** found that rate of 50 kg/fed. gave a significant increase in spike weight in comparison with the 70 kg grains/fed.

Data presented in Table (25) cleared that grain yield/fed. was significantly affected by cultivars x seeding rates of wheat. It is observed that under the three tested wheat cultivars, grain yield was noticeably increased by raising seeding rate. Under each cultivar, the highest seeding rate (70 kg/fed.) produced the highest grain yield/fed. comparing to 40 or

55 kg/fed. On the other hand, wheat cultivar Sakha 8 significantly outyielded both Sakha 61 and Giza 163 cultivars when seeded at the same seeding rate. The highest value of grain yield was achieved by Sakha 8 at 70 kg/fed. , while the lowest one was recorded by Sakha 61 at 40 kg seeds/fed. The superiority of Sakha 8 in grain yield compared to Sakha 61 or Giza 163 might be referred to its higher yield components and lower weed competition especially when seeded by the higher seeding rate (70 kg/fed.). Moreover this findings may be related to genetical differences as found by **Menshawy (1996)**. Additionaly, the positive effect of seeding rate on grain yield of wheat was found by **Ghanem and El-Khawaga (1991), Mosalem (1993) and Shehab El-Din (1993a)**.

The effect of interaction between cultivar, seeding rate and seasons are shown in Table (25). As it clear from this table, the effect of this interaction was significant on weight of grains/spike, spike weight, and grain yield/fed. This indicated the changeable effect of varieties x seeding rates on these characters from seasons to season.

6. Effect of interaction between cultivars and weed control treatments:

Table (26) indicates the mean values of wheat yield and its components as affected by cultivars and weed control treatments as combined data over two seasons.

The obtained results revealed that cultivars x weed control treatments had a no significant effects on number of spikes/m^2, No. of spikelets/spike, number of grains/spike, 1000 grain weight and grain yield/fed. On the other hand, spike length, spike weight, weight of grains/spike and biological yield/fed. were significantly affected by cultivars x weed control treatments.

Table (26) : The average values of spike length, spike weight, weight of grains/spike and biological yield as affected by (cultivars x weed control treatments) interaction. (Combined data of 1994/95 and 1995/96 seasons).

Wheat cultivar	Sakha 8			Sakha 61			Giza 163			F. test (CV x WCT) X S*
Weed control treatment	Arelon	Hand weeding	Check	Arelon	Hand weeding	Check	Arelon	Hand weeding	Check	
Spike length (cm)	13.31 d	13.65 d	12.47 e	15.44 b	15.96 a	14.17 c	12.81 e	13.41 d	13.41 d	NS
Spike weight (g)	12.71 d	13.32 b	12.35 e	2.94 c	3.54 a	12.40 e	12.90 c	3.21 b	2.57 d	NS
Weight of grains/spike (g)	1.79 d	2.08 a	1.44 e	1.98 b	2.04 ab	1.75 d	1.84 c	2.10 a	1.54 f	S
Biological yield (kg/fed.)	7438.67 a	7060.67 b	6347.33 e	6889.33 c	6383.99 a	5557.900g	6696.67 d	6019.67 f	4993.33 h	S

CV = Cultivars

WCT = Weed control treatment

*S = Seasons

S = Significant difference

NS = Not significant difference

Data in Table (26) cleared that spike length was significantly increased by applying both chemical and manual weed control treatments. The same trend was obtained under the three tested cultivars. Sakha 61 cultivar gave the longest spikes as compared to Giza 163 or Sakha 8 cultivars. Moreover, under both Sakha 61 and Giza 163 hand weeding treatment resulted in significant increase in spike length than Arelon, however, with Sakha 8 the difference was not significant between Arelon and hand-weeding treatment in this respect. The tallest spikes were produced by hand-weeded plots of Sakha 61 while the shortest ones were obtained from weedy check treatment of Sakha 8 cultivar. The increase in spike length of Sakha 61 cultivar under hand weeding treatment could be related to the lower number of spikes under this treatment which may gave better growth condition for spikes. Additionally, the superiority of the chemical weed control than the untreated weedy check was recorded by **Ghanem and El-Khawaga (1991)**. Also, **El-Metwaly (1994)** reported that Arelon at 1.25 L/fed. as well as hand-weeding significantly increased spike length.

Referring to the results of Table (26), it is clear that spike weight was greatly affected by the effect of interaction between wheat cultivars and weed control treatments. The weight of spike significantly increased by controlling weeds with Arelon or hand-weeding under all tested cultivars. Additionally, hand-weeded plots produced the heaviest spikes under Sakha 8, Sakha 61 or Giza 163 cultivars. The highest values of spike weight was recorded by Sakha 61 plots when hand-weeding was applied while the lowest value of spike weight was found with the untreated plots of Sakha 8 cultivar. The increased weight of spike for Sakha 61 cultivar with hand-weeding treatment could be associated with the higher number of grains/spike in this treatment.

As mentioned in Table (26), it could be observed that weight of grains/spike considerably increased by application of chemical and mechanical weed control than those obtained from the untreated plots. This finding was true under the three tested cultivars. Sakha 61 exceeded both Giza 163 and Sakha 8 cultivars in weight of grains/spike under Arelon or untreated plots. The heaviest grains/spike were recorded by Giza 163 with hand-weeded plots. However, the least weight of grain/spike was observed with the same cultivar in the untreated plots. This character might be dependent on number of grains and 1000-grain weight and their differences in this study.

Concerning the biological yield/fed., data presented in Table (28) indicated that the interaction effect of cultivars x weed control treatment significantly affected this character. The biological yield greatly increased when weeds were controlled by Arelon 50% or hand weeding as compared with the weedy check plots. The same trend was repeated with all tested cultivars. Arelon application exceeded hand-weeded plots in biological yield/fed. under Sakha 8, Sakha 61 and Giza 163 cultivars. Sakha 8 achieved the heaviest biological yield under both weed control treatments and even with the untreated checks. However, the lowest biological yield was recorded by Giza 163 with the untreated plots.

The presented data in Table (26) show that wheat cultivar x weed control x season interaction significantly affected, number of grains/spike, weight of grains/spike, 1000-grain weight, grain yield and biological yield. This indicated the unconstant effect of cultivar x weed control treatment interaction for seasons. However, the non significant effect of this interaction on the other presented characters confirms the constant effect of this interaction (cultivars x weed control treatments) on those characters from season to season.

7. Effect of interaction between seeding rates and weed control treatments:

Table (27) indicates the mean values of wheat yields and its components as affected by the interaction between seeding rates and weed control treatments in combined data over two seasons. It is clear from the obtained results that all traits were insignificantly affected by this interaction except of grain yield and biological yield/fed.

Regarding wheat grain yield, it is clear from the data in Table (27) that Arelon 50% and hand weeding greatly increased grain yield/fed. as compared to the weedy check plots. Additionally, Arelon treatment was superior to hand weeded plots in grain yield of wheat.

The same trend was obtained under 40, 55 and 70 kg/fed. seeding rates. The highest grain yield/fed. was obtained by applying Arelon 50% with the highest seeding rate (70 kg/fed.) while the lowest yield of grains/fed. was recorded from the weedy check plots seeded by 40 kg/fed.

Data presented in Table (27) cleared that biological yield of wheat/fed. was significantly influenced by the interaction of seeding rates x weed control treatments. Under all seeding rates (40, 55 and 70 kg/fed.), both Arelon 50% and hand weeding considerably raised the biological yield of wheat/fed. as compared to the untreated checks. In addition, Arelon treatment showed its superiority in the biological yield than the hand-weeded plots. On the other hand, biological yield of wheat significantly increased by increasing seeding rate. The highest seeding rate had the greatest biological yield. This finding is true with Arelon, hand weeding and even with the weedy checks. The highest value of biological

Table (27) : The average values of grain and biological yields as affected by seeding rates x weed control interaction. (Combined data of 1994/95 and 1995/96 seasons).

Seeding rate	40			55			70			F. test
Weed control treatment	Arelon	Hand weeding	Check	Arelon	Hand weeding	Check	Arelon	Hand weeding	Check	(SR x WCT) x S*
Grain yield (kg/fed.)	2365.99 c	2095.33 e	1175.99 h	2599.33 b	2230.67 d	1343.99 g	2739.33 a	2412.67 c	1446.67 f	S
Biological yield (kg/fed.)	6659.33 d	6192.67 f	5231.33 i	7013.99 b	6467.99 e	5646.67 h	7359.33 a	6789.99 c	6024.67 g	S

SR = Seeding rate

WCT = Weed control treatment

*S = Seasons

S = Significant difference

NS = Not significant difference

yield was recorded by using Arelon 50% in plots seeded by 70 kg/seeds/fed. The lowest weight of biological yield was observed with the untreated plots under 40 kg seeding rate of wheat.

The interaction between seeding rates, weed control treatments and seasons had significant effects on grain and biological yields, referring the unconstant effect of this interaction from season to another.

Insiginificant effect of interaction between wheat cultivar, seeding rate and weed control treatments was shown on all studied traits, consequently , the data were excluded.

SUMMARY

Two field experiments were conducted in the Experimental farm of Sakha Research Station, Kafr El-Sheikh during 1994/95 and 1995/96 winter seasons. The study aimed to investigate the effect of cultivars, seeding rates and weed control treatments on weeds, wheat growth and yield and its components. The investigation included three wheat cultivars, namely Sakha 8, Sakha 61 and Giza 163, three seeding rates of 40, 55 and 70 kg/fed. and three weed control treatments (Arelon at 1.25 L/fed., hand weeding twice and the untreated check).

The experimental design was split plot design with four replicates. The cultivars were arranged at random in main plots while seeding rates x weed control treatments were asigned at random in the sub-plots. Each sub-plot was 3.5 meters width and 4.5 meters length, wheat was sown as (Afir method) dry method and broadcasting.

Three samples were taken randomly for weeds at 60, 90 and 120 days after sowing while two samples were taken for wheat characters at 60 and 120 days from sowing and the data were recorded for weeds and wheat characters.

At maturity, ten spikes were taken at random from each plot, while the yield was determined from the encountered nine m^2. The data were recorded for yield, yield components and the biological yield of wheat.

Results could be summarized as follows:

a. A weeds:

I-Effect of seasons :

The seasonal effects were significant on the most of the studied characters for weed growth during the three sampling dates excluding the numbers of total weeds at 60 and 120 days after sowing.