*J. Agric. Sci. Mansoura Univ., 34 (3): 1541 - 1557, 2009*

# EFFECT OF DIFFERENT LATE SOWING DATES AND SEEDING RATES ON PRODUCTIVITY OF SOME EGYPTIAN WHEAT CULTIVARS IN NEWLY CULTIVATED SANDY SOILS

**Badran, M.S.S.**
**Agronomy Department, Faculty of Agriculture, Damanhour, Alexandria, University, Egypt**..

## ABSTRACT

Two field experiments were carried out in the Experimental Farm of the Faculty of Agriculture Damanhour, Alexandria University at El-Boustan region in each of 2003/2004 and 2004/2005 growing seasons. The aim of this investigation was to study the effect of the three late sowing dates (Dec.10$^{th}$, Dec.20$^{th}$ and Dec.30$^{th}$ ) on productivity of four Egyptian wheat cultivars (Sakha 8, Gemmiza 7 ,Giza 168 and Seds 1) which were sown by the three seeding rates (350,400 and 450 grains /m$^2$).A split –split-plot design with four replicates was used in each experiment. The sowing dates occupied the main plots while both cultivars and seeding rates were arranged in the sub and sub-sub plots , respectively.

**The results could be summarized as follows:**

- The sowing dates had a significant effect on all studied traits, except harvest index in both seasons. The highest values were recorded when the wheat cultivars were sown at Dec.10$^{th}$.
- Significant differences among wheat cultivars were observed for all studied traits , in both seasons. Giza 168 cultivar surpassed the three other cultivars for all traits, in both seasons.
- All studied traits were significantly affected by seeding rates except spike length and harvest index in the second season and number of spikelets/spike & number of grains /spike, in both seasons.
- The first and second order interactions significantly affected all studied traits in both seasons,except the interaction between sowing dates and seeding rates for harvest index in the second season.

Generally, it could be concluded that sowing Giza 168 wheat cultivar, by 400 grains/m$^2$ with delayed dates on Dec.10$^{th}$ increasing to 450 grains /m$^2$ with more delaying dates until Dec.30$^{th}$ could improve wheat yield under newly cultivated sandy soil conditions

## INTRODUCTION

Wheat is the main winter cereal crop in Egypt. The gap between the national needs and the local wheat production was estimated by about 4-5 million tons yearly which represent about 40% of the national consumption *(Sorour et al.,2004* ). So, increasing wheat production is an important national goal to decrease this gap. Many efforts had been made in this direction, either by suitable technical package of practices such as sowing times and seeding rates, or by releasing new high yielding cultivars.

Utilization of land after late summer crops (*Nili* crops) such as potato and maize for wheat production may partially, decrease the problem of wheat shortage. Harvesting Nili crops usually terminate in January, where most of winter crops had been sown. It is quiet well known that the productivity of

wheat decreases if its sowing is delayed beyond the optimum date (*Gupta, 1970; Ciha, 1983; Eissa, 1991 and El-Moselhy, 2004).*

Planting high yielding wheat cultivars is considered an important way to increase the amount of production per unit area, especially under both delaying of optimum sowing date and sandy soil conditions. In this respect ,many studies reported significant differences in growth and yield characteristics *(Kumar, 1985; Mosalem, 1993; El-Karamity, 1998 and El-Ganbeehy et al., 2001).*

Seeding rate is one of the important factors contributing for maximum wheat production. Increasing wheat grain yield due to seeding rate was primarily a function of higher number of spikes being produced, especially because more plants were established *(Cromack and Clark,1987; Andrews et al., 1992; El-Bana, 1999 and Toaima et al., 2000).*

Till date, no studies have been made on the response of cultivars for seeding rates under late sowing dates on Egyptian wheat productivity in newly cultivated sandy soil conditions. Therefore, the present study aims to determine the optimal seeding rate and wheat cultivar under different late sowing dates in such abstract soil conditions.

## MATERIALS AND METHODS

Two field experiments were carried out during the two successive winter growing seasons of 2003/2004 and 2004/2005 at the Experimental Farm of the Faculty of Agriculture of Damanhour, Alexandria University, at El–Boustan region,EL- Behera Governorate, Egypt. This investigation was designed to study the effect of different seeding rates for different wheat cultivars under different sowing dates on some agronomic characters, yield and yield components in sandy soil conditions (Table 1).

Each experiment included 36 treatments representing the combination of three sowing dates ($10^{th}$, $20^{th}$ and $30^{th}$ of December), four wheat cultivars (Sakha 8, Gemmiza 7, Giza 168 and Seds 1) and three seeding rates (350, 400 and 450grains/$m^2$).

A split–split–plot experimental design with four replicates was used in both seasons. The sowing dates were randomly assigned to the main–plots, whereas the cultivars and seeding rates were allocated to the sub and sub - sub–plots, respectively. The area of sub–sub–plot was 4.2 $m^2$ (3m in length and 1.4m in width) including 7 rows, 20cm apart, where seeds were hand drilled in both seasons.

Phosphorus fertilizer was applied during soil preparation in the form of calcium super phosphate (15.5 $P_2O_5$%) at the rate of 74.4 kg $P_2O_5$/ha. Potassium sulphate (48% $K_2O$) at the rate of 57.6 kg $K_2O$/ha was added before the first irrigation, while ammonium sulphate (20.5% N) at the rate of 240 kg N/ha was added in three equal doses before $1^{st}$, $2^{nd}$ and $3^{rd}$ irrigations. All other cultural practices, were applied as recommended for wheat fields in EL-Boustan region.

Number of days to 50% heading was recorded as the number of days from sowing to complete emergence of 50% of main stem spikes in each sub-sub-plot.

At harvest, a random sample of ten guarded plants was taken from each sub-sub-plot to measure the following characteristics:-

1- Plant height (cm): measured from ground surface up to the terminator of spike.
2- Spike length (cm).
3- Number of spikelets/spike.
4- Number of grains/spike.

Also, a guarded length of one meter from the inner of five rows of each sub-sub-plot was harvested to determine the following traits:-

5- Number of spikes/m²: number of fertile tillers/m² were calculated by counting all spikes carrying grains per square meter.
6- Biological yield (ton/ha): was recorded for the harvested area and converted to ton/ha.
7- Grain yield (ton/ha): was recorded for the harvested area after threshing and then converted to ton/ha.
8- Straw yield (ton/ha): the straw yield of the previous sample was estimated in kg/m²=[Biological yield (kg/m²) – Grain yield (kg/m²)] then it was converted to ton/ha.
9- 1000-grain weight (g): recorded as the average of two samples each of one–thousand kernel of clean grains.
10- Harvest index (H.I%): it was calculated as follows:

$$H.I\% = (\text{Grain yield}/\text{Biological yield}) \times 100.$$

Soil mechanical analysis of the experimental sites are shown in Table 1 (Piper, 1950).

**Table 1: Soil mechanical analysis of the experimental filed sites before sowing during 2004 / 2005 and 2005 / 2006 seasons**

| Characteristics | Seasons | |
|---|---|---|
| | 2003/2004 | 2004/2005 |
| Sand (%) | 96.4 | 95.8 |
| Silt (%) | 2.51 | 2.27 |
| Clay (%) | 1.09 | 1.93 |
| Texture class | Sandy | |

All obtained data ware statistically analyzed according to the technique of analysis of variance (ANOVA) for the split - split - plot design as published by *Steel and Torrie, 1980 . Least significant difference (LSD) method was used to test the differences among* treatment means at 5% level of probability .

## RESULTS AND DISCUSSION

**A. Effect of sowing dates :**

Analysis of variance showed significant effects for sowing dates on all studied traits in both seasons, except harvest index trait (Table 2).Number of days from sowing to 50% heading decreased by 7.54 days on average, by delayed sowing from Dec.10$^{th}$ to Dec.30$^{th}$ (Table 3) over both seasons, cultivars and seeding rates.

2

These findings may be due to the fact that heat units and the accumulated metabolites required for wheat flowering were reduced in late sowing due to the rise in the atmospheric temperature. In this concern*, Kheiralla and Sherif (1992)* showed that delaying the sowing date in relation to favorable date reduced the number of days from sowing to heading of wheat plants by nine days, on average.

**Table 3 : Number of days from sowing to 50% heading as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 350 | ٤٠٠ | 450 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ٨٨,٧٠ | ٨٨,٣٠ | ٨٧,٠٠ | ٨٨,٠٠ | ٩٣,٣٠ | ٨٩,٥٠ | ٨٦,٣٠ | ٨٩,٧٠ |
| | Gemmiza7 | ٩٢,٣٤ | ٩١,٢٦ | ٩٠,٠٠ | ٩١,٢٠ | ٩٤,٢٠ | ٩٢,٠٠ | ٨٩,١٠ | ٩١,٧٧ |
| | Giza 168 | ٩٤,٧٠ | ٩٤,١٠ | ٩٢,٦٠ | ٩٣,٨٠ | ٩٥,١٠ | ٩٣,٣٠ | ٩٠,٢٠ | ٩٢,٨٧ |
| | Seds 1 | ٩١,٠٠ | ٩٠,٦٠ | ٨٩,٠٠ | ٩٠,٢٠ | ٩٤,١٠ | ٩١,٦٠ | ٨٨,٠٠ | ٩١,٢٣ |
| | Mean | ٩١,٦٩ | ٩١,٠٧ | ٨٩,٦٥ | ٩٠,٨٠ | ٩٤,١٨ | ٩١,٦٠ | ٨٨,٤٠ | ٩١,٣٩ |
| Dec.20th | Sakha 8 | ٨٤,٨٠ | ٨٦,٩٠ | ٨٢,١٠ | ٨٤,٦٠ | ٨٥,٦٠ | ٨٥,٣٠ | ٨١,٤٠ | ٨٤,١٠ |
| | Gemmiza7 | ٩٠,٣٠ | ٨٧,٢٠ | ٨٥,٩٠ | ٨٧,٨٠ | ٨٧,١٠ | ٨٦,٠٠ | ٨٥,٠٠ | ٨٦,٠٣ |
| | Giza 168 | ٩٢,١٠ | ٨٧,٣٠ | ٨٧,٣٠ | ٨٨,٩٠ | ٨٨,٦٠ | ٨٦,٧٠ | ٨٦,٠٠ | ٨٧,١٠ |
| | Seds 1 | ٨٨,١٠ | ٨٧,٠٠ | ٨٤,٧٠ | ٨٦,٦٠ | ٨٦,٣٠ | ٨٥,٢٠ | ٨٤,٠٠ | ٨٥,١٧ |
| | Mean | ٨٨,٨٣ | ٨٧,١٠ | ٨٥,٠٠ | ٨٦,٩٨ | ٨٦,٩٠ | ٨٥,٨٠ | ٨٤,١٠ | ٨٥,٦٠ |
| Dec.30th | Sakha 8 | ٨٢,٩٠ | ٨١,٩٠ | ٨٠,٣٠ | ٨١,٧٠ | ٨١,٥٠ | ٨٢,٧٠ | ٨٠,٩٠ | ٨١,٧٠ |
| | Gemmiza7 | ٨٦,٠٠ | ٨٣,٩٠ | ٨٣,٣٠ | ٨٤,٤٠ | ٨٥,٠٠ | ٨٢,٩٠ | ٨٢,٦٠ | ٨٣,٥٠ |
| | Giza 168 | ٨٩,٥٠ | ٨٥,٦٠ | ٨٤,١٠ | ٨٦,٤٠ | ٨٦,٠٠ | ٨٣,١٠ | ٨٣,٨٠ | ٨٤,٣٠ |
| | Seds 1 | ٨٦,٨٠ | ٨٣,٢٠ | ٨٠,٧٠ | ٨٣,٥٧ | ٨٣,٩٠ | ٨٢,٩٠ | ٨١,٩٠ | ٨٢,٩٠ |
| | Mean | 86.30 | 83.65 | 82.10 | 84.02 | 84.10 | 82.90 | 82.30 | 83.10 |
| Average over all means | | 88.94 | 87.27 | 85.58 | 87.26 | 88.40 | 86.77 | 84.93 | 86.70 |
| $LSD_{0.05}$ | | | | | | | | | |
| Sowing dates (D) | | 5.54 | | | | 5.02 | | | |
| Cultivars (C) | | 4.13 | | | | 2.60 | | | |
| Seeding rates (S) | | 1.78 | | | | 2.19 | | | |
| D×C | | 7.15 | | | | 7.72 | | | |
| D×S | | 3.08 | | | | 3.80 | | | |
| C×S | | 3.55 | | | | 4.39 | | | |
| D×C×S | | 6.15 | | | | 7.60 | | | |

The highest plants and tallest spikes 90.50 and 9.80 cm, respectively were recorded with sowing wheat on Dec.10th, while the shortest ones 79.47 and 7.56 cm, respectively, were recorded with sowing date of Dec.30th as an average over cultivars and seeding rates (Tables 4 and 5). The increase in both plant height and spike length of wheat may be due to the role of photoperiod and light intensity that prevailed during growth period of early planting in increasing number and length of internodes of plants (El-Moselhy, 2004).

**Table 4 : Plant height (cm) as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons .**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3٥0 | ٤٠٠ | 4٥0 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ٨٦,٧٠ | ٩٠,٠٠ | ٩٣,٦٠ | ٩٠,١٠ | ٨٨,١٩ | ٩١,٦٦ | ٩٦,١٠ | ٩١,٩٨ |
| | Gemmiza7 | ٨٥,٣٠ | ٨٧,٩٠ | ٩١,٤٠ | ٨٨,٢٠ | ٨٧,٧٧ | ٩٢,٢٢ | ٩٥,٠٠ | ٩١,٦٦ |
| | Giza 168 | ٨٩,٨٠ | ٩١,٦٠ | ٩٥,٥٠ | ٩٢,٣٠ | ٩٠,٣٥ | ٩٤,٤١ | ٩٧,٤٠ | ٩٤,٠٥ |
| | Seds 1 | ٨٣,٨٠ | ٨٥,٦٠ | ٨٩,٢٠ | ٨٦,٢٠ | ٨٥,٦٥ | ٩٠,١٥ | ٩٢,٧٠ | ٨٩,٥٠ |
| | Mean | ٨٦,٤٠ | ٨٨,٧٨ | ٩٢,٤٣ | ٨٩,٢٠ | ٨٧,٩٩ | ٩٢,١١ | ٩٥,٣٠ | ٩١,٨٠ |
| Dec.20th | Sakha 8 | ٨٣,٧٠ | ٨٥,٨٠ | ٨٩,٤٠ | ٨٦,٣٠ | ٨٢,١١ | ٨٦,٢٢ | ٩٠,٦٦ | ٨٦,٣٣ |
| | Gemmiza7 | ٨١,٨٠ | ٨٢,٦٠ | ٨٦,١٠ | ٨٣,٥٠ | ٨١,٣٣ | ٨٤,٢١ | ٨٧,٧٥ | ٨٤,٤٣ |
| | Giza 168 | ٨٥,٩٠ | ٨٨,١٠ | ٩١,٢٠ | ٨٨,٤٠ | ٨٤,٢٣ | ٨٧,٩٩ | ٩٢,٢٦ | ٨٨,١٦ |
| | Seds 1 | ٨٠,٧٠ | ٨٢,٩٠ | ٨٥,٤٠ | ٨٣,٠٠ | ٨٠,٠٩ | ٨٢,٠٢ | ٨٥,١٣ | ٨٢,٤١ |
| | Mean | ٨٣,٠٣ | ٨٤,٨٥ | ٨٨,٠٣ | ٨٥,٣٠ | ٨١,٩٤ | ٨٥,١١ | ٨٨,٩٥ | ٨٥,٣٣ |
| Dec.30th | Sakha 8 | ٧٦,٦٠ | ٧٩,٥٠ | ٨٢,١٠ | ٧٩,٤٠ | ٧٨,٣٤ | ٨١,٨١ | ٨٤,٨١ | ٨١,٦٥ |
| | Gemmiza7 | ٧٤,٠٠ | ٧٧,٠٠ | ٨٠,٠٠ | ٧٧,٠٠ | ٧٦,٥٥ | ٧٩,٦٢ | ٨٣,٢٧ | ٧٩,٨١ |
| | Giza 168 | ٧٩,٦٠ | ٨١,٨٠ | ٨٥,٢٠ | ٨٢,٢٠ | ٨٠,١١ | ٨٣,٤٤ | ٨٥,١٩ | ٨٢,٩١ |
| | Seds 1 | ٧٣,٦٠ | ٧٥,٢٠ | ٧٩,٨٠ | ٧٦,٢٠ | ٧٣,٦٨ | ٧٣,٠١ | ٨٢,٩٧ | ٧٦,٥٥ |
| | Mean | 75.95 | 78.38 | 81.78 | 78.70 | 77.17 | 79.47 | 84.06 | 80.23 |
| Average over all means | | 81.79 | 84.00 | 87.41 | 84.40 | 82.37 | 85.56 | 89.44 | 85.79 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | 6.36 | | | | 8.19 | | | |
| Cultivars (C) | | 5.31 | | | | 5.16 | | | |
| Seeding rates (S) | | 3.96 | | | | 4.69 | | | |
| D×C | | 9.19 | | | | 10.84 | | | |
| D×S | | 6.86 | | | | 8.12 | | | |
| C×S | | 7.93 | | | | 9.37 | | | |
| D×C×S | | 13.73 | | | | 16.23 | | | |

**Table 5: Spike length (cm) as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3٥0 | ٤٠٠ | 4٥0 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ١٠,٠٠ | ٧,٣٠ | ٧,٠٠ | ٨,١٠ | ١٠,١٩ | ٧,٩٢ | ٨,٥١ | ٨,٨٧ |
| | Gemmiza7 | ١١,٠٠ | ٩,٠٠ | ٨,٩٠ | ٩,٦٣ | ١١,٤٦ | ١٠,٢٧ | ٨,٢٧ | ١٠,٠٠ |
| | Giza 168 | ١٢,٦٠ | ١٠,٨٠ | ٩,٤٠ | ١٠,٩٣ | ١٢,٣٠ | ١١,٤٧ | ١٠,٢٦ | ١١,٣٤ |
| | Seeds 1 | ١٠,٣٠ | ٩,٧٠ | ٩,١٠ | ٩,٧٠ | ١١,٠٥ | ٨,٤٦ | ٩,٩٦ | ٩,٨٢ |
| | Mean | ١٠,٩٨ | ٩,٢٠ | ٨,٦٠ | ٩,٥٩ | ١١,٢٥ | ٩,٥٣ | ٩,٢٥ | ١٠,٠١ |
| Dec.20th | Sakha 8 | ٦,٦٠ | ٧,٩٠ | ٧,٠٠ | ٧,١٧ | ٦,٣٩ | ٨,٧٤ | ٨,٦٠ | ٧,٩١ |
| | Gemmiza7 | ٨,١٠ | ٨,٢٠ | ٧,٦٠ | ٧,٩٧ | ٨,٧٦ | ٩,٤٠ | ٨,٨٥ | ٩,٠٠ |
| | Giza 168 | ٨,٩٠ | ٨,٦٠ | ٨,٣٠ | ٨,٦٠ | ٩,٩٩ | ١٠,٣٠ | ٩,٩٧ | ١٠,٠٩ |
| | Seeds 1 | ٨,٠٠ | ٨,١٠ | ٧,٤٠ | ٧,٨٣ | ٧,٩٤ | ٩,٠٠ | ٨,٢٢ | ٨,٣٩ |
| | Mean | ٧,٩٠ | ٨,٢٠ | ٧,٥٨ | ٧,٨٩ | ٨,٢٧ | ٩,٣٦ | ٨,٩١ | ٨,٨٥ |
| Dec.30th | Sakha 8 | ٦,٥٠ | ٦,٥٠ | ٦,٩٠ | ٦,٦٣ | ٦,٨٢ | ٦,٢٨ | ٧,٩١ | ٧,٠٠ |
| | Gemmiza7 | ٧,٠٠ | ٦,٨٠ | ٧,٠٠ | ٦,٩٣ | ٨,٠١ | ٨,٨١ | ٨,٣٦ | ٨,٣٩ |
| | Giza 168 | ٧,٣٠ | ٨,٠٠ | ٨,٦٠ | ٧,٩٧ | ٨,٦٨ | ٩,٩٩ | ٩,٦٤ | ٩,٤٤ |
| | Seeds 1 | ٦,٨٠ | ٦,٧٠ | ٧,١٠ | ٦,٨٧ | ٦,٦٩ | ٧,٠٠ | ٧,٩٣ | ٧,٢١ |
| | Mean | 6.90 | 7.00 | 7.40 | 7.10 | 7.55 | 8.02 | 8.46 | 8.01 |
| Average over all means | | 8.59 | 8.13 | 7.86 | 8.19 | 9.02 | 8.97 | 8.87 | 8.95 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | 0.50 | | | | 0.63 | | | |
| Cultivars (C) | | 0.36 | | | | 0.43 | | | |
| Seeding rates (S) | | 0.20 | | | | 0.31 | | | |
| D×C | | 0.62 | | | | 0.75 | | | |
| D×S | | 0.35 | | | | 0.53 | | | |
| C×S | | 0.41 | | | | 0.61 | | | |
| D×C×S | | 0.71 | | | | 1.06 | | | |

As shown in Tables 6,7 and 8 number of spikelets/spike, number of grains /spike and number of spikes/$m^2$ significantly decreased from (17.84, 30.46 and 362.35), to (16.52, 25.05and 317.14), to (14.60, 20.66 and 261.55) on an average, respectively, with delaying sowing date from Dec. 10, to Dec. 20 to Dec. 30 over cultivars and seeding rates. These results could be attributed to the climatological conditions prevailing during Dec. 10 sowing which favored the production of fertile tillers per square meter and spikelets/spike. These results are in accordance with those reported by *Abdel-Rahman et al. (1979), Sarkar (1987), Blue et al. (1990) and Hefnawi (1993).*

**Table ٦: Number of spikelets/spike as affected by the interactions among sowing dates, wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3٥0 | ٤٠٠ | 4٥0 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ١٦,٩٠ | ١٥,٩٠ | ١٤,٧٠ | ١٥,٨٣ | ١٨,٥٩ | ١٦,٤٠ | ١٦,٢٠ | ١٧,٠٦ |
| | Gemmiza7 | ١٧,٨٠ | ١٦,٦٠ | ١٦,٠٠ | ١٦,٨٠ | ١٩,٣٠ | ١٧,٩٠ | ١٧,٠٠ | ١٨,٠٧ |
| | Giza 168 | ١٩,٥٠ | ١٨,١٠ | ١٧,٢٠ | ١٨,٢٧ | ٢٢,٢٠ | ١٩,٩٠ | ١٨,٨٠ | ٢٠,٣٠ |
| | Seeds 1 | ١٨,٢٠ | ١٧,٠٠ | ١٦,١٠ | ١٧,١٠ | ٢١,١١ | ١٨,٦٠ | ١٨,٠٠ | ١٩,٢٤ |
| | Mean | ١٨,١٠ | ١٦,٩٠ | ١٦,٠٠ | ١٧,٠٠ | ٢٠,٣٠ | ١٨,٢٠ | ١٧,٥٠ | ١٨,٦٧ |
| Dec.20th | Sakha 8 | ١٤,٥٠ | ١٥,٩٠ | ١٤,٢٠ | ١٤,٨٧ | ١٤,٥٠ | ١٥,٤٠ | ١٥,٩٥ | ١٥,٢٨ |
| | Gemmiza7 | ١٥,٣٠ | ١٦,٨٠ | ١٥,٥٠ | ١٥,٨٧ | ١٦,٩٠ | ١٧,٢٢ | ١٦,١٦ | ١٦,٧٦ |
| | Giza 168 | ١٦,٣٠ | ١٧,٢٠ | ١٦,١٠ | ١٦,٥٣ | ١٩,٠٠ | ٢٠,٠٠ | ١٨,٣٨ | ١٩,١٣ |
| | Seeds 1 | ١٥,٥ | ١٦,٩٠ | ١٥,٤٠ | ١٥,٩٣ | ١٨,٠٠ | ١٨,١٨ | ١٧,١١ | ١٧,٧٦ |
| | Mean | ١٥,٤٠ | ١٦,٧٠ | ١٥,٣٠ | ١٥,٨٠ | ١٧,١٠ | ١٧,٧٠ | ١٦,٩٠ | ١٧,٢٣ |
| Dec.30th | Sakha 8 | ١٢,١٠ | ١٢,٨٠ | ١٣,٨٠ | ١٢,٩٠ | ١١,٨٢ | ١٣,٤١ | ١٣,٢٧ | ١٢,٨٣ |
| | Gemmiza7 | ١٣,٢٠ | ١٣,١٠ | ١٥,٤٠ | ١٣,٩٠ | ١٢,٧٧ | ١٤,٤٦ | ١٥,٥٥ | ١٤,٢٦ |
| | Giza 168 | ١٤,٤٠ | ١٤,٩٠ | ١٥,٨٠ | ١٥,٠٣ | ١٦,٦٦ | ١٧,٧٧ | ١٨,٨١ | ١٧,٧٥ |
| | Seeds 1 | ١٣,٥٠ | ١٣,٦٠ | ١٥,٤٠ | ١٤,١٧ | ١٥,١٥ | ١٥,١٦ | ١٧,٥٧ | ١٥,٩٦ |
| | Mean | 13.30 | 13.60 | 15.10 | 14.00 | 14.10 | 15.20 | 16.30 | 15.20 |
| Average over all means | | 15.60 | 15.73 | 15.47 | 15.60 | 17.17 | 17.03 | 16.90 | 17.03 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | ١,٠١ | | | | 1.36 | | | |
| Cultivars (C) | | ٠,٧٦ | | | | 0.99 | | | |
| Seeding rates (S) | | ٠,٤١ | | | | 0.38 | | | |
| D×C | | ١,٣١ | | | | 1.71 | | | |
| D×S | | ٠,٧٢ | | | | 0.65 | | | |
| C×S | | ٠,٨٣ | | | | 0.75 | | | |
| D×C×S | | ١,٤٤ | | | | 1.3 | | | |

**Table 7 : Number of grains/spike as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3•0 | ٤٠٠ | 4•0 | Mean | 3•0 | ٤٠٠ | 4•0 | Mean |
| Dec.10th | Sakha 8 | ٣٠,٨٠ | ٢٩,٩٠ | ٢٨,٣٨ | ٢٩,٦٩ | ٣١,٠٠ | ٣٠,٤٠ | ٢٨,٢٠ | ٢٩,٨٧ |
| | Gemmiza7 | ٣٢,٠٠ | ٣٠,٣٠ | ٢٨,٩٠ | ٣٠,٤٠ | ٣٣,٠٠ | ٣٢,١٠ | ٣٠,٢٠ | ٣١,٧٧ |
| | Giza 168 | ٣٣,٢٠ | ٣١,١٠ | ٢٩,٦٠ | ٣١,٣٠ | ٣٦,١٠ | ٣٣,٠٠ | ٣١,٣٠ | ٣٣,٤٧ |
| | Seeds 1 | ٢٩,٦٠ | ٢٩,٥٠ | ٢٨,٠٤ | ٢٩,٠٥ | ٢٧,١٠ | ٢٨,٩٠ | ٢٦,٣٠ | ٢٨,١٠ |
| | Mean | ٣١,٤٠ | ٣٠,٢٠ | ٢٨,٧٣ | ٣٠,١١ | ٣٢,٣٠ | ٣١,١٠ | ٢٩,٠٠ | ٣٠,٨٠ |
| Dec.20th | Sakha 8 | ٢٣,٧٠ | ٢٥,٣٠ | ٢٣,٩٠ | ٢٤,٣٠ | ٢٣,٨٠ | ٢٥,٦٠ | ٢٤,٢٠ | ٢٤,٥٣ |
| | Gemmiza7 | ٢٤,٠٠ | ٢٦,٧٠ | ٢٤,٨٠ | ٢٥,١٧ | ٢٥,٧٠ | ٢٦,٢٠ | ٢٦,١٠ | ٢٦,٠٠ |
| | Giza 168 | ٢٤,٨٠ | ٢٧,٤٠ | ٢٥,٧٠ | ٢٥,٩٧ | ٢٦,٢٠ | ٢٨,٩٠ | ٢٧,٧٠ | ٢٧,٦٠ |
| | Seeds 1 | ٢٣,١٠ | ٢٥,٠٠ | ٢٣,٢٠ | ٢٣,٧٧ | ٢٠,٧٠ | ٢٦,٥٠ | ٢٢,٠٠ | ٢٣,٠٧ |
| | Mean | ٢٣,٩٠ | ٢٦,١٠ | ٢٤,٤٠ | ٢٤,٨٠ | ٢٤,١٠ | ٢٦,٨٠ | ٢٥,٠٠ | ٣٥,٣٠ |
| Dec.30th | Sakha 8 | ١٨,٨٠ | ١٩,٩٠ | ٢١,٠٠ | ١٩,٩٠ | ١٩,٩٠ | ٢٠,٦٠ | ٢٠,٤٠ | ٢٠,٣٠ |
| | Gemmiza7 | ١٩,٤٠ | ٢٠,٣٠ | ٢١,٥٠ | ٢٠,٤٠ | ٢١,٥٠ | ٢٢,٠٠ | ٢٢,٨٠ | ٢٢,١٠ |
| | Giza 168 | ٢٠,٣٠ | ٢١,٢٠ | ٢١,٩٠ | ٢١,١٣ | ٢٢,٢٠ | ٢٣,٣٠ | ٢٤,٤٠ | ٢٣,٣٠ |
| | Seeds 1 | ١٧,٩٨ | ١٩,٠٠ | ٢٠,٤٠ | ١٩,١٣ | ١٧,٢٠ | ١٨,٢٢ | ٢١,٦٠ | ١٩,٠١ |
| | Mean | 19.12 | 20.10 | 21.20 | 20.14 | 20.20 | 21.03 | 22.30 | 21.18 |
| Average over all means | | 24.81 | 25.47 | 24.78 | 25.02 | 25.53 | 26.31 | 25.43 | 25.76 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | 1.37 | | | | 1.86 | | | |
| Cultivars (C) | | 0.97 | | | | 1.28 | | | |
| Seeding rates (S) | | 0.78 | | | | 0.85 | | | |
| D×C | | 1.68 | | | | 2.22 | | | |
| D×S | | 1.36 | | | | 1.48 | | | |
| C×S | | 1.57 | | | | 1.71 | | | |
| D×C×S | | 2.71 | | | | 2.96 | | | |

**Table 8 : Number of spikes/m² as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3•0 | ٤٠٠ | 4•0 | Mean | 3•0 | ٤٠٠ | 4•0 | Mean |
| Dec.10th | Sakha 8 | ٣٣٧ | ٣٧١ | ٣٦٠ | ٣٥٦ | ٣٣٢,٢ | ٣٩٠ | ٣٦٧,٤ | ٣٦٣,٢ |
| | Gemmiza7 | ٣٤٤ | ٣٨٧ | ٣٧٣ | ٣٦٨ | ٣٣٩,٢ | ٤٠١,٢ | ٣٦٥,١ | ٣٦٨,٥ |
| | Giza 168 | ٣٥١ | ٤٠٣ | ٣٨٠ | ٣٧٨ | ٣٤٤,٢ | ٤١٥,٩ | ٣٧٢,١ | ٣٧٧,٤ |
| | Seeds 1 | ٢٨٨ | ٣٨٤ | ٣٣٠ | ٣٣٤ | ٣٢٥,٢ | ٣٧٤,٩ | ٣٦١ | ٣٥٣,٧ |
| | Mean | ٣٣٠ | ٣٨٦,٢٥ | ٣٦٠,٧٥ | ٣٥٩ | ٣٣٥,٢ | ٣٩٥,٥ | ٣٦٦,٤ | ٣٦٥,٧ |
| Dec.20th | Sakha 8 | ٣٠٢ | ٣٠٧ | ٣١٥ | ٣٠٨ | ٢٩٥,٤ | ٣٠٠,٤ | ٣٣٠,٩ | ٣٠٨,٩ |
| | Gemmiza7 | ٣٠٤ | ٣٢١ | ٣٢٩ | ٣١٨ | ٣٠٥ | ٣٢٠,٩ | ٣٥٠,٣ | ٣٢٥,٤ |
| | Giza 168 | ٣١٠ | ٣٤٠ | ٣٥٨ | ٣٣٦ | ٣١٩ | ٣٧٠,١ | ٣٨٠,١ | ٣٥٦,٤ |
| | Seeds 1 | ٢٥٧ | ٢٨٩ | ٣٣٣ | ٢٩٣ | ٢٧٧ | ٢٩٧,٨ | ٢٩٩,٥ | ٢٩١,٤٣ |
| | Mean | ٢٩٣,٢٥ | ٣١٤,٢٥ | ٣٣٣,٧٥ | ٣١٣,٧٥ | ٢٩٩,١ | ٣٢٢,٣ | ٣٤٠,٢ | ٣٢٠,٥٣ |
| Dec.30th | Sakha 8 | ٢١٨ | ٢٥١ | ٢٩٦ | ٢٥٥ | ٢٢٩,٩ | ٢٦٠,٦ | ٢٩٥,٤ | ٢٦١,٩٧ |
| | Gemmiza7 | ٢١٨ | ٢٦٢ | ٣٠٩ | ٢٦٣ | ٢٣٦,١ | ٢٧٠,٣ | ٣٢١,٢ | ٢٧٥,٨٧ |
| | Giza 168 | ٢٤٢ | ٢٧٢ | ٣١٤ | ٢٧٦ | ٢٤٥,٨ | ٢٨٨,١ | ٣٥٠,١ | ٢٩٤,٦٧ |
| | Seeds 1 | ٢٠١ | ٢٣٨ | ٢٨٧ | ٢٤٢ | ١٨٦,٦ | ٢٢٦,٢ | ٢٥٨,٩٠ | ٢٢٣,٩٠ |
| | Mean | 219.75 | 255.75 | 301.50 | 259 | 224.6 | 261.3 | 306.4 | 264.10 |
| Average over all means | | 281.00 | 318.75 | 332.00 | 310.58 | 286.3 | 326.37 | 337.67 | 316.78 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | 20.79 | | | | 30.12 | | | |
| Cultivars (C) | | 18.78 | | | | 22.98 | | | |
| Seeding rates (S) | | 14.07 | | | | 14.66 | | | |
| D×C | | 32.52 | | | | 39.81 | | | |
| D×S | | 24.38 | | | | 25.40 | | | |
| C×S | | 28.15 | | | | 29.33 | | | |
| D×C×S | | 48.75 | | | | 50.79 | | | |

It is evident, from Tables 9, 10 and 11, the occurrence of progressive decrease in biological yield, straw yield and grain yield means with delaying sowing dates over cultivars and seeding rates. Such traits were significantly decreased from (9.37, 5.93 and 3.44 ton/ha), to (7.27, 4.66 and 2.61 ton/ha), to (5.76, 3.74 and 2.02 ton/ha) as an average, respectively with delaying sowing dates from Dec.10$^{th}$ to Dec.20$^{th}$ to Dec.30$^{th}$. Therefore, late sowing date to Dec.20$^{th}$ and to Dec.30$^{th}$ , compared to Dec.10$^{th}$, lowered such yields (biological yield, straw yield and grain yield) by (22.41, 21.42 and 24.13%) and (38.53, 36.93 and 41.28%) over both seasons, respectively. It could be observed that Dec.10$^{th}$ sowing date had a longer period for flowering and grain filling which consequently resulted in higher grain weight and consequently higher grain yield . Also, it might be attributed to the favorable effect of early sowing date on increasing number of spikes/m$^2$, number of spikets/spike and 1000-grain weight. Again, these higher results could be due to the rate of solar energy converted into chemical energy in plants sown on Dec.10$^{th}$ compared to those plants sown late on Dec.20$^{th}$ or Dec.30$^{th}$ .Then Dec.10$^{th}$ sowing date caused increase in plant height, spike length and number of spikes/m$^2$ which consequently gave higher straw and biological yields while the late sowing at the end of Dec., caused the plants to finish their life cycle early, so the growth process was terminated early and the growth attributes were negatively affected compared to those of the early sowing. These results are in general agreement with those reported by *Knapp and Knapp (1978); Connor et al. (1992); Rout and Satapathy (1994) and El-Sayed et al. (1998) .*

Concerning the response of harvest index (%) to the three studied sowing dates i.e., Dec.10$^{th}$, Dec.20$^{th}$ and Dec.30$^{th}$, over both cultivars and seeding rates, results presented in Table 12 indicated that the differences did not reach to the level of significance in both seasons. Thousand grain weight was found to be appreciably influenced by the sowing dates over both cultivars and seeding rates in both seasons. Wheat plants sown on Dec.10$^{th}$ significantly surpassed those that were sown on Dec.30$^{th}$, but the differences were insignificant between plants which were sown on Dec.20$^{th}$ and Dec.30$^{th}$ (Table13). These results may be due to that the grains under Dec.10$^{th}$ sowing date reached maturity before being affected by high temperature which result in shriveled kernels. These findings are supported with those obtained by *Eissa (1991).*

**B- Cultivars performance:-**

Mean squares for wheat cultivars were significant to highly significant for all studied traits (Table2). Regarding the number of days from sowing to 50% heading, data in Table(3) indicated that the earliest cultivar was Sakha 8, where it recorded 84.97 days, while the latest one was Giza 168 where it recorded 88.90 days, averaged over both seasons. Differences in heading dates among cultivars might be attributed to the genetic constitution of each cultivar and its interaction with the environment. These results are in harmony with those of Amer (2007).

Wheat cultivar Giza 168 had the tallest plants, where it recorded 88.0 cm, while the shortest one was Seds 1 where it recorded 82.3 cm (Table 4). With regard to the spike length and number of spikelets/spike, data indicated that the Giza 168 cultivar had the longest spike(9.73cm)and highest number of spikelets/spike (17.84), while the shortest spike (7.62cm) and lowest number of spiklets/spike (14.80) were obtained from Sakha 8 cultivar as shown in Tables 5 and 6. Wheat cultivar Giza 168 had the highest means for number of grains/spike, number of spikes/$m^2$, biological yield (ton/ha), straw yield (ton/ha), grain yield (ton/ha), harvest index (%) and thousand grain weight (g), where it recorded (27.13, 336.41, 8.74, 5.40, 3.34, 37.91 and 39.60) respectively averaged over both seasons, while wheat cultivar Seds 1 recorded the lowest means (Tables 7, 8, 9, 10, 11, 12 and 13). Such results could be attributed to the genetic variations of the tested cultivars .Significant differences among wheat cultivars in yield and yield components were reported by *(Samre et al., 1989; Eissa, 1990; Mosalem, 1993;; Saleh, 2000; Moussa, 2001 and Ali et al., 2004)* .

**C-Seeding rates effect:-**

Mean squares for seeding rates (S) were significant to highly significant for all studied traits except number of grains/spike in the first season, spike length and harvest index in the second season, and number of spikelets/spike in both seasons (Table 2). Number of days from sowing to 50% heading significantly decreased with increasing seeding rates from 350 to 450 grains/$m^2$ in both seasons as shown in Table 3.

Spike length (cm) and 1000-grain weight (g) in the first season decreased with increasing seeding rates. Thus the highest means ( 8.59 and 39.5) were obtained from the plants sown with 350 grains/$m^2$, while the lowest ones (7.86 and 37.33) resulted from the plants sown with 450 grains/$m^2$, respectively (Tables 5 and 13). These results may be due to that increase in seeding rates may be related to increase in the competition among growing plants at higher population density per unit area *(Tabl et al., 2005)*.

With respect to the effect of seeding rates on number of grains/spike in the second season, data in Table 7, showed that the highest mean (26.31) was recorded by seeding rate (400 grains/ $m^2$), while the lowest one (25.43) was produced with seeding rate (450 grains/ $m^2$). These results can be explained that for low density, the low number of the plants per unit area had a higher chance to get more light and nutritional elements compared to plants sown at higher densities.

Data in Table 8, showed that number of spikes/ $m^2$ increased with the increasing seed rates from 350 to 450 grains/ $m^2$. Thus the lowest mean (283.65) was obtained by using the lowest seeding rate (350 grains/ $m^2$) while, the highest mean (334.84) was recorded with highest seeding rate (450 grains/ $m^2$).

The seeding rate affected plants height in both seasons and harvest index traits in the second season. Data in Tables (4 and 12) revealed that such means increased with each increase in the seeding rate ( from 350 to 400 and 450 grains/$m^2$ ) but the means recorded at seeding rate (400 grains

/$m^2$) were statistically equal to those recorded at the two other seeding rates either (350 or 450 grains/$m^2$).

Results with respect to the effect of seeding rates on biological, straw and grain yields revealed that their means increased with each increase in the seeding rates in both seasons. Thus the lowest means ( 6.30, 4.10 and 2.21 tons/ha) were recorded from plants sown with 350 grains/$m^2$, while the highest ones ( 8.33, 5.30 and 3.04 tons/ha) were produced from plants sown with 450 grains/$m^2$, respectively ( Tables 9,10 and 11). This increase in wheat yields i.e., biological yield , straw yield and grain yield with increase in seeding rates could be attributed to the similarly increasing in plant height and number of spike/$m^2$ by increasing seeding rates. Such finding are in general agreement with those of *Briggs and Aytenfisu (1979), Mohamed* (1997), Mahfouz and Ghabour (1998), Gaballah and Bassiuny (2001), Moussa (2001) and Tabl *et al.* (2005).

**Table 9 : Biological yield (ton/ha) as affected by the interactions among sowing dates, wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | ٣٥٠ | ٤٠٠ | ٤٥٠ | Mean | ٣٥٠ | ٤٠٠ | ٤٥٠ | Mean |
| Dec.10th | Sakha 8 | ٧,٩٩ | ١٠,٢٨ | ٨,٧٣ | ٩,٠٠ | ٨,١٨ | ١٠,٥٥ | ٩,٤٠ | ٩,٣٨ |
| | Gemmiza7 | ٨,٩٩ | ١١,٢٢ | ٩,٢٢ | ٩,٨١ | ٨,٦٧ | ١١,٤٠ | ١٠,٠٠ | ١٠,٠٢ |
| | Giza 168 | ٩,٠٥ | ١١,٦٦ | ١٠,٤٩ | ١٠,٤٠ | ٩,٧١ | ١٢,٠٠ | ١١,١٠ | ١٠,٩٤ |
| | Seeds 1 | ٦,٠٠ | ٧,١٥ | ٨,٤٢ | ٧,١٩ | ٧,٥٦ | ٨,٦٩ | ٨,٣٠ | ٨,١٨ |
| | Mean | ٨,٠١ | ١٠,٠٨ | ٩,٢٢ | ٩,١٠ | ٨,٥٣ | ١٠,٦٦ | ٩,٧٠ | ٩,٦٣ |
| Dec.20th | Sakha 8 | ٥,٧٣ | ٦,٧٠ | ٨,٥٤ | ٦,٩٩ | ٦,٠٠ | ٦,٩٩ | ٨,٨٨ | ٧,٢٩ |
| | Gemmiza7 | ٦,٥٥ | ٧,٣٣ | ٨,٩٨ | ٧,٦٢ | ٧,٠٠ | ٧,٤٤ | ٩,٢٤ | ٧,٨٩ |
| | Giza 168 | ٧,٣٦ | ٨,١١ | ١٠,٠٦ | ٨,٥١ | ٧,٥٥ | ٨,٠٠ | ١٠,٧٦ | ٨,٧٧ |
| | Seeds 1 | ٤,٤٤ | ٥,٢٢ | ٦,٤٢ | ٥,٣٦ | ٤,٤١ | ٦,٠١ | ٦,٦٤ | ٥,٦٩ |
| | Mean | ٦,٠٢ | ٦,٨٤ | ٨,٥٠ | ٧,١٢ | ٦,٢٤ | ٧,١١ | ٨,٨٨ | ٧,٤١ |
| Dec.30th | Sakha 8 | ٤,٨٨ | ٥,٦٤ | ٦,٧٩ | ٥,٧٧ | ٤,١٥ | ٥,٩٨ | ٧,٠٠ | ٥,٧١ |
| | Gemmiza7 | ٥,٠٠ | ٥,٩٢ | ٧,٠٨ | ٦,٠٠ | ٤,٧٧ | ٦,٦٤ | ٧,٥٥ | ٦,٣٢ |
| | Giza 168 | ٥,٩٦ | ٦,٨٨ | ٧,٨٩ | ٦,٩١ | ٥,٢٥ | ٧,٤٧ | ٨,٠١ | ٦,٩١ |
| | Seeds 1 | ٢,٩١ | ٣,٨١ | ٤,٩٢ | ٣,٨٨ | ٣,٠٧ | ٥,٢٣ | ٥,٤٤ | ٤,٥٨ |
| | Mean | 4.69 | 5.56 | 6.67 | 5.64 | 4.31 | 6.33 | 7.00 | 5.88 |
| Average over all means | | 6.24 | 7.49 | 8.13 | 7.29 | 6.36 | 8.03 | 8.53 | 7.64 |
| $LSD_{0.05}$ | | | | | | | | | |
| Sowing dates (D) | | 0.80 | | | | 0.96 | | | |
| Cultivars (C) | | 0.63 | | | | 0.74 | | | |
| Seeding rates (S) | | 0.37 | | | | 0.46 | | | |
| D×C | | 1.10 | | | | 1.28 | | | |
| D×S | | 0.64 | | | | 0.79 | | | |
| C×S | | 0.74 | | | | 0.92 | | | |
| D×C×S | | 1.29 | | | | 1.59 | | | |

**Table 10 : Straw yield (ton/ha) as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3٥0 | ٤٠٠ | 4٥0 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ٥,١٨ | ٦,٤٦ | ٥,٥٩ | ٥,٧٤ | ٥,٣٢ | ٦,٦٥ | ٦,١٣ | ٦,٠٣ |
| | Gemmiza7 | ٥,٧٤ | ٦,٩١ | ٥,٨٠ | ٦,١٥ | ٥,٥٦ | ٧,١١ | ٦,٣٦ | ٦,٣٤ |
| | Giza 168 | ٥,٦٠ | ٦,٩٨ | ٦,٣٩ | ٦,٣٢ | ٦,٠٥ | ٧,٢٠ | ٦,٨٦ | ٦,٧٠ |
| | Seeds 1 | ٤,٠٤ | ٤,٧١ | ٥,٤٠ | ٤,٧٢ | ٥,١٢ | ٥,٨٠ | ٥,٤٣ | ٥,٤٥ |
| | Mean | ٥,١٤ | ٦,٢٧ | ٥,٨٠ | ٥,٧٣ | ٥,٥١ | ٦,٦٩ | ٦,٢٠ | ٦,١٣ |
| Dec.20th | Sakha 8 | ٣,٧٧ | ٤,٣٥ | ٥,٤٥ | ٤,٥٢ | ٣,٩٧ | ٤,٦٠ | ٥,٧٤ | ٤,٧٧ |
| | Gemmiza7 | ٤,٢٣ | ٤,٦٨ | ٥,٦٤ | ٤,٨٥ | ٤,٥٨ | ٤,٨١ | ٥,٨٨ | ٥,٠٩ |
| | Giza 168 | ٤,٦٣ | ٥,٠١ | ٦,٠٥ | ٥,٢٣ | ٤,٨٠ | ٥,٠١ | ٦,٥٨ | ٥,٤٦ |
| | Seeds 1 | ٢,٩٩ | ٣,٤٨ | ٤,٢٢ | ٣,٥٦ | ٢,٩٣ | ٤,٠٣ | ٤,٤١ | ٣,٧٩ |
| | Mean | ٣,٩١ | ٤,٣٨ | ٥,٣٤ | ٤,٥٤ | ٤,٠٧ | ٤,٦١ | ٥,٦٥ | ٤,٧٨ |
| Dec.30th | Sakha 8 | ٣,٢٤ | ٣,٧٠ | ٤,٣٨ | ٣,٧٧ | ٢,٧٦ | ٣,٩٥ | ٤,٥٨ | ٣,٧٦ |
| | Gemmiza7 | ٣,٢٩ | ٣,٨٢ | ٤,٥٠ | ٣,٨٧ | ٣,١٧ | ٤,٣٣ | ٤,٨٨ | ٤,١٣ |
| | Giza 168 | ٣,٨٤ | ٤,٣٢ | ٤,٨٤ | ٤,٣٣ | ٣,٣٨ | ٤,٧٦ | ٥,٠٠ | ٤,٣٨ |
| | Seeds 1 | ١,٩٩ | ٢,٥٧ | ٣,٢٥ | ٢,٦٠ | ٢,٠٨ | ٣,٥٧ | ٣,٦٥ | ٣,١٠ |
| | Mean | 3.09 | 3.60 | 4.24 | 3.64 | 2.85 | 4.15 | 4.53 | 3.84 |
| Average over all means | | 4.05 | 4.75 | 5.13 | 4.64 | 4.14 | 5.15 | 5.46 | 4.92 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | 0.56 | | | | 0.71 | | | |
| Cultivars (C) | | 0.45 | | | | 0.61 | | | |
| Seeding rates (S) | | 0.26 | | | | 0.34 | | | |
| D×C | | 0.78 | | | | 1.06 | | | |
| D×S | | 0.45 | | | | 0.59 | | | |
| C×S | | 0.51 | | | | 0.68 | | | |
| D×C×S | | 0.89 | | | | 1.18 | | | |

**D-Interactions effect:-**

The analysis of variance showed that all the first and second order interactions among the three studied factors i.e., sowing dates (D), cultivars (C) and seeding rates (S) were significant for all traits in both seasons except (D x S) for the harvest index trait in the second season (Table 2).

The significance of second order interaction among the studied factors (D x C x S) indicated that these factors were not independent in their effect, the simple effect of a factor differ and the magnitude of any simple effect depends upon the levels of the other factors of the interaction term. Significant interactions between cultivars, seeding rates, and planting dates for grain yield have been reported by Briggs and Aytenfisu (1979). Therefore, delayed planting past the optimum date reduced grain yield and increasing the seeding rate only partially compensated for the reduced of grain yield (Briggs and Aytenfisu, 1979 and Ciha, 1983)

Generally, this study indicated that Giza 168 cultivar produced the highest means for yield and yield components when sown using a seeding rate of 400 grains/$m^2$ under sowing date of Dec.10th. Similarly Giza 168 cultivar recorded the highest means for grain yield and yield components when planted using a seeding rate of 450 grains/$m^2$ under the two sowing dates i.e., Dec.20th and Dec.30th in newly cultivated sandy soil conditions.

**Table ١1 : Grain yield (ton/ha) as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3٥0 | ٤٠٠ | 4٥0 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ٢,٨١ | ٣,٨٢ | ٣,١٤ | ٣,٢٦ | ٢,٨٦ | ٣,٩٠ | ٣,٢٧ | ٣,٣٤ |
| | Gemmiza7 | ٣,٢٥ | ٤,٣١ | ٣,٤٢ | ٣,٦٦ | ٣,١١ | ٤,٢٩ | ٣,٦٤ | ٣,٦٨ |
| | Giza 168 | ٣,٤٥ | ٤,٦٨ | ٤,١٠ | ٤,٠٨ | ٣,٦٦ | ٤,٨٠ | ٤,٢٤ | ٤,٢٣ |
| | Seeds 1 | ١,٩٦ | ٢,٤٤ | ٣,٠٢ | ٢,٤٧ | ٢,٤٤ | ٢,٨٩ | ٢,٨٧ | ٢,٧٣ |
| | Mean | ٢,٨٧ | ٣,٨١ | ٣,٤٢ | ٣,٣٧ | ٣,٠٢ | ٣,٩٧ | ٣,٥١ | ٣,٥٠ |
| Dec.20th | Sakha 8 | ١,٩٦ | ٢,٣٥ | ٣,٠٩ | ٢,٤٧ | ٢,٠٣ | ٢,٣٩ | ٣,١٤ | ٢,٥٢ |
| | Gemmiza7 | ٢,٣٢ | ٢,٦٥ | ٣,٣٤ | ٢,٧٧ | ٢,٤٢ | ٢,٦٣ | ٣,٣٦ | ٢,٨٠ |
| | Giza 168 | ٢,٧٣ | ٣,١٠ | ٤,٠١ | ٣,٢٨ | ٢,٧٥ | ٢,٩٩ | ٤,١٨ | ٣,٣١ |
| | Seeds 1 | ١,٤٥ | ١,٧٤ | ٢,٢٠ | ١,٨٠ | ١,٤٨ | ١,٩٨ | ٢,٢٣ | ١,٩٠ |
| | Mean | ٢,١٢ | ٢,٤٦ | ٣,١٦ | ٢,٥٨ | ٢,١٧ | ٢,٥٠ | ٣,٢٣ | ٢,٦٣ |
| Dec.30th | Sakha 8 | ١,٦٤ | ١,٩٤ | ٢,٤١ | ٢,٠٠ | ١,٣٩ | ٢,٠٣ | ٢,٤٢ | ١,٩٥ |
| | Gemmiza7 | ١,٧١ | ٢,١٠ | ٢,٥٨ | ٢,١٣ | ١,٦٠ | ٢,٣١ | ٢,٦٧ | ٢,١٩ |
| | Giza 168 | ٢,١٢ | ٢,٥٦ | ٣,٠٥ | ٢,٥٨ | ١,٨٧ | ٢,٧١ | ٣,٠١ | ٢,٥٣ |
| | Seeds 1 | ٠,٩٢ | ١,٢٤ | ١,٦٧ | ١,٢٨ | ٠,٩٩ | ١,٦٦ | ١,٧٩ | ١,٤٨ |
| | Mean | 1.60 | 1.96 | 2.43 | 2.00 | 1.46 | 2.18 | 2.47 | 2.04 |
| Average over all means | | 2.20 | 2.74 | 3.00 | 2.65 | 2.22 | 2.88 | 3.07 | 2.72 |
| $LSD_{0.05}$ | | | | | | | | | |
| Sowing dates (D) | | 0.30 | | | | 0.34 | | | |
| Cultivars (C) | | 0.25 | | | | 0.29 | | | |
| Seeding rates (S) | | 0.14 | | | | 0.17 | | | |
| D×C | | 0.43 | | | | 0.50 | | | |
| D×S | | 0.24 | | | | 0.29 | | | |
| C×S | | 0.28 | | | | 0.34 | | | |
| D×C×S | | 0.49 | | | | 0.58 | | | |

**Table 12 : Harvest index (%) as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3٥0 | ٤٠٠ | 4٥0 | Mean | 3٥0 | ٤٠٠ | 4٥0 | Mean |
| Dec.10th | Sakha 8 | ٣٥,١٧ | ٣٧,١٧ | ٣٥,٩٩ | ٣٦,١١ | ٣٤,٩٦ | ٣٦,٩٧ | ٣٤,٧٩ | ٣٥,٥٧ |
| | Gemmiza7 | ٣٦,١١ | ٣٨,٤١ | ٣٧,١١ | ٣٧,٢١ | ٣٥,٨٧ | ٣٧,٦٣ | ٣٦,٤٠ | ٣٦,٦٣ |
| | Giza 168 | ٣٨,١١ | ٤٠,١٨ | ٣٩,١٠ | ٣٩,١٣ | ٣٧,٦٩ | ٤٠,٠٠ | ٣٨,٢٠ | ٣٨,٦٣ |
| | Seeds 1 | ٣٢,٦٥ | ٣٤,١٧ | ٣٥,٨١ | ٣٤,٢١ | ٣٢,٢٨ | ٣٣,٢٦ | ٣٤,٥٨ | ٣٣,٣٧ |
| | Mean | ٣٥,٥١ | ٣٧,٤٨ | ٣٧,٠٠ | ٣٦,٦٦ | ٣٥,٢٠ | ٣٦,٩٧ | ٣٥,٩٩ | ٣٦,٠٥ |
| Dec.20th | Sakha 8 | ٣٤,٢٩ | ٣٥,٠٦ | ٣٦,٢٢ | ٣٥,١٩ | ٣٣,٨٣ | ٣٤,١٩ | ٣٥,٣٦ | ٣٤,٤٦ |
| | Gemmiza7 | ٣٥,٣٧ | ٣٦,١٠ | ٣٧,١٩ | ٣٦,٢٢ | ٣٤,٥٧ | ٣٥,٣٥ | ٣٦,٣٦ | ٣٥,٤٣ |
| | Giza 168 | ٣٧,١٦ | ٣٨,٢٢ | ٣٩,٩١ | ٣٨,٤٣ | ٣٦,٤٢ | ٣٧,٣٨ | ٣٨,٨٥ | ٣٧,٥٥ |
| | Seeds 1 | ٣٢,٦٦ | ٣٣,٣٣ | ٣٤,٢١ | ٣٣,٤٠ | ٣٣,٥٦ | ٣٢,٩٥ | ٣٣,٥٨ | ٣٣,٣٦ |
| | Mean | ٣٤,٨٧ | ٣٥,٦٨ | ٣٦,٨٨ | ٣٥,٨١ | ٣٤,٦٠ | ٣٤,٩٧ | ٣٦,٠٤ | ٣٥,٢٠ |
| Dec.30th | Sakha 8 | ٣٣,٥٦ | ٣٤,٣٦ | ٣٥,٥٥ | ٣٤,٤٩ | ٣٣,٤٩ | ٣٣,٩٥ | ٣٤,٥٧ | ٣٤,٠٠ |
| | Gemmiza7 | ٣٤,١٣ | ٣٥,٤٠ | ٣٦,٤٦ | ٣٥,٣٣ | ٣٣,٥٤ | ٣٤,٧٩ | ٣٥,٣٦ | ٣٤,٥٦ |
| | Giza 168 | ٣٥,٦٤ | ٣٧,٢٢ | ٣٨,٧١ | ٣٧,١٩ | ٣٥,٦٢ | ٣٦,٢٨ | ٣٧,٥٨ | ٣٦,٤٩ |
| | Seeds 1 | ٣١,٦٧ | ٣٢,٦١ | ٣٣,٩١ | ٣٢,٧٣ | ٣٢,٢٥ | ٣١,٧٤ | ٣٢,٩٠ | ٣٢,٣٠ |
| | Mean | 33.75 | 34.90 | 36.16 | 34.94 | 33.73 | 34.19 | 35.10 | 34.34 |
| Average over all means | | 34.71 | 36.02 | 36.68 | 35.80 | 34.51 | 35.38 | 35.71 | 35.20 |
| $LSD_{0.05}$ | | | | | | | | | |
| Sowing dates (D) | | | | | | 4.74 | | | |
| Cultivars (C) | | 4.11 | | | | 4.33 | | | |
| Seeding rates (S) | | 3.64 | | | | 2.16 | | | |
| D×C | | 1.90 | | | | 7.51 | | | |
| D×S | | 6.3 | | | | 3.73 | | | |
| C×S | | 3.29 | | | | 4.31 | | | |
| D×C×S | | 3.80 | | | | 7.47 | | | |
| | | 6.58 | | | | | | | |

**Table 13 : 1000-garin weight (g) as affected by the interactions among sowing dates ,wheat cultivars and seeding rates during 2003/2004 and 2004/2005 seasons.**

| Sowing dates (D) | Wheat cultivars (C) | 2003/2004 season | | | | 2004/2005 season | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Seeding rates (grains/m²) ; S | | | | Seeding rates (grains/m²) ; S | | | |
| | | 3*0 | ٤٠٠ | 4*0 | Mean | 3*0 | ٤٠٠ | 4*0 | Mean |
| Dec.10th | Sakha 8 | ٤٠,١ | ٣٩,٠ | ٣٨,٠ | ٣٩,٠٣ | ٤١,٨ | ٤٠,٧ | ٣٩,١٤ | ٤٠,٥٥ |
| | Gemmiza7 | ٤١,٤ | ٤١,٢ | ٤٠,٠ | ٤٠,٨٧ | ٤٢,٦ | ٤١,٤ | ٤٠,١١ | ٤١,٣٧ |
| | Giza 168 | ٤٢,٣ | ٤١,٥ | ٤٠,٦ | ٤١,٤٧ | ٤٣,٤ | ٤٢,١ | ٤١,٩٠ | ٤٢,٤٧ |
| | Seeds 1 | ٤١,٠ | ٣٧,٥ | ٣٧,٤ | ٣٨,٦٣ | ٤١,٤ | ٤٠,٢ | ٤١,٤٥ | ٤١,٠٢ |
| | Mean | ٤١,٢ | ٣٩,٨ | ٣٩,٠ | ٤٠,٠٠ | ٤٢,٣ | ٤١,١ | ٤٠,٦٥ | ٤١,٣٥ |
| Dec.20th | Sakha 8 | ٣٨,٢ | ٣٧,٧ | ٣٦,٤ | ٣٧,٤٣ | ٣٧,٨ | ٣٧,٧٦ | ٣٦,٧٤ | ٣٧,٤٣ |
| | Gemmiza7 | ٣٩,٩ | ٣٨,١ | ٣٧,٥ | ٣٨,٥٠ | ٤٠,٢ | ٣٧,٧٨ | ٣٧,١١ | ٣٨,٣٦ |
| | Giza 168 | ٤١,٤ | ٣٩,٣ | ٣٨,٦ | ٣٩,٧٧ | ٤٠,٨ | ٣٨,٦٠ | ٣٧,٨٨ | ٣٩,٠٩ |
| | Seeds 1 | ٣٨,١ | ٣٦,٥ | ٣٥,٥ | ٣٦,٧٠ | ٣٧,٢ | ٣٦,٤٦ | ٣٦,٢٣ | ٣٦,٦٣ |
| | Mean | ٣٩,٤ | ٣٧,٩ | ٣٧,٠ | ٣٨,١٠ | ٣٩,٠ | ٣٧,٦٥ | ٣٦,٩٩ | ٣٧,٨٨ |
| Dec.30th | Sakha 8 | ٣٧,٥ | ٣٥,٩ | ٣٥,٣ | ٣٦,٢٣ | ٣٦,٨ | ٣٥,٧٥ | ٣٥,٦٠ | ٣٦,٠٥ |
| | Gemmiza7 | ٣٧,٩ | ٣٧,٧ | ٣٦,٨ | ٣٧,٤٧ | ٣٧,٢٢ | ٣٦,١١ | ٣٦,٠٠ | ٣٦,٤٤ |
| | Giza 168 | ٣٨,٨ | ٣٧,٩ | ٣٧,١ | ٣٧,٩٣ | ٣٧,٤٤ | ٣٦,٨٢ | ٣٦,٣٥ | ٣٦,٨٧ |
| | Seeds 1 | ٣٧,٤ | ٣٥,٧ | ٣٤,٨ | ٣٥,٩٧ | ٣٦,٥٤ | ٣٤,٩٦ | ٣٥,٠٥ | ٣٥,٥٢ |
| | Mean | 37.9 | 36.8 | 36.0 | 36.9 | 37.00 | 35.91 | 35.75 | 36.22 |
| Average over all means | | 39.5 | 38.17 | 37.33 | 38.33 | 39.43 | 38.22 | 37.80 | 38.48 |
| LSD 0.05 | | | | | | | | | |
| Sowing dates (D) | | 1.91 | | | | 2.11 | | | |
| Cultivars (C) | | 1.48 | | | | 1.67 | | | |
| Seeding rates (S) | | 0.61 | | | | 0.69 | | | |
| D×C | | 2.57 | | | | 2.90 | | | |
| D×S | | 1.06 | | | | 1.20 | | | |
| C×S | | 1.22 | | | | 1.39 | | | |
| D×C×S | | 2.12 | | | | 2.40 | | | |

**Acknowledgments**

The author wishes to express his great thanks to all members of El-Boustan Experimental Farm, Faculty of Agriculture at Damanhour, for their help and attention during this study

## REFERENCES

Abdel–Rahman, K.A.; E.M. Shalaby ; M.A. Khalifa and R. A. Dawood (1979). Effect of some agricultural practices on grain yield and its components ,of local and dwarf wheat cultivars. Assiut J. Agric. Sci., 10:25-41.

Ali, A.G.A.; O.E. Zeiton; A.H. Bassiuny and A.Y.A. El-Bana (2004). Productivity of wheat cultivars growth at El-Khattara and El-Arish under different levels of planting densities and N fertilization . Zagazig J.Agric.Res.,31(4A):1225-1256.

Amer, k. El- Sayed (2007). Screening methods for drought tolerance in wheat. M. Sc. Thesis, Fac. of Agric., Damanhour, Alex. Univ., Egypt.

Andrews, G.J.; M.K. Promeroy; W.L. Seaman and G. Hockstra (1992). Planting dates and seeding rates for soft white winter wheat in eastern Ontario. Canadian J. of Plant Sci., 72(2):391-402.

Blue, E.N.; S.C. Mason and D.H. Sander (1990). Influence of planting date, seeding rate and phosohorus rate on wheat yield. Agron. J., 82:762-768.

Briggs, K.G. and A. Aytenfisu (1979). The effects of seeding rate, seeding date and location on grain yield, maturity, protein percentage and protein yield of some spring wheats in central Aleberta. Can. J. Plant Sci.,59:1139- 1145.

Ciha, A. J. (1983). Seeding rate and seeding date effects on spring seeded small grain cultivars. Agron. J. 75:795- 799.

Connor, D.J.;S. Theiveyanathan and G.M. Rimmington (1992). Development, growth, water use and yield of spring and a winter wheat in response to time of sowing. Australian J. of Agric. Res., 43(3): 493- 516.

Cromack , H.T.H and A.N.D. Clark (1987). Winter wheat and winter barley the effect of seed rate and sowing date on grain quality. Aspects of Applied Biology. No. 15.

Eissa, A. M. (1991). Effect of sowing dates and nitrogen fertilizer on spring wheat cultivars of diverse origin and correlations analysis of yield. Alex Sci., Exchange , 12:29- 46.

Eissa,F.A.(1990).The effect of planting methods, seeding rates and time of nitrogen application on yield and its components of some wheat varieties. M.Sc. Thesis, Fac. of Agric., Mansoura Univ., Egypt.

El-Bana, A.Y.A.(1999).Response of wheat varieties to planting density and nitrogen fertilization under newly cultivated soil conditions. M.Sc. Thesis, Fac. of Agric. Zagazig Univ, Egypt.

El-Ganbeehy, M.M.;E.S. Essam and S.Sh. El-Tabakh (2001). Effect of seeding rates and planting methods on grain yield and yield components of two wheat cultivars grown under rainfed in north western coast of Egypt. J. Agric. Sci., Mansoura Univ.,26(6):3401-3409.

El-Karamity,A.F.(1998).Response of some wheat cultivars to seeding and N fertilization rates. J. Agric. Sci., Mansoura Univ.,23(2):643-655.

El-Moselhy, M.A.(2004). Study of late sowing dates of barley for maximizing the utilization of irrigated lands after late summer crops. J. Agric . Sci., Mansoura Univ., 29 (10): 5529-5537.

El-Sayed, A.A.; A.A. Mansour; M.A. El-Moselhy and A.M.Orabi (1998). Effect of sowing date and seeding rate on barley production in the New Valley. J. Agric. Sci., Mansoura Univ., 23(2): 633-641.

Gaballah, A.B. and A. H. Bassiuny (2001).Response of some new wheat cultivars to seeding rates under newly reclaimed sandy soil conditions. J. Product & Dev., 6(1): 91-102.

Gupta , V.K.; A. C. Vig and S. Ranjodh (1970). Influence of spacing, time of sowing and nitrogen fertilization on the yield of wheat. Indian J. Agron., 15:251- 253.

Hefnawi, F.A.M. (1993). Effect of different sowing and harvesting dates on yield and yield components of some new released wheat cultivars. M. Sc. Thesis, Fac. of Agric., Al-Azhar Univ., Egypt.

Kheiralla, K. A. and T.H.I. Sherif (1992). Inheritance of earliness and yield in wheat under heat stress. Assiut J. Agric. Sci., 23: 105- 126.

Knapp, W.R and J.S.Knapp (1978). Response of winter wheat to date of planting and full fertilization. Agron. J., 70:1048- 1053.

Kumar, A.(1985). Response of wheat cultivars to nitrogen fertilization under late sowing condition. Indian J. Agron., 30(4):464-467.

Mahfouz, H. and S.K. Ghabour (1998). Performance of some newly released wheat varieties treated with different levels of nitrogen fertilization and seeding rates under Fayoum conditions. Egypt J. Appl. Sci., 13(1):76-94.

Mohamed, A.A.E.(1997). Effect of seeding rate and nitrogen levels on bread wheat cultivars (*Treaticum aestivum* L.). J. Agric. Res., Tanta Univ., 23 (4):359-368.

Mosalem, M.E.(1993). Response of two wheat cultivars to nitrogen levels and seeding rate. J. Agric. Res., Tanta Univ., 19(4):791-805.

Moussa, A.M.M. (2001).Sowing methods, seeding rates and nitrogen fertilization on productivity of some wheat cultivars. Ph. D. Thesis, Fac. of Agric. Kafr El-Sheikh, Tanta Univ., Egypt.

Piper, C. S. (1950). Soil and plant analysis. Interscience Publishers Inc., New York, P.151 – 172.

Rout, D. and M. R. Satapathy (1994). Effect of date of sowing on wheat (*Triticum aestivum*) varieties in umerkote zone of Orissa. Indian J. Agron. 39: 466-468.

Saleh, M.E.(2000). Effect of seeding rate on yield, yield component and some agronomic characters of two wheat cultivars. J. Agric. Sci., Mansoura Univ., 25(3):1467- 1473.

Samre, J. S.; S. S. Dhilion and P. S. Kahlon (1989). Response of wheat varieties to date of sowing. Indian J. Agron. Sci., 34:286- 289.

Sarkar, R.K.(1987). Effect of extending sowing date of wheat cultivars on rice follows. Indian J. Agric. Sci., 31:181-189.

Sorour, F.A.;S.M. El-Aishy; M.E. Mosalem; M.M. Abd El-Hamid and A.E. Khaffagy (2004). Effect of some tillage systems and weed control treatments on annual weeds, and wheat grain yield and its components. J. Agric. Res. Tanta Univ., 30(2):246-260.

Steel, R.G.D and I. N. Torrie (1980). Principles and Procedures of Statistics 2nd Edition .Mc. Graw Hill Co, New York , USA.

Tabl, M.A.; A. M. Omar; E. El - Sheref and M. H. M . Koriem (2005). Effect of seeding rates and nitrogen levels on two wheat cultivars. Proceed. 1st Sci. Conf.Creal Crops, June 20 – 21, Alex. J. Agric. Res ., 50(2B): 87 – 95, Special Issue.

Toaima, S. E. A.; Amal, A.El-Hofi and H. Ashoush (2000). Yield and technological characteristics of some wheat varieties as affected by N-fertilizer and seed rates. J. Agric. Sci., Mansoura Univ.,25(5) :2449-2467.

# تـأثير الزراعـات المـتأخرة ومعـدلات التقـاوي علـى إنتاجيـة بعـض أصـناف القمـح المصري في الأراضي الرملية حديثة الاستزراع.

**محمد صبحي سعد بدران**
**كلية الزراعة بدمنهور - قسم المحاصيل - جامعة الإسكندرية.**

أقيمت تجربتان حقليتان بمحطة البحوث و التجارب الزراعية لكلية الزراعة بدمنهور – جامعة الإسكندرية – بمنطقة البستان – محافظة البحيرة خلال موسمي ٢٠٠٤/٢٠٠٣ و ٢٠٠٥/٢٠٠٤ م وذلك بهدف دراسة تأثير مواعيد الزراعة المتأخرة (١٠ & ٢٠ و ٣٠ ديسمبر ) على إنتاجية الأصناف ( سخا ٨ & جميزة ٧ & جيزة ١٦٨ و سدس ١) من القمح المصري حال زراعتها بمعدلات التقاوي ( ٣٥٠ & ٤٠٠ و ٤٥٠ بذرة/ م ٢ ). وقد نفذت هذه الدراسة بتصميم القطع المنشقة مرتين بأربع مكررات حيث خصصت القطع الرئيسية لمواعيد الزراعة والقطع الفرعية للأصناف بينما القطع تحت الفرعية فقد تم تخصيصها لمعدلات التقاوي ، و يمكن تلخيص أهم نتائج هذه الدراسة على النحو التالي :-

- كان لمواعيد الزراعة تأثيرا معنويا على جميع الصفات التي تم دراستها في كلا موسمي الدراسة ، حيث سُجلت أعلى المتوسطات عندما تم زراعة القمح في ١٠ ديسمبر باستثناء صفة معامل الحصاد.
- كانت الاختلافات بين أصناف القمح معنوية ، وذلك في جميع الصفات التي تم دراستها وفي كلا موسمي الدراسة ، و قد أثبت الصنف جيزة ١٦٨ تفوقا على الأصناف الثلاث الأخرى و ذلك في جميع الصفات التي تم دراستها و في كلا موسمي الدراسة .
- تأثرت جميع الصفات التي تم دراستها معنويا بمعدلات التقاوي وفي كلا موسمي الدراسة باستثناء صفتي ( طول السنبلة و عدد الحبوب / سنبلة ) في الموسم الثاني وأيضا صفتي ( عدد السنيبلات / سنبلة وعدد الحبوب / سنبلة ) في كلا موسمي الدراسة .
- كان التفاعل ( الثنائي و الثلاثي ) بين العوامل المدروسة معنويا على جميع الصفات التي تم دراستها في كلا موسمي الدراسة باستثناء التفاعل الثنائي بين ( مواعيد الزراعة و معدلات التقاوي ) و ذلك بالنسبة لصفة معامل الحصاد في الموسم الثاني من الدراسة.

من نتائج هذه الدراسة يمكن التوصية بأهمية استخدام صنف القمح جيزة ١٦٨ وزراعته بمعدل ٤٠٠ بذرة/م٢ تحت ظروف الزراعات المتأخرة في ١٠ ديسمبر و ٤٥٠ بذرة/م٢ في المواعيد الأكثر تأخيرا حتى ٣٠ ديسمبر وذلك لتحسين إنتاجية محصول القمح حال التأخر بزراعته في الأراضي الرملية حديثة الاستزراع.

**Table 2 : Analysis of variance of yield ,yield components and some agronomic traits of wheat as influenced by sowing dates ,cultivars and seeding rates during 2003/ 2004 and 2004/ 2005 seasons.**

| S.O.V | d. f | Traits | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of days to 50% heading | | Plant height (cm) | | Spike length (cm) | | No. of spikelets/spike | | No. of grains/spike | | No. of spikes/$m^2$ | |
| | | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 |
| Replications | ٣ | * | * | Ns | * | * | Ns | * | ** | Ns | Ns | * | Ns |
| Sowing dates (D) | ٢ | * | ** | ** | * | ** | ** | ** | ** | ** | ** | ** | * |
| Error "a" | ٦ | ١٢٢,٩٧ | 101.12 | ١٦٢,٢٨ | 268.86 | 0.99 | 1.57 | 4.11 | 7.42 | 7.57 | 13.93 | 1732.03 | 3636.00 |
| Wheat cultivars (C) | ٣ | * | * | * | * | ** | ** | ** | ** | ** | ** | ** | ** |
| D x C | 6 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| Error "b" | 27 | 72.76 | 28.89 | 120.38 | 113.74 | ٠,٥٤ | 0.80 | 2.45 | 4.18 | 4.04 | 7.04 | 1507.19 | 2258.00 |
| Seeding rates (S) | 2 | ** | ** | ** | ** | ** | Ns | Ns | Ns | Ns | * | ** | ** |
| D x S | 4 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| C x S | 6 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| D x C x S | 12 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| Error "c" | 72 | 18.93 | 22.97 | 94.21 | 101.90 | ٠,٢٥ | 0.56 | 1.03 | 0.85 | 3.68 | 4.37 | 1188.48 | 1290.0 |
| C.V % | | 4.99 | 5.53 | 11.50 | 11.77 | 6.11 | 8.36 | 6.51 | 5.41 | 7.67 | 8.12 | 11.10 | 11.34 |

**Ns, * and ** are not significant, significant at 0.05 and 0.01 level , respectively .**

**Table 2: Cont.**

| S.O.V | d.f | Traits | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Biological yield (ton/ha) | | Straw yield (ton/ha) | | Grain yield (ton/ha) | | Harvest index (%) | | 1000-grain weight (gm) | |
| | | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 | 2003/ 2004 | 2004/ 2005 |
| Replications | ٣ | * | ** | * | * | ** | * | Ns | Ns | * | * |
| Sowing dates (D) | ٢ | ** | ** | ** | ** | ** | ** | Ns | Ns | ** | ** |
| Error "a" | ٦ | 2.59 | ٣,66 | 1.24 | 2.00 | ٠,٣٧ | 0.46 | 67.8 | 90.11 | 14.69 | 17.90 |
| Wheat cultivars (C) | ٣ | ** | ** | ** | ** | ** | ** | * | * | ** | * |
| D x C | 6 | ** | ** | ** | ** | ** | ** | * | Ns | ** | ** |
| Error "b" | 27 | 1.72 | 2.33 | ٠,٨٦ | 1.6 | 0.26 | 0.36 | 56.52 | 80.30 | 9.40 | 11.99 |
| Seeding rates (S) | 2 | ** | ** | ** | ** | ** | ** | * | Ns | ** | ** |
| D x S | 4 | ** | ** | ** | ** | ** | ** | * | Ns | ** | ** |
| C x S | 6 | ** | ** | ** | ** | ** | ** | ** | * | ** | ** |
| D x C x S | 12 | ** | ** | ** | ** | ** | ** | * | * | ** | ** |
| Error "c" | 72 | ٠,٨٣ | ١,٢٦ | ٠,٤0 | 0.70 | ٠.12 | ٠,١٧ | 21.66 | 27.90 | 2.25 | 2.88 |
| C.V % | | 12.50 | 14.69 | 13.63 | 17.01 | 13.07 | 15.16 | 13.00 | 15.01 | 3.91 | 4.41 |

**Ns, * and ** are not significant, significant at 0.05 and 0.01 level , respectively .**