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RESPONSE OF SOME WHEAT CULTIVARS TO VARYING SOWING DATES AND NITROGEN FERTILIZER LEVELS UNDER SANDY SOIL CONDITIONS

AbdAllah A.H. Fadle[1*], A.Y.A. El-Bana[2], A.E.A. Omar[2] and M.E.I. Abdul Hamid[2]

1. Agent. Agric., Manag., Fakous, Sharkia, Egypt

2. Agron. Dept., Fac. Agric., Zagazig Univ., Egypt

ABSTRACT

Two field experiments were conducted at Abazah Village, Faqous District, Sharkia Governorate, Egypt during 2013/2014 and 2014/2015 growing seasons, to study the effect of three sowing dates (November 10th, November 30th and December 20th), three nitrogen fertilizer levels (60, 90 and 120 kg N/fad.) and four wheat cultivars (Gemmizea 11, Sids 12, Giza 164 and Misr 1) on yield and yield attributes of wheat under sandy soil conditions. Each experiment included 36 treatments, which were the combinations of three sowing dates, three nitrogen fertilizer levels and four wheat cultivars. A split-split plot design with three replicates was used where; the main plots were devoted to sowing dates while the sub plots were occupied by nitrogen fertilizer levels whereas wheat cultivars were allotted in the sub-sub plots. The obtained results revealed that plant height, number of spikes /m^2, spike length, number of spikelets/spike, number of grains/spike, 1000-grain weight as well as grain, straw and biological yields/fad., were significantly higher on November,30th sowing as compared to other sowing dates. Nitrogen fertilizer level affected significantly all studied traits. Since, increasing nitrogen fertilizer level up to 120 kg N/fad., significantly increased plant height, spike length, number of spikelets/spike, number of grains/ spike as well as grain, straw and biological yields/fad., while 1000-grain weight significantly decreased. On the other side, number of spikes /m^2 was responded only to nitrogen up to 90 kg N/fad. (Combined data). Misr 1 cv. recorded the maximum plant height, number of spikes/m^2 as well as grain, straw and biological yields/fad., but without significant differences than Gemmizea 11 in grain and biological yields. Otherwise Sids 12 surpassed other cultivars in spike length, number of spikelets/spike, number of grains/spike and 1000-grain weight.

Key words: Wheat cultivars, sowing dates, nitrogen levels, sandy soil, yield and its attributes.

INTRODUCTION

Wheat (*Triticum aestivum*, L.) is one of the most important cereal crops in the world and it has the widest distribution among cereal crops. The crop is primarily grown for its grain, which is consumed as human food. Wheat also is the most important cereal crop in Egypt and accounts for about 40.2% of the total cereal production with acreage of 3.024 million faddans, produced an average of 8.371 million tons of grain in 2011 (Ministry of Agriculture and Land Reclamation, 2012).

The high and rising consumption of subsidized wheat is a central problem. At 172 kilos per capita a year, Egypt's wheat consumption is among the highest in the world. Another problem is the cultivation of Egyption clover (berseem) for animal feed, in a larger acerage than any other winter crop in the country. Therefore, raising wheat in newly cultivated area has become a cornerstone for sustaining its national production.

Improving the productivity of this crop is a main task due to its short supply which mandated importing about 50% of the needed

*** Corresponding author. Tel.:** + 01224604990
E-mail address: adel_elbna@yahoo.com

wheat. Therefore, many efforts were done to increase wheat cultivated area in sandy soils in Egypt.

Increasing wheat production could be possible *via* two ways: horizontal expansion through increasing the wheat cultivated area and vertical expansion through the development of new cultivars having the high potentiality and subsequently implementing the proper cultural practices (Ragab, 2011).

Sowing date is one of the most important agronomic factors involved in proceeding high yielding of small grain cereal crops, which affects timing and duration of the vegetative and reproductive stages. Optimum sowing date of different wheat cultivars, varies with regions depending on growing conditions of a specific tract that could be assessed by planting them at different times. On the other hand, late sowing of wheat might expose the crop plants to higher temperature during and after heading, resulting in reduced number of spikes per square meter and number of grains/spike (Randhawa *et al.*, 1977). Late sowing mostly accompanied with late seedling emergence due to low day and night temperatures. Aftab *et al.* (2004), in Pakistan reported that, biomass accumulation, grain yield, number of spikes/ m^2 and thousand grain weight of wheat were increased with early sowing (early November) over late sowing (December). Many workers reported that early sowing of wheat, significantly increased yield and its attributes compared with late sowing (Shafiq, 2004; Akhtar *et al.*, 2006; Hardan, 2008 ; Swelam *et al.*, 2010). El-Gizawy (2009), in Egypt showed that the highest values of number of tillers and spikes /m^2, 1000-grain weight and grain yield per unit area were obtained when wheat was sown on mid of November but early or delayed planting caused a significant decrease in forenamed traits. Amin (2010), found that early sowing (15^{th} of November) increased grain weight/spike, grain yield/ fad., but late sowing (30^{th} November) gave much spikelets/ spike, spikes/m ^{2}. El-Sarag and Ismaeil (2013), in their study on the effect of the potential impact of three sowing dates; first sowing date (16^{th} November), second sowing date (1^{st} December) and third sowing date (16^{th} December) on two wheat cultivars (Giza 168 and Sakha 93) showed that the second sowing date caused superiority in wheat grain yield and most of its components. Fayed *et al.* (2015), in Egypt and under Saini conditions, found that the highest values of spike length and thousand grain weight were recorded by Gemmeiza-9 cultivar under early sowing date (October, 15). However, the highest values of spike weight, grain yield and dry biological yield were obtained when the same cultivar was cultivated under mediate sowing date (mid-November).

Nitrogen is the most important fertilizer element to be added under sandy soil conditions. It plays an important role in plant growth and it is considered the most important fertilizer needed for maximizing yield in most of field crops as well as wheat. The response of wheat to nitrogen levels is affecting with many factors such as cultivar, soil, climatic and proceeding crop. In this connection, several research workers got significant response to nitrogen level up to 75 kg N/fad., under old soil (El-Gizawy, 2010 and Swelam *et al.*, 2010). However, Mehasen and Mohamed (2005) showed higher response of wheat grain yield when they added 90 kg N/fad. Moreover, Hassan and Gaballah (2000); Sawires (2000) and Ahmed (2009) found that this response reaching 100 kg N/fad., (sandy soil). Furthermore, Ashmawy and Abo-Warda (2002), Abdul Galil *et al.* (2003) and Ali *et al.* (2004) recorded higher responses when they added 120 kg N/fad., under sandy soil conditions. Iqbal *et al.* (2012), in Pakistan investigated five nitrogen levels (*i.e.* 0, 75, 100, 125 and 150 kg N/ha) on wheat. They reported that plant height, number of tillers/m^2, spike length, number of spikelets/spike, number of grains/spike, 1000-grain weight, grain yield, biological yield and harvest index were highest at 125 kg N /ha level and lowest at zero level of nitrogen. Abd El-Razek and El-Sheshtawy (2013) tested four nitrogen levels (45, 90, 135 and 180 kg/ha) on wheat yield. They found that increasing nitrogen fertilizer level up to 180 kg N/ ha., significantly increased plant height, yield and its attributes compared with the other nitrogen treatments. The values of grain yield (ton/ha) due to increasing nitrogen fertilizer levels were 9.68 for 180 kg /ha, followed by 8.82 for 135 kg N, 7.15 for 90 kg N and 5.46 ton/ ha for 45 kg N in the combined analysis. Noureldin *et al.* (2013), reported that increasing N up to 180 kg/ ha increased grain yield and its components (number of spikes/ m^2, spike length, number of grains per spike, weight of grains per spike, and 1000 grain weight). Youssef *et al.* (2013), tried four N levels (*i.e.* 0, 96, 192 and 288 kg/ha.) on wheat. They found that increasing N levels from 0 to 288 kg/ha., significantly increased number of tillers/plant, number of grains/spike spike length, 1000 grain weight as well grain yields and harvest index while plant height responded to 96 kg/ha.

Khalid *et al.* (2014), in Pakistan, tested five different nitrogen levels (*i.e*. 0, 50, 100, 150 and 200 kg N/ha) on wheat yield and yield attributes. They found that, number of spikelets and grains/ spike, 1000 grain weight as well as grain and biological yields/ha., responded up to 100 kg N/ ha., while number of tillers/m^2, plant height and harvest index responded up to 150, 200 and 50 kgN/ha., respectively.

Several investigators reported that wheat cultivars showed significant differences in yield and yield attributes due to differences in their genetic background (Amin, 2010; Swelam *et al.*, 2010 ; Hafez *et al.*, 2012 ; Abd El-kreem and Ahmed, 2013; El-Sarag and Ismaeil, 2013; Geith *et al.*, 2013; Abd El-Lattief, 2014 and Fayed *et al.*, 2015).

Therefore, the objective of the present investigation was to study the performance of four wheat cultivars on different sowing dates under different levels of nitrogen to determine the proper cultivar in proper sowing date and specific of nitrogen.

MATERIALS AND METHODS

Two field experiments were conducted at Abazah Village, Faqous District, Sharkia Governorate, Egypt during 2013/2014 and 2014/2015 growing seasons, to study the effect of sowing dates, nitrogen fertilizer levels and wheat cultivars on growth, yield and yield attributes of wheat (*Triticum aestivum* L.).

Each experiment included 36 treatments, which were the combinations of three sowing dates, three nitrogen fertilizer levels and four wheat cultivars as follows:

Sowing Dates

The three sowing dates used were:

a- November 10th (early).

b- November 30th (moderate).

c- December 20th (late).

Nitrogen fertilizer level

The three nitrogen fertilizer levels used were 60 Kg N/fad., 90 Kg N/fad. and 120 Kg N/fad. These three nitrogen levels were added in six equal splits at sowing, 15 days after sowing and four spilts at every 10 days interval. Nitrogen was added in the form of urea (46.5% N).

Wheat Cultivars

The four wheat cultivars used were Gemmaza11, Sids 12, Giza 168 and Misr 1 .

Experimental Design

A split-split plot design with three replicates was used where, the main plots were devoted to sowing dates while the sub plots were occupied by nitrogen fertilizer levels, whereas wheat cultivars were allotted in the sub-sub plots.

Cultural Practices

Nitrogen fertilizer in form of urea (46.5%) was added at six equal splits at sowing, 15 days after sowing and four spilts at every 10 days interval.. The preceding crop was maize in both seasons. The sub – sub plot area was 12 m^2 (3m. in width x 4m. in length) which included 20 rows, 15 cm apart. Calcium super phosphate (15.5% P_2O_5) at level of 200 kg/fad., and potassium sulphate (50% K_2O) at level of 100 kg./fad., were added during seedbed preparation. Irrigation was applied as it was needed by the crop (10 days interval). Cultivars were sown using seed rate of 70 kg/fad., in the two successive seasons. Weeds were controlled manually (two times). The other culture practices were applied as recommended.

The experimental soil was sandy in texture. Some physical and chemical properties of the experimental field soils in the two seasons are presented in Table 1. Temperature and relative humidity during wheat growing season are shown in Table 2.

Table 1. Some physical and chemical properties of the experimental soil in the two seasons (2013/2014 – 2014/2015)

Soil characteristics	Soil depth			
	0-15 cm		15-30 cm	
	2013/2014	2014/2015	2013/2014	2014/2015
Soil particles distribution				
Sand (%)	80.87	84.05	91.13	93.61
Silt (%)	12.03	10.23	7.83	4.23
Clay (%)	7.10	5.72	1.04	2.16
Textural class	Sandy loam	Sandy loam	Sand	Sand
pH *	7.98	8.11	8.32	8.49
EC,(ds/m)*	0.40	0.36	0.14	0.13
Soluble cations and anions (mmole/l)*				
Ca++	1.4	1.3	0.42	0.22
Mg++	0.7	0.6	0.13	0.23
Na+	1.55	1.38	0.64	0.55
K+	0.35	0.32	0.21	0.30
$CO3^{=}$	-	-	-	-
$HCO3^{-}$	1.32	1.19	0.56	0.37
Cl^{-}	1.29	1.16	0.43	0.51
$SO4^{=}$	1.34	1.25	0.41	0.37
Available N,(mg/ Kg soil)	40.33	53.91	36.72	31.49
Available P,(mg/ Kg soil)	7.26	6.24	5.11	3.95
Available K,(mg/ Kg soil)	60.40	58.09	53.95	49.81

*Soil-water suspension 1:2.5

Table 2. Average monthly temperature and relative humidity during growing seasons of wheat

Month	Temperature C^0			Relative humidity (%)			Rainfall Mean (mm)
	Max	Min	Mean	Max	Min	Mean	
			2013/2014 season				
November	29.4	14.7	22.1	63.0	36.0	49.5	0.140
December	19.4	14.0	16.7	76.3	43.8	60.1	0.150
January	17.8	14.5	16.2	80.5	46.5	63.5	0.185
February	22.1	13.9	18.0	77.8	51.1	64.5	0.530
March	23.6	13.7	18.7	75.6	45.1	60.4	0.210
April	29.0	15.5	22.3	68.6	41.1	54.8	-
			2014/2015 season				
November	30.2	16.0	23.1	64.0	43.0	53.5	-
December	20.9	14.6	17.8	79.4	44.2	61.8	0.560
January	18.6	15.1	16.9	80.1	54.5	67.3	0.255
February	23.7	16.2	20.0	82.5	55.6	69.1	0.190
March	25.5	14.7	20.1	80.0	51.3	65.7	0.225
April	30.1	17.0	23.6	73.4	49.5	61.5	-

Recorded Data

Yield and yield attributes

At harvest, yield and yield attributes were determine as follows:

Plant height (cm)

Twenty tillers were taken at random from each plot at 3 places, their long heights were measured in cm and means were determined.

Number of spikes/ m^2

An area of 0.5 m^2 was selected at random in each plot to count total number of spikes/spike.

1- Spike length (cm).
2- Number of spikelets/spike.
3- Number of grains/spike.

Ten spikes were randomly taken from each unit area in each plot. Each spike was threshed separately and grains of each spike were counted and averaged.

4- Thousand grain weight (g).

Thousand grains were counted at random from each plot and their weights were taken with a spring balance.

The final straw yield ton/fad., grain yield ardab/ fad., and biological yield ton/fad., were determined from a central area of 0.75 m^2 (5 rows by long of one meter) in both seasons

Statistical Analysis

The data obtained from each trial was subjected to the analysis of variance of split – split plot design using computer program MSTAT-C as described by Snedecor and Cochran (1981). Then, a combined analysis was made for the data of the two seasons after test the homogeneity of error by Bartellet test (Steel *et al.*, 1997). The differences among treatments were compared using Duncan's multiple range test (Duncan, 1955), where means had the different letters were statistically significant, while those means followed by the same letters were statistically insignificant. In the interaction tables, capital and small letters were used to compare between means in rows and columns, respectively.

RESULTS AND DISCUSSION

Plant Height, Number of Spikes/m^2 and Spike Length

Data presented in Table 3 show the influence of sowing dates, nitrogen fertilizer levels and cultivars on plant height, number of spikes/m^2 and spike length of wheat during both growing seasons and their combined.

Regarding the effect of sowing dates, it was quite evident that delaying sowing to December 20th was followed by a significant decrease in each of plant height and number of spikes/m^2 compared with early or moderate sowing on November 10th and November 30th, respectively. Results of the combined indicated that the tallest plants (122.17 cm) was observed at moderate sowing (November, 30th), while the shortest plants (114.31 cm) was recorded by later sowing (December, 20th). This finding might be attributed to other optimum environmental factors that encouraged growth and early development of plant sown on November 30th rather than those sown on November, 10th or December, 20th. Maximum number of spikes/m^2 was recorded by sowing wheat plants on November 30th (424.8) while, minimum number of spikes/m^2 was recorded by late sowing on December 20th (359.2). This might be due to the high efficiency of plants to convert solar energy to chemical energy which increased number of spikes/m^2 with sowing on 30th Nov. than the other tested sowing dates. Also, the longest spike (12.19 cm) was recorded due to sowing on November, 30th while the shortest one was recorded with sown on December, 20th (11.635 cm) and on November, 10th (11.564 cm). These results are in accordance with those reported by. El-Gizawy (2009), Amin (2010), Swelam *et al.* (2010) and El-Sarag and Ismaeil (2013).

Concerning the effect of nitrogen fertilizer levels, results presented in Table 3 show that N fertilizer levels had a significant effect on plant height, number of spikes/m^2 and spike length. Increasing N fertilizer level from 60 to 120 kg N/fad., was associated with significant increase in formentioned traits in both growing seasons and their combined analysis, while number of spikes/m^2 responded up to application of 120 kg N/fad., in both seasons and thier combined analysis.

Table 3. Plant height, No. of spikes/m^2 and spike length of wheat as affected by sowing dates, nitrogen fertilizer levels , cultivars and their interactions during two successive winter seasons (2013/2014 and 2014/2015) as well as their combined.

Main effects and interactions	Plant height (cm)			Number of spikes/m^2			Spike length (cm)		
	1st season	2nd season	Com.	1st season	2nd season	Com.	1st season	2nd season	Com.
Sowing date (S)									
November 10th	121.06b	112.47b	116.76b	382.7b	371.6b	377.2b	12.31b	10.81b	11.56b
November 30th	127.22a	117.11a	122.17a	443.3a	406.2a	424.8a	13.13a	11.25a	12.19a
December 20th	117.72b	110.89b	114.31c	361.6b	356.8c	359.2c	12.40b	10.86b	11.63b
F. test	**	**	**	**	**	**	**	*	**
Nitrogen fertilizer level (N)									
60 kg/fad.	117.67c	111.22c	114.44c	346.6c	382.9 b	347.3c	12.29b	10.51b	11.40b
90 kg/fad.	121.72b	113.61b	117.67b	407.1b	348.1c	377..6b	12.43b	10.75b	11.59b
120 kg/fad.	126.61a	115.64a	121.12a	433.9a	403.8a	418.8a	13.11a	11.65a	12.38a
F. test	**	**	**	**	*	**	**	**	**
Cultivar (C)									
Gemmeiza 11	122.59ab	114.41a	118.50a	405.7ab	378.3a	392.0b	12.79b	11.32b	12.05b
Sids 12	121.22ab	114.52a	117.87a	355.7c	339.0b	347.4c	13.66a	11.61a	12.64a
Giza 168	120.74b	111.41b	116.07b	392.7b	389.1a	390.9b	12.29b	10.73c	11.51c
Misr 1	123.44a	113.63a	118.54a	429.2a	406.4a	417.8a	11.71c	10.22c	10.97d
F. test	**	**	**	**	**	**	**	**	**
Interactions									
S x N	NS	NS	NS	*.	NS	*	*	NS	NS
S x C	NS	**	NS	**	*	*	NS	**	**
N x C	**	*	**	*	**	**	NS	**	*

*, ** and NS. indicate significant at 0.05 and 0.01 levels and insignificant of differences, in respective order.

Table 3-a. Plant height "cm"as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	C	B	A
Gemmieza 11	113.39a	119.17a	122.94a
	B	B	A
Sids 12	115.17a	115.83b	122.61a
	B	A	A
Giza 168	113.94a	117.33ab	116.94b
	C	B	A
Misr 1	115.28a	118.33ab	122.00a

Table 3-b. Number of spikes/m^2 as affected by the interaction between sowing dates and nitrogen fertilizer levels (combined data)

Nitrogen fertilizer level	Sowing date		
	November 10th	November 30th	December 20th
	B	A	B
60 kg/fad.	331.58 b	372.45 b	337.87 b
	B	A	C
90 kg/fad.	390.45 a	436.45 a	357.95 ab
	C	A	B
120 kg/fad.	409.50 a	465.33 a	381.75 a

Table 3-c. Number of spikes/m^2 as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	November30th	December 20th
	B	A	B
Gemmieza 11	376.72 b	435.16 ab	364.11 b
	B	A	B
Sids 12	337.56 c	377.83 b	326.78 c
	B	A	C
Giza 168	383.11 b	432.72 ab	357.00 b
	B	A	C
Misr 1	411.33 a	453.28 a	388.89 a

Table 3-d. Number of spikes/m^2 as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data).

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	C	B	A
Gemmieza 11	355.05 b	398.16 b	422.77 b
	C	B	A
Sids 12	298.39 c	358.83 c	384.94 c
	C	B	A
Giza 168	355.89 b	396.72 b	420.22 b
	C	B	A
Misr 1	379.89 a	426.11 a	447.50 a

Table 3-e. Spike length "cm" as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	November 30th	December 20th
	B	A	AB
Gemmieza 11	11.650b	12.439b	12.089a
	B	A	B
Sids 12	12.139a	13.661a	12.122a
	A	A	A
Giza 168	11.483bc	11.472c	11.589a
	A	A	A
Misr 1	10.983c	11.189c	10.739b

Table 3-f. Spike length as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	B	A	A
Gemmieza 11	11.578b	12.189a	12.411b
	B	B	A
Sids 12	12.183a	12.117a	13.622a
	B	B	A
Giza 168	11.261b	11.128b	12.156b
	B	A	A
Misr 1	10.611c	10.956b	11.344c

These results confirm the vital role of nitrogen in cell division as well as building organic metabolites. These results are in agreement with those obtained by Ashmawy and Abo-Warda (2002), Abdul Galil *et al.* (2003) and Ali *et al*. (2004) and Iqbal *et al.* (2012).

Respecting varietal differences, it is clear that Misr 1cv, Gemmieza 11 cv and Sids 12 cv gave taller plants without significant differences (Table 3), while the shortest plants were recorded by Giza 168 cv in both seasons and combined. Misr 1 cv gave the highest number of spikes/m^2 followed by Gemmizea 11 then Giza 168 cv (combined analysis) while, Sids 12cv recorded the lowest ones in both growing seasons and their combined. Sids 12 cv had longest spike followed by Gemmizea 11cv then Giza 168cv (combined analysis), while the shortest spike length was recorded by Misr 1 in both growing seasons and their combined analysis. It could be concluded that varietal differences among wheat cultivars may be due to geneticall make up. These results are in a good line with those obtained by (Amin, 2010;

Hafez *et al.,* 2012; El-Sarag and Ismaeil, 2013; Abd E l-Lattief, 2014 and Fayed *et al.,* 2015.

Furthermore, the significant interaction between N-fertilizer levels and wheat cultivars in the combined analysis (Table 3-a), revealed that the tallest plant (122.94 cm) was recorded by Gemmeiza 11 , Sids 12 and Misr 1 cv when high N-level of 120 kgN/fad., was applied. Otherwise, the shorter plant was recorded for all cultivars when low nitrogen fertilizer level of 60 kg N/fad., was applied.

Regarding the significant interaction between sowing dates and nitrogen fertilizer levels on number of spikes/m^2 (Table 3-b), the results indicated that the highest number of spikes/m^2 were obtained with wheat sown on November, 30th and fertilized with 90 or 120 kg N/fad., without significant differences between both levels of 90 and 120 kgN/fad. These results are in accordance with those reported by Amin (2010). With respect to the significant interaction between sowing dates and wheat cultivars in the combined analysis (Table 3c), the obtained results showed that maximum number of spikes/m^2 (453.28) was achieved by Misr 1 cv when sowing took place on November, 30th, while the lowest number of spikes/m^2 (326.78) was obtained by Sids 12 cv. when was sown on November, 10th. The significant interaction between sowing dates and cultivars shows the sensitivity of different cultivars to photoperiod and temperature differently for plant height. Likely, the significant interaction between nitrogen fertilizer levels and cultivars (Table 3-d) indicated that, the highest number of spikes/m^2 (447.50) was obtained by Misr 1 cv. when 120 kg N/fad., was added On the other hand the lowest one (298.39) was obtained by Sids 12 cv. when fertilized with 60 kg N/fad. Spike length (cm) was significantly affected by the interaction between sowing dates and cultivars in the combined analysis (Table 3-e). Sowing Sids 12 cv on November, 30th produced the longest spike (13.661 cm), while shortest spike (10.739 cm) was obtained when Misr 1 cv., was sown on December, 20th. The significant interaction between cultivars and sowing dates shows the sensitivity of different cultivars to photoperiod and temperature differently for spike length of wheat. Regarding the significant interaction effects between nitrogen fertilizer levels and wheat cultivars in the combined (Table 3-f) the results indicate that the longest spikes (13.622 cm) was achieved by Sids 12 cv., when 120 kgN/fad., was applied. However, the shortest spike (10.611cm) was recorded by Misr 1 cv., when low nitrogen fertilizer level was applied.

Number of Spikelets/Spike, Number of Grains/ Spike and 1000-Grain Weight

Data presented in Table 4 show the influence of sowing date, nitrogen fertilizer levels and cultivars on number of spikelets/spike, number of grains/spike and 1000-grain weight of wheat during both growing seasons and their combined.

Regarding the effect of sowing date, the obtained results clearly indicated that sowing dates had highly significant effect on number of spikelets/spike in the 1st season and significant in the 2nd season as well as those of the combined of both seasons. Results of the combined indicated that wheat sown on November, 30th recorded highest number of spikelets/spike which was 20.406 compared with 18.944 and 18.672 for wheat sown early (November, 10th) or late (December, 20th), respectively. The obtained results clearly indicated that sowing dates had a significant effect on number of grains/spike in the 2ndth season and highly significant in the combined of both seasons (Table 4). The highest number of grains /spike (58.28 and 59.06) was recorded on November, 30th sowing date compared to December, 20th sowing which showed lower number of grains/ spike (50.22 and 50.35) in the 2nd season and the combined, respectively. On the other side, the differences did not reach the level of significant in the 1st season. The results indicated significant differences among sowing dates on thousand grain weight (g) in the 1st season and the combined data and highly significant in the 2nd season, where thousand grain weight (g) was significantly decreased due to early (November, 10th) or late (December, 20th) sowing without significant difference in the 1st season and the combined data. According to the combined analysis, the heaviest grain weight (44.76 g) was achieved when wheat was sown on November 30th, On the other hand, the lighter 1000-grain weight was obtained when wheat was sown early (November, 10th) or late (December, 20th).

Table 4. Number of spikelets/spike, number of grains/spike and 1000-grain weight (g) of wheat as affected by sowing dates, nitrogen fertilizer levels, cultivars and their interactions during two successive winter seasons (2013/2014 and 2014/2015) as well as their combined.

Main effects and interactions	Number of spikelets/spike			Number of grains/spike			1000-grain weight (g)		
	1st season	2nd season	Com.	1st season	2nd season	Com.	1st season	2nd season	Com.
Sowing dates (S)									
November 10th	19.86b	18.02b	18.94b	54.53	53.69b	54.11b	43.08ab	42.56b	42.82b
November 30th	21.64a	19.16a	20.40a	59.83	58.28a	59.06a	44.03a	45.50a	44.76a
December 20th	19.48b	17.86b	18.67b	50.47	50.22b	50.35c	42.61b	41.17c	41.89b
F. test	**	*	*	N.S	*	**	*	**	*
Nitrogen fertilizer level (N)									
60 kg/fad.	19.63b	17.48b	18.56c	49.89c	49.28c	49.58c	44.97a	43.67	44.32a
90 kg/fad.	20.10b	18.54a	19.32b	56.25b	53.89b	55.07b	43.75ab	43.47	43.61ab
120 kg/fad.	21.25a	19.01a	20.13a	58.69a	59.03a	58.86a	41.00b	42.08	41.54b
F. test	**	**	**	**	**	**	*	N.S	*
Cultivar (C)									
Gemmeiza 11	19.96b	18.06b	19.01b	51.85 b	54.19b	53.02b	43.89b	41.56b	42.72b
Sids 12	23.22a	20.13a	21.67a	68.93a	61.26a	65.09a	48.37a	51.89a	50.13a
Giza 168	18.65d	17.46c	18.06d	48.93c	49.19c	49.06b	39.74c	38.89c	39.31c
Misr 1	19.48c	17.73bc	18.60c	50.07bc	51.63bc	50.85b	40.96c	39.96bc	40.46c
F. test	**	**	**	**	**	**	**	**	**
Interactions									
S x N	NS	NS	NS	NS	**	*	NS	NS	NS
S x C	*	*	*	**	*	**	**	**	**
N x C	*	NS	*	**	NS	NS	*	**	**

*, ** and NS indicate significant at 0.05 and 0.01 levels and insignificant of differences, in respective order.

This might be due to the high efficiency of plants to convert solar energy to chemical energy which increased grain weight with sowing on November, 30th than the other tested sowing dates. These results are supported by data obtained by El-Gizawy (2009), Amin (2010), Swelam *et al.* (2010), El-Sarag and Ismaeil (2013) and Fayed *et al.* (2015).

Concerning the influence of nitrogen fertilizer levels, the data obtained show that nitrogen fertilizer levels had highly significant effect on number of spikelets/spike and number of grains/spike (Table 4). It was clearly eviedent from the data of combined that, the highest number of spikelets/spike (20.136) and grains/ spike (58.86) were obtained by applying 120 kg N/fad., while the lowest values were recorded with applying 60 kg N/fad., This might be due to that nitrogen fertilizer significantly affected vegetative and reproductive growth of the plant depending upon the availability of needed nutrition which leads to proportional increases in number of spikelets and grains/ spike. Greater partitioning of dry matter to spikes due to nitrogen fertilization causes more grains /spike. Regarding, the influence of N fertilizer levels on thousand grain weight (g), the data obtained show that nitrogen fertilizer levels had not significant effect on thousand grain weight (g) in the 2nd season and significant in the 1st season as well as those of the combined of both growing seasons (Table 4). Results of the combined analysis revealed that highest values of thousand grain weight (44.32 g) were noted when 60 kg N/fad., was applied, while the lowest value of thousand grain weight (41.54 g) was recorded with the high level of (120 kg N/ fad.). These results are also in conformity with those reported by Ashmawy and Abo-Warda (2002), Ali *et al*. (2004), El-Gizawy (2010), Iqbal *et al.* (2012), Noureldin *et al.* (2013) and Khalid *et al.* (2014).

Respecting varietal differences, it is clear that wheat cultivars were differed significantly in their number of spikelets/spike, number of grains/ spike and 1000-grain weight in both seasons and their combined analysis (Table 4). According to combined analysis Sids 12 cv recorded the highest number of spikelets/ spike (21.678), number of grains/spike (65.09) and 1000-grain weight (50.13). While, the lowest number of spikelets /spike was recorded by Giza 168 cv (18.063). However, Giza 168 cv recorded the light 1000-grain weight with at par average with Misr1 in both seasons and their combined analysis. The reasons for differences in number and weight of grains might be attributed to of genetic structure of the cultivars primarily affected by heredity. These results are in harmony with those obtained by (Swelam *et al.,* 2010 ; Hafez *et al.,* 2012; Abd El-Razek *et al.,* 2013; El-Sarag and Ismaeil, 2013; Abd E l-Lattief, 2014; Fayed *et al.,* 2015).

Regarding the significant interaction effects between sowing dates and wheat cultivars on number of spikelets/spike. (Table 4-a), the results indicate that the highest number of spikelets/spike (22.722) was obtained by Sids 12 cv., when wheat was sown on November, 30th. Otherwise, the lowest number of spikelets/spike (17.078) was obtained by Giza 168 cv when wheat was sown on December, 20th. The significant interaction between cultivars and sowing dates shows the sensitivity of different cultivars to photoperiod and temperature differently for number of spikelets / spike of wheat. Moreover, the significant interaction between nitrogen fertilizer levels and cultivars on number of spikelets/ spike are presented in (Table 4-b). These results revealed that the highest number of spikelets/spike (22.722) was obtained by Sids 12 cv when high N-level of 120 kg N/fad., was applied. Otherwise, the lowest number of spikelets/spike (17.267) was recorded by Giza 168 cv., when received 60 kg N/fad. Results of the combined data for both growing seasons, presented in Tale (4-c) show the significant interaction between sowing dates and cultivars on number of grains/spike. These results revealed that the highest number of grains/spike (70.05) was obtained by Sids 12 cv with sowing on November, 30th. Otherwise, the lowest number of grains/spike (44.94) was obtained by Giza 168 cv with sowing on December, 20th. Data of the combined analysis for both seasons, presented in Table (4-d) show the significant interaction between nitrogen fertilizer levels and cultivars on number of grains/spike. The obtained data revealed that the maximum number of grains/spike (67.94) was achieved by Sids 12 cv when high N-level of 120 kg N/fad., was applied. Otherwise, the minimum number of grains/spike (43.05) was obtained by Gemmizea 11 cv. when low N-level of 60 kg N/fad., was used.

Grain, Straw and Biological Yields/fad.

Data presented in Table 5 show the influence of sowing dates, nitrogen fertilizer levels and cultivars on grain, straw and biological yields of wheat during both growing seasons and their combined.

Sowing dates affected significantly on each of grain, straw and biological yields of wheat during both growing seasons and their combined (Table 5). The maximum grain yield was recorded when sowing was done on November, 30th compared to early sowing (November 10th) or late sowing (December 20th). Also, it is clear from these results that sowing on November 30th increased grain yield by 8.21% and 23.37% in the first season and by 11.60% and 17.26% in the second season and by 9.82% and 20.36% in the combined as compared with early sowing (November, 30th), respectively. Also, sowing on

Table 4-a. Number of spikelets /spike as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	November 30th	December 20th
	B	A	B
Gemmieza 11	18.378b	20.056b	18.611b
	B	A	B
Sids 12	21.422a	22.722a	20.889a
	B	A	B
Giza 168	17.778b	19.333b	17.078c
	B	A	B
Misr 1	18.200b	19.511b	18.111b

Table 4-b. Number of spikelets /spike as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	B	A	A
Gemmieza 11	18.178b	19.167b	19.700b
	C	B	A
Sids 12	20.622a	21.689a	22.722a
	C	B	A
Giza 168	17.267c	18.156c	18.767c
	B	B	A
Misr 1	18.189b	18.278c	19.356bc

Table 4-c. Number of grains/spike as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	November 30th	December 20th
	B	A	C
Gemmieza 11	52.56 b	57.94 b	48.55 b
	B	A	C
Sids 12	64.11 a	70.05 a	61.11 a
	AB	A	B
Giza 168	48.61 b	53.61 c	44.94 c
	AB	A	B
Misr 1	51.16 b	54.61 c	46.77 b

Table 4-d. Number of grains/spike as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	C	B	A
Gemmieza 11	43.05 c	53.94 b	62.05 b
	B	A	A
Sids 12	59.66 a	67.66 a	67.94 a
	B	B	A
Giza 168	48.16 b	46.55 c	52.44 c
	B	A	A
Misr 1	47.44 b	52.11 b	53.00 c

Table 4-e. Thousand grain weight (g) of wheat as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	November 30th	December 20th
	B	A	AB
Gemmieza 11	40.67 bc	44.89b	42.61b
	AB	A	B
Sids 12	49.11a	54.50a	46.78a
	A	A	A
Giza 168	39.28c	40.11cd	38.56d
	A	A	A
Misr 1	42.22b	39.56d	39.61cd

Table 4-f. Thousand grain weight (g) of wheat as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	A	A	A
Gemmieza 11	42.89 b	43.72b	41.56b
	B	B	A
Sids 12	48.33a	49.06a	53.00a
	B	A	A
Giza 168	35.67b	41.22bc	41.06b
	A	A	A
Misr 1	39.28c	40.44c	41.67b

November 30^{th} produced higher number of spikes/ m^2 (Table 3), number of grains/spike and 1000- grain weight values (Table 4) compared with sowing on November 10^{th} and December 20^{th}. This indicates that the climatic conditions were not relatively suitable for growth through early or delay sowing dates. So, weather conditions prevailing during wheat growth may be the reason for the detected variations. Another possible and strong attributes could be the high temperature during delay sowing which prolonged the period of grain filling and resulted in reduce development of grain and ultimately decreasing the grain yield (Guilioni *et al*., 2003). The recorded data indicated that there were highly significant differences between sowing dates in both growing seasons and their combined analysis respecting straw yield of wheat (Table 5). It is clear from obtained results that sowing on November 30^{th} increased straw yield compared with late sowing on December 20^{th} but without significant differences than early sowing (November 10^{th}) through seasons and the combined. These increments in straw yield might be due to the increase in number of tillers/m^2 and plant height (Table 3). Also, it might be attributed to the chance given to plants of appropriateness sowing to receive higher heat summation, intercepted light and energy with prolonging the growth period which in turn on metabolic processes translocation of synthesized metabolites and its accumulation in plant. In this connection, Geith *et al.* (2013) found that delay in sowing from November 25^{th} to December 25^{th} produced low straw yield. The recorded data obvious revealed that there were significant differences between sowing dates in both growing seasons and their combined analysis in biological yield of wheat (Table 5). It is clear from these results that sowing on November, 30^{th} increased biological yield by 15.41% and 35.30% in the first season and by 18.05% and 31.19% in the second season and by 16.38% and 33.17% in the combined data as compared with sowing on November 10^{th} and December 20^{th}, respectively. These increments in biological yield achieved by moderate sowing (November 30^{th}) might be due to the increase in grain yield /fad., and straw yield /fad., (Table 5) compared with early sowing (November 10^{th}) and late sowing (December 20^{th}). Combined data showed that a lot of decrease in yield due to delay in sowing time. The first reason may be more suitable climatic condition for maximum vegetative and reproductive components which increased biomass yield. Secondly it may be due to reproductive plants unit area. In later sowing date’s biomass and grain yields decreased due to undesired environmental conditions and lack of suitable transforming preserved matters to seeds as a result of increasing temperature at the end of growth season (Emami *et al*., 2011). Many investigators concluded that appropriate sowing date is important to have the crop in the field. Similar trends were reported by El-Gizawy (2009), Amin (2010), Swelam *et al.* (2010), El-Sarag and Ismaeil (2013) and Fayed *et al.* (2015).

Concerning the influence of nitrogen fertilizer level on grain, straw and biological yields/ fad., the results in Table 5 indicated significant differences in both seasons and their combined, where increasing nitrogen fertilizer level from 60 or 90 up to 120 kg N/fad., significantly increased grain, straw and biological yields/fad., while the grain yield responded up to 90 kg N/fad., only, in the first season. Such results could be attributed to the promotion effect of nitrogen on vegetative growth which in turn favored metabolic processes and increased all yield attributes as mentioned before. The positive response of grain and straw yields of wheat to nitrogen fertilization was noticed by several investigators in the literature as Abdul Galil *et al.* (2003), Ali *et al*. (2004), El-Gizawy (2010), Swelam *et al.* (2010), Iqbal *et al.* (2012), Abd El-Razek *et al*. (2013), Geith *et al*. (2013) and Khalid *et al.* (2014).

Regarding wheat cultivars effect, the results revealed highly significant differences between grain, straw and biological yields/fad., in both growing seasons and their combined analysis. As far as, varietal differences concerning grain and biological yields/fad., the results in Table 5 clearly show the superiority of Misr 1 followed by Gemmizea 11 but without significant differences between them and then by Sids 12 which was at par with Giza 168 (combined analysis). These results are rather expected as Misr 1 recorded the highest number of spikes/m^2 (Table 3) followed by Gemmizea 11 which had the heavier 1000-grain after Sids 12 (Table 4).

Table 5. Grain yield (ardab/faddan), straw yield (ton/fad.)and biological yield (ton/fad.) of wheat as affected by sowing dates, nitrogen fertilizer levels, cultivars and their interactions during two successive winter seasons (2013/2014 and 2014/2015) as well as their combined

Main effects and interactions	Grain yield (ardab/fad.)			Straw yield (ton/fad.)			Biological yield (ton/fad.)		
	1st season	2nd season	Com.	1st season	2nd season	Com.	1st season	2nd season	Com.
Sowing date (S)									
November 10th	21.07b	18.44b	19.75b	3.78ab	4.32ab	4.05ab	6.94b	7.09b	7.01ab
November 30th	22.80a	20.58a	21.69a	4.59a	5.29a	4.94a	8.01a	8.37a	8.19a
December 20th	18.48c	17.55c	18.02c	3.15b	3.75b	3.45b	5.92c	6.38b	6.15b
F. test	**	**	**	**	**	**	*	*	*
Nitrogen fertilizer level (N)									
60 kg/fad.	18.92b	17.92b	18.42b	2.89b	3.97b	3.43b	5.73c	6.66c	6.20c
90 kg/fad.	21.22a	18.58b	19.90b	3.64b	4.48b	4.06b	6.82b	7.27bc	7.05b
120 kg/fad.	22.21a	20.08a	21.14a	4.98a	4.91a	4.95a	8.31a	7.92a	8.12a
F. test	**	*	**	**	**	**	**	**	**
Cultivars (C)									
Gemmeiza 11	20.92a	18.85b	19.88ab	3.90b	4.69ab	4.29b	7.04b	7.47ab	7.25ab
Sids 12	20.58ab	18.52b	19.55b	3.59bc	4.12bc	3.85bc	6.67bc	6.89bc	6.78bc
Giza 168	19.76b	17.96b	18.86b	3.23c	3.74c	3.48c	6.19c	6.43c	6.31c
Misr 1	22.18a	20.11a	21.14a	4.63a	5.27a	4.95a	7.95a	8.28a	8.11a
F. test	**	**	**	**	**	**	**	**	**
Interactions									
S x N	NS	NS	NS	NS	NS	NS	NS	NS	*
S x C	*	NS	**	NS	NS	*	NS	NS	NS
N x C	NS	*	*	NS	*	*	NS	*	**

*, ** and NS indicate significant at 0.05 and 0.01 levels and insignificant of differences, in respective order.

Concerning biological yield, Misr 1cv was the highest one (8.11 ton/fad.) followed by either Gemmizea 11 cv (7.25 ton/fad.) or Sids 12 (6.78 ton/fad.), while Giza 168 cv scored lowest one (6.31 ton/fad.) according to combined analysis results. These results may be attributing to the differences among cultivars under study in growth habit and response of each one to the environmental conditions during the growing seasons which controlled by genetical factors. Such responses reflected on growth characteristics and consequently yield attributes and ultimately grain yield .Several investigators showed such great differences among wheat cultivars regarding grain and straw yields included Ashmawy and Abo-Warda (2002), Amin (2010), Geith *et al.* (2013) and Noureldin *et al.* (2013).

Likely, the significant interaction between nitrogen fertilizer levels and cultivars in the combined data (Table 5-a) indicated that, the highest grain yield (22.13 ardab/fad.) was achieved by Misr 1 cv. when received 120 kg N/fad. On the other hand the lowest grain yield (17.41 ardab/fad.,) was obtained by Giza 168 cv. when received 60 kg N/fad. With respect to the significant interaction between sowing dates and cultivars at (Table 5-b), the significant interaction between sowing dates and wheat cultivars in the combined analysis showed that

Table 5-a. Grain yield (ardab /fad) as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilize level		
	60 kg/fad.	**90 kg/fad.**	**120 kg/fad.**
	B	AB	A
Gemmieza 11	18.27bc	19.81ab	21.57a
	B	B	A
Sids 12	18.28bc	18.99b	20.94ab
	B	A	A
Giza 168	17.41c	19.23b	19.94 b
	B	AB	A
Misr 1	19.71a	21.58a	22.13a

Table 5-b. Grain yield of wheat (ardab/fad.) as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	**November 30th**	**December20th**
	B	A	B
Gemmieza 11	19.34 b	21.53 b	18.77 b
	B	A	C
Sids 12	19.54 bc	21.48 b	17.18 b
	B	A	B
Giza 168	18.93 c	20.49 c	17.15 b
	B	A	C
Misr 1	21.21 a	23.26 a	18.95 a

the highest grain yield (23.26 ardab/fad.) was obtained by Misr 1 cv. with sowing on November, 30th, while the lowest grain yield (18.93 ardab/fad.) was recorded by Giza 168 cv. with sowing on November, 10th. The significant interaction between cultivars and sowing dates shows the sensitivity of different cultivars to photoperiod and temperature differently for grain yield of wheat. Data obtained in (Table 5-c) revealed the significant effect of interaction between sowing dates and wheat cultivars on straw yield (combined data). Misr 1 cv recorded the maximum straw yield (5.87 t/fad.) when sowing was done on November 30th, while Giza 168 cv recorded the minimum straw yield (2.84 t/fad.) when sowing was done on December 20th. The significant interaction between cultivars and sowing dates shows the sensitivity of different cultivars to photoperiod and temperature differently for straw yield of wheat. Furthermore, the significant interaction between nitrogen fertilizer levels and wheat cultivars in the combined analysis (Table 5-d) indicated that the highest straw yield of 5.75 ton/fad., was achieved by Misr 1 cv., when high nitrogen fertilizer levels of 120 kg N/fad., was applied (combined data). On the other hand, the lowest straw yield (3.21 ton/fad.) was obtained by Giza 168 cv., when low nitrogen fertilizer level of 60 kg N/fad., was used.

Regarding the significant interaction between sowing dates and nitrogen fertilizer levels on biological yield (Table 5-e), the results showed that maximum biological yield (9.231 ton/fad.) was obtained with wheat sowing on November 30th and received 120 kg N/fad., while minimum one (5.579 t/fad.) was recorded with wheat sowing on December, 20th and received 60 kg N/fad. Furthermore, the significant interaction between nitrogen fertilizer levels and wheat cultivars in the combined analysis (Table 5-f)

Table 5-c. Straw yield (ton/fad.) as affected by the interaction between sowing dates and cultivars (combined data)

Cultivar	Sowing date		
	November 10th	November 30th	December 20th
	AB	A	B
Gemmieza 11	4.28b	5.02ab	3.57ab
	B	A	B
Sids 12	3.40c	4.83b	3.32ab
	AB	A	B
Giza 168	3.57c	4.02b	2.84b
	AB	A	B
Misr 1	4.93a	5.87a	4.04a

Table 5-d. Straw yield (ton/fad.) as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	90 kg/fad.	120 kg/fad.
	B	B	A
Gemmieza 11	3.39ab	4.23b	5.24a
	B	B	A
Sids 12	3.31ab	3.44c	4.81ab
	B	B	A
Giza 168	3.21b	3.25c	3.98b
	B	A	A
Misr 1	3.79a	5.31a	5.75a

Table 5-e. Biological yield (ton/fad.) as affected by the interaction between sowing dates and nitrogen fertilizer levels (combined data)

Nitrogen fertilizer level	Sowing date		
	November 10th	November 30th	December 20th
	B	A	C
60 kg N/fad.	5.963 c	7.037c	5.579b
	B	A	AB
90 kg N/fad.	7.050b	8.309b	7.786a
	AB	A	B
120 kg N/fad.	8.032a	9.231a	7.088a

Table 5-f. Biological yield (ton/fad.) as affected by the interaction between nitrogen fertilizer levels and cultivars (combined data)

Cultivar	Nitrogen fertilizer level		
	60 kg/fad.	**90 kg/fad.**	**120 kg/fad.**
	B	B	A
Gemmieza 11	6.028a	7.174b	8.555ab
	B	B	A
Sids 12	6.072a	6.327c	7.969b
	B	A	A
Giza 168	6.010a	6.129c	6.812c
	B	A	A
Misr 1	6.662a	8.562a	9.132a

indicated that the highest biological yield of 9.132 ton/fad., was obtained by Misr 1 cv., when nitrogen fertilizer level of 120 kg N/fad., was applied as well as when 90 kg N/fad., was applied (8.562 ton/fad.) followed by Gemmizea 11 cv., when nitrogen fertilizer level of 120 kg N/fad., was applied. On the other hand, the lowest biological yield was obtained under application of 60 kg N/fad., for all cultivars.

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استجابة بعض أصناف القمح لاختلاف ميعاد الزراعة ومستوى السماد النيتروجينى تحت ظروف الأراضى الرملية

عبد الله عبد الجواد حسن فضل[١] – عادل يوسف عبد الحميد البنا[٢]

عبد الرحمن السيد أحمد عمر[٢] - محمد إبراهيم السيد عبد الحميد[٢]

١- الإدارة الزراعية بفاقوس- محافظة الشرقية - مصر

٢- قسم المحاصيل - كلية الزراعة - جامعة الزقازيق - مصر

أقيمت تجربتان حقليتان بقرية أباظة – مركز فاقوس – محافظة الشرقية – مصر خلال موسمى النمو ٢٠١٤/٢٠١٣ و٢٠١٥/٢٠١٤ بهدف دراسة تأثير ثلاث مواعيد للزراعة (١٠ نوفمبر، ٣٠ نوفمبر، ٢٠ ديسمبر)، ثلاث مستويات للسماد النتروجينى (٦٠، ٩٠ ، ١٢٠ كجم نيتروجين /فدان) وأربعة أصناف (جميزة ١١ ، سدس ١٢ ، جيزة ١٦٨، مصر ١) على المحصول ومساهماته فى القمح تحت ظروف الأراضى الرملية، تضمنت التجربة ٣٦ معامله عبارة عن التوافيق بين ثلاث مواعيد للزراعة، ثلاث مستويات للسماد النتروجينى وأربعة أصناف من القمح، كان التصميم التجريبى المستخدم هو القطع المنشقة مرتين فى ثلاث مكررات، حيث وضعت مواعيد الزراعة فى القطع الرئيسية ووضع السماد النتروجينى فى القطع المنشقة الأولى والأصناف فى القطع المنشقة الثانية، تبين من نتائج متوسط الموسمين أن تأثير مواعيد الزراعة كان معنوياً على صفة عدد السنيبلات/سنبلة، وزن حبوب السنبلة ووزن الـ١٠٠٠ حبه والمحصول البيولوجى/ فدان، فى حين كان التأثير عالى المعنوية على صفة ارتفاع النبات، عدد السنابل/م٢، طول السنبلة ، عدد الحبوب / سنبله ، محصول القش والحبوب/فدان، كما سجل موعد الزراعة فى ٣٠ نوفمبر أعلى القيم لصفة ارتفاع النبات، عدد السنابل/م٢، طول السنبلة، عدد السنيبلات/ السنبلة، عدد الحبوب / السنبلة ووزن الـ ١٠٠٠ حبه، محصول القش والحبوب والبيولوجى/ فدان بينما أدت الزراعة فى كل من ١٠ نوفمبر، ٢٠ ديسمبر إلى نقص معنوى فى صفات المحصول ومساهماته، تشير نتائج متوسط الموسمين إلى أن السماد النتروجينى اثر معنوياً على وزن الـ ١٠٠٠ حبه والمحصول البيولوجى للفدان فى حين كان التأثير عالى المعنوية على صفة ارتفاع النبات وعدد السنابل/ م٢ وطول السنبلة وعدد السنيبلات/سنبله وعدد الحبوب/ سنبله ومحصول الحبوب والقش والبيولوجى/فدان، أدى زيادة النيتروجين إلى ٩٠ كجم ن/فدان إلى زيادة معنوية لصفة عدد السنابل/م٢، ووزن الـ ١٠٠٠ حبه فى حين زاد معنوياً ارتفاع النبات وطول السنبلة وعدد السنيبلات/سنبله وعدد الحبوب /سنبله ومحصول الحبوب والقش والبيولوجى/فدان بزيادة مستوى النيتروجينى حتى ١٢٠ كجم ن /فدان، توضح نتائج متوسط الموسمين وجود تأثير عالى معنوى بين الأصناف على صفات المحصول ومساهماته، أعطى الصنف مصر ١ أعلى القيم لصفات ارتفاع النبات وعدد السنابل/م٢ ومحصول الحبوب والقش والبيولوجى /فدان، ولم يختلف معنوياً عن الصنف جميزه ١١فى اتفاع النبات، محصول الحبوب والمحصول البيولوجى، فى حين أعطى الصنف سدس ١٢ أعلى القيم لطول السنابل وأعلى عدد للسنيبلات/ سنبله وأعلى عدد حبوب للسنبلة وأعلى وزن للألف حبه، وبصفة عامه سجل الصنف جيزه ١٦٨ أقل القيم لصفة محصول الحبوب والقش والبيولوجى /فدان وكذلك مساهمات المحصول.

المحكمـــون:

١- أ.د. ماهر عبدالله قطب علـــى أستاذ ورئيس قسم المحاصيل – كلية الزراعة بالإسماعيلية- جامعة قناة السويس.

٢- أ.د. احمد محمد عبدالغنى على أستاذ المحاصيل المتفرغ – كلية الزراعة – جامعة الزقازيق.