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Influence of Sowing Dates, Nitrogen Fertilizer under Low Rates and Foliar with Boron on Production and Quality of Wheat

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ABSTRACT

The present work was conducted at the Experimental Farm of the Agriculture Research Center in Al-Azhar Univ. at Assiut, Governorate during 2016/2017 and 2017/2018 seasons to study the effect of three sowing dates (1st November, 15th November and 1st December), nitrogen fertilizer three rates (30, 50 and 70 kg N /fad.) and foliar application with boron (control, 50 and 100 ppm) on the production and quality of wheat (cv. Sids-12**)**. The experiments were performed in a split-split plot design with replicates three, where sowing dates were assigned to the main plot, while nitrogen rates and boron were distributed randomly in the sub and sub-sub plot, respectively.The obtained results showed that sowing dates significant effect in plant height, flag leaf area, number of grains/spike, 1000-grains weight (g) and carbohydrate percentage in both seasons, except number of spikes/m^2 in the second season only, as well as grain yields ton/fad in the first season only . On the other hand, number of tillers/plant, straw yield ton/fad. and protein percentage didn't show significant effects in both seasons. In generally, sown wheat in 15- November produced the highest values in all studied traits except of 1000-grains weight (g), in the first season only from sowing on 1- December. Increasing the level of nitrogen fertilizer from 30 or 50 to 70 kg N /fad. caused a significant increases in all traits under study in both seasons, except straw yield ton/fad. in the second season only. Foliar application with boron significant increases in all studied characters, i.e. plant height, no., of tillers/plant, flag leaf area, no. of spikes/m^2, number of grains/spike and 1000-grains weight (g) as well as grain and straw yields/fad. Also, such treatment increased protein and carbohydrate percentages of wheat grains.In general, the highest value of grain yield/ fad. and quality were obtained from sowing wheat on the 15th Nov. when received 70 N / fad. and boron foliar application concentration of 100 ppm under Assiut conditions.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important grain crops grown in the world and plays a major role in economic activity. It is used as stable food grains for urban and rural communities and as a major straw exporter for animal feed. In Egypt, the cultivated area was about 3 million feddans annually. The cultivated area of wheat should be increased in the reclaimed lands because of the limited areas of the Nile Valley and the main crop competitor. Therefore, improving the quantitative and qualitative characteristics of wheat has been the goal of many researchers.

Changes in climate factors are felt around the world in the form of changes in temperature and precipitation patterns. An increase in ambient CO_2 is usually considered beneficial as it results in increased photosynthesis in crops, especially those with C_3 mechanism of photosynthesis as wheat crop. Adaptation options such as growing improved varieties, change in sowing date can reduce the impacts of climate change on wheat crop. Sowing date is one of the most important agricultural factors that determine crop productivity especially wheat crop, which affects the duration of the vegetative and reproductive stages. Gheith *et al.* (2013) found that sowing dates showed significant differences for all studied characters (plant height, number of tillers/m^2 and straw yield), produced the highest values at early sowing (25 November) in both seasons. Fadle *et al.* (2016) showed that plant height, number of spikes/m^2, number of grains/spike, 1000-grains weight as well as grain and straw yields/fad., were significantly higher on November, 30th sowing as compared to other sowing dates. Abd El-Hadi *et al.* (2018) reported that the early wheat sowing on 15th Nov. appeared to be produced the highest plant height, number of grains/spike, 1000-grains weight (g) and grain yield/ fad.

Nitrogen plays a major role in the growth and development of the plant, and reduces its lack of the presence of leaves and roots, loss of the efficiency of representation and the disorder of all metabolic functions (Marschner,1995). Bayoumi and El-Demardash (2008) reported that increasing nitrogen fertilizer level (40 to 120 kg N/fad.) to wheat increased the 1000-grains weight, protein and carbohydrate percentage. Gehan *et al.* (2011) showed that increased nitrogen fertilizer at rates 35 and 70 to 105 kg N/fed. significantly increased plant height, no., of spikes/ m^2 , number of grains/spike, 1000-grains weight, straw yield, protein and carbohydrate percentages. Santosh (2011) indicated that nitrogen levels supply on plant height and flag leaf area were significantly enhanced at all applied treatments. Fadle *et al.* (2016) showed that nitrogen fertilizer levels affected significantly all studies traits (plant height, number of spikes/m^2, number of grains/spike, 1000-grains weight, straw yield ton/fad. and grain yield ard./fad.).

Boron is one of the essential micronutrients needed for plant growth and productivity. Plays an important role in cell wall synthesis, RNA metabolism and root elongation as well as phenol metabolism. Also, boron participates in the growth of pollen and tube (Marschner, 1995; Srivastava and Gupta,1996). Islam and Jahiruddin (2008) showed that foliar application had significant and positive effect on the grain nitrogen concentration indicating that boron helped protein synthesis. Tahir *et al.,* (2009) showed that foliar application with boron significantly increased number of grains per spike, 1000-grain weight and grain yield on wheat. Rehman *et al.* (2012) pointed that foliar spraying of boron significant increased on plant height, no. of tillers (m^2), number of grains/spike, 1000-grains weight (gm), Straw yield (ton/ha.) and grain (ton/ha.). Mahdi *et al.* (2013) showed that application of boron on wheat caused significant increase on no. of spikes/ plant, 1000 grain weight and grain yield. Rawashdeh and Sala (2014) reported that foliar application of boron had positive effect on growth, yield and yield parameters of wheat crop.

Therefore, the present study aimed to investigate the effect of three sowing dates, three nitrogen fertilizer rates and foliar application with boron on the production and quality of wheat under Assiut Governorate conditions.

MATERIALS AND METHODS

The present investigation was carried out conducted at the Agricultural Exp., Farm of the Agric., Research Center in Al-Azhar Univ. at Assiut, during 2016/2017 and 2017/2018 seasons to study the effect of three sowing dates [1st November (early), 15th November (moderate) and 1st December (late), different nitrogen fertilizer rates (30, 50 and 70 kg N /fad.) and foliar application with boron (control, 50 and 100 ppm) on the production and quality of wheat (cv. Sids-12). A randomized completed blocks design in split–split plot arrangement with three replications were used planting dates were assigned to the main plot, nitrogen fertilizer rates were distributed randomly in the sub plots and boron were allocated to the sub –sub plots. The experimental unit comprised each 3.5m long and 3.0 m wide (10.5 m^2 in area = 1/400/ fad.). Nitrogen rates under test were 30, 50 and 70 kg N /fad. as ammonium nitrate (33.5%N) applied in two equal doses at first irrigation and second irrigation. Boron was used boric acid (H_3Bo_3 17% boron) a source of boron and applied as foliar at 30 and 60 days after sowing. All other practices were uniformly applied as recommended for wheat production in the region. The physical and chemical analyses of the experimental site are presented in Table (1).

Table 1. The mechanical and chemical analysis of soil field experiments:

Mechanical analysis	2016/17	2017/18	Chemical analysis	2016/17	2017/18
Sand (%)	25.68	26.85	Organic matter (%)	0.94	1.05
Silt (%)	39.46	38.28	Available N (ppm)	63.50	70.20
Clay (%)	34.86	34.87	Available P(ppm)	9.14	10.20
			Available K (ppm)	348.30	355.00
Soil texture	Clay loam		pH (s.p. 65)	7.80	8.02
			E.C. (ds. m^{-1})	1.15	1.16
			Total $CaCo_3$ (%)	2.80	2.50

Meteorological data (monthly temperature °C and relative humidity) of Assiut district during the two growing seasons of 2016/2017 and 2017/2018 were shown in Table (2).

Table 2. Meteorological data recorded at Assiut Station 2016/2017 and 2017/2018 seasons . **

Month	2016/2017			2017/2018		
	T –max °C	T –min °C	R.H%	T –max °C	T –min °C	R.H%
November	27.66	13.72	42.92	25.36	11.45	46.50
December	18.92	6.04	60.23	23.00	10.17	49.10
January	18.90	5.42	48.59	19.91	5.48	51.80
February	20.48	5.46	42.05	24.40	10.53	32.84
March	26.16	10.18	32.60	31.09	13.85	23.52
April	31.90	15.28	24.44	32.76	15.78	24.45

**** Weather Bureau Station.**

Studied characters:-

A- Growth characters:-

After 90 days from sowing, 10 plants were randomly selected from each treatment and the following data were recorded:-

1- Plant height (cm).
2- Number of tillers/plant.
3- **Flag leaf area (cm^2):** the flag leaf area was calculated using the following equation of Palamiswamy and Gomex (1974).

Leaf area (L.A) = K (LxW).

Where: L= leaf length, W = maximum width of the leaf.
K=factor of 0.75

B- Yield and yield components:

1- Number of spikes/m^2: counted in randomly chosen one meter square in each plot.

2- Number of grains/spike.

3- 1000-grain weight (g): average weight of 1000-grain randomly taken from each plot.

4- Grain yield (ton/fad.): weight of grains harvested from each plot converted to ton (ton = 1000 kg)

5- Straw yield (ton/fad.): it was calculated by subtracting grain yield from the total yield for each plot and converted to ton/fad.

C-Grain quality:-

1- Protein (%): Protein percentage in the dry grains were calculated by multiplying N% by the factor of 5.70 which determined by using the micro Kjeldahl method as described by A.A.C.C (2000).

2- Carbohydrate (%): Total carbohydrate percentage in the dry grains were estimated using the method described by Dubois *et al.* (1956).

Statistical analysis:-

The results were statistically analyzed according to Gomez and Gomez (1984) using the computer MSTAT-C statistical analysis package by Freed *et al.* (1989). The least significant differences (LSD) test at probability level of 0.05 was manually calculated to compare the differences among means.

RESULTS AND DISCUSSION

A- Growth characters:-

1- Plant height (cm).

Results in presented in Table (3) show a significant effect for sowing dates on plant height (cm) in 2016/2017 and 2017/2018 seasons. Tallest plants (59.90 and 59.86 cm) were observed at moderate sowing (15th November), while shortest plants (55.90 and 57.66 cm) were recorded at early sowing (1st November) in both seasons, respectively. This finding might be attributed to the favorable temperature conditions beside other optimum environmental factor that encouraged growth and early development of plant sown moderate in November rather than those sown early November and December. These results are in agreement with those obtained by Gheith *et al.* (2013), Fadle *et al.* (2016) and Abd El-Hadi *et al.* (2018).

The results revealed that the application of nitrogen fertilizer rates to wheat plants exerted a significant influence on plant height (cm) in both seasons. The highest values (61.53 and 62.75 cm) were obtained when nitrogen was applied at a rate of 70 kg N/ fad. in both seasons, respectively. These result are in harmony with those obtained by Gehan *et al.* (2011), Santosh (2011) and Fadle *et al.* (2016). This may be due to the role N plays that in plant growth and development. Nitrogen shortage resulted in reduction in foliage and roots expansion, loss in photosynthetic efficiency and disturbance of all metabolic functions. This, in turn could enhance the plants to produce more assimilates which was reflected in high plant height.

The foliar application with boron to wheat plants exerted a significant influence on plant height (cm) in the first and the second seasons. In general, plant height (cm) were increased gradually with increasing boron levels from 0.0, 50 to 100 ppm in both seasons.These results could have been attributed to improved photosynthesis activity and activity. These results are consistent with this obtained by Rehman *et al.* (2012)

Results in Table (3) indicated that, the interaction between sowing dates x boron had significant effect on this trait the first season only where the highest value of 63.88 cm was obtained from sowing wheat in 15th November and 100 ppm boron, also, plant height was significantly affected by the interaction between nitrogen x boron in the first season only. The second order interaction exerted significant effect on plant height in 2016/2017 season only, where the highest value of 68.57 cm was obtained from sowing wheat plants in 15th November when received 70 N / fad. and 100 ppm boron.

Table 3. Plant height (cm) of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Plant height(cm)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	50.10	54.00	52.22	52.10	50.05	53.66	55.21	52.97
	50	51.14	57.93	59.12	56.06	53.86	58.74	60.58	57.72
	70	55.01	60.13	63.45	59.53	57.14	65.18	64.54	62.28
	Mean	52.08	57.35	58.26	55.90	53.68	59.19	60.11	57.66
November 15th	30	52.71	56.59	59.28	56.19	51.58	56.53	60.08	56.06
	50	55.65	60.44	63.80	59.96	56.02	61.17	64.40	60.53
	70	57.72	64.31	68.57	63.53	57.62	63.23	68.17	63.00
	Mean	55.36	60.44	63.88	59.90	55.07	60.31	64.21	59.86
December 1st	30	50.96	54.81	57.22	54.33	51.47	55.00	57.12	54.53
	50	54.22	60.21	62.00	58.81	55.36	59.84	61.28	58.82
	70	57.04	62.60	64.9	61.53	59.13	63.08	66.74	62.98
	Mean	54.07	59.20	61.39	58.23	55.32	59.30	61.71	58.78
Means of N-rates	30	51.25	55.13	56.24	54.21	51.03	55.06	57.47	54.52
	50	53.67	59.52	61.64	58.27	55.08	59.91	62..08	59.02
	70	56.59	62.34	65.66	61.53	57.96	63.83	66.48	62.75
	Mean	53.83	59.00	61.18		54.69	59.60	62.01	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	0.92	1.61
Nitrogen (N)	0.27	1.28
Boron (B)	0.38	1.09
S X N	NS	NS
S X B	0.66	NS
N X B	0.66	NS
S X N X B	1.45	NS

2- **Number of tillers/plant**.

Results in Table (4) showed that, the two studied sowing dates did not significantly differed in number of tillers/plant in 2016/2017 and 2017/2018 seasons.

Results indicated that nitrogen rates had a significant effect on no., of tillers/plant in both seasons. Maximum number of tillers/plant (3.03 and 3.21) were observed at nitrogen rate of 70 kg N/ fad., while at 30 kg N /fad., rate of nitrogen, minimum number of tillers/plant (1.96 and 2.29) were recorded in both seasons, respectively.

The foliar application with boron to wheat plants exerted a significant influence on number of tillers/plant in both seasons. In general, number of tillers/plant were increased gradually with increasing boron levels from 0.0, 50 to 100 ppm in both seasons. These results could have been attributed to improved photosynthesis activity and activity. These results are consistent with this obtained by Rehman *et al.* (2012)

The Results revealed that, no., of tillers/plant were not affected significantly by the interactions among experiment factors.

Table 4. Number of tillers/plant of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Number of tillers/plant							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	1.42	1.82	2.11	1.78	1.72	2.16	2.57	2.15
	50	2.02	2.36	2.84	2.40	2.28	2.68	3.26	2.74
	70	2.68	2.88	3.23	2.93	2.81	2.88	3.51	3.06
Mean		2.04	2.35	2.72	2.37	2.27	2.57	3.11	2.65
November 15th	30	1.77	2.17	2.50	2.14	1.99	2.42	3.02	2.47
	50	2.27	2.53	3.10	2.63	2.43	2.88	3.12	2.81
	70	2.97	3.20	3.53	2.23	3.20	3.46	3.72	3.46
Mean		2.33	2.63	3.04	2.67	2.54	2.92	3.28	2.91
December 1st	30	1.62	1.96	2.28	1.95	1.78	2.23	2.78	2.26
	50	2.11	2.14	2.68	2.31	2.36	2.78	3.29	2.81
	70	2.78	3.02	3.00	2.93	2.61	3.12	3.58	3.10
Mean		2.17	2.37	2.65	2.40	2.25	2.71	3.21	2.72
Means of N-rates	30	1.60	1.98	2.29	1.96	1.83	2.27	2.79	2.29
	50	2.13	2.34	2.87	2.45	2.35	2.78	3.22	2.78
	70	2.81	3.03	3.25	3.03	2.87	3.15	3.60	3.21
Mean		2.18	2.45	2.80		2.35	2.73	3.20	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	NS	NS
Nitrogen (N)	0.22	0.31
Boron (B)	0.23	0.30
S X N	NS	NS
S X B	NS	NS
N X B	NS	NS
S X N X B	NS	NS

3- Flag leaf area (cm^2).

The results presented in Table (5) revealed that the flag leaf area (cm^2) was significantly affected by sowing dates in two seasons. The highest means of flag leaf area (25.39 and 25.87 cm^2) were obtained on account of sowing wheat plants on 15th Nov. in the first and the second seasons, resp., However, the lowest one of this trait (23.24and 23.42 cm^2) from sown in 1st Nov. in the first and the second seasons, respectively.

Table 5. Flag leaf area (cm^2) of wheat plant as affected by sowing dates, nitrogen fertilization , boron spraying and their interaction in the two seasons.

Characters		Flag leaf area (cm^2)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	20.94	22.75	22.80	22.16	21.01	22.30	23.22	22.17
	50	21.37	22.69	25.10	23.05	21.74	23.62	24.40	23.25
	70	22.92	24.71	25.88	24.50	23.15	24.62	26.70	24.82
Mean		21.74	23.38	24.59	23.24	21.96	23.51	24.77	23.42
November 15th	30	22.78	24.27	25.10	24.05	23.22	24.43	25.51	24.38
	50	23.83	25.54	26.71	25.36	25.31	25.74	27.27	26.10
	70	25.36	27.02	27.93	26.77	25.69	27.10	28.59	27.12
Mean		23.99	25.61	26.58	25.39	24.74	25.75	27.12	25.87
December 1st	30	21.92	22.85	23.63	22.81	22.02	23.29	24.35	23.22
	50	22.55	23.86	24.90	23.77	22.71	24.65	25.49	24.28
	70	23.65	25.64	26.96	25.32	24.18	26.21	27.48	25.95
Mean		22.70	24.11	25.07	23.96	22.97	24.71	25.77	24.48
Means of N-rates	30	21.88	23.29	23.84	23.00	22.08	23.34	24.36	23.26
	50	22.58	24.03	25.57	24.06	23.25	24.67	25.72	24.54
	70	23.97	25.79	26.83	25.53	24.34	25.97	27.59	25.96
Mean		22.81	24.37	25.41		23.22	24.66	25.89	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	0.65	0.83
Nitrogen (N)	0.24	0.49
Boron (B)	0.39	0.56
S X N	NS	NS
S X B	NS	NS
N X B	NS	NS
S X N X B	NS	NS

It could be concluded that varying the applied nitrogen rates had a significant effect on this trait in 2016/2017 and 2017/2018 seasons, where the highest flag leaf area values (25.53 and 25.96 cm^2) were obtained when nitrogen was applied at a rate of 70 kg N/ fad. in first and second seasons, respectively. These results can be attributed to plant growth and the representation of the lack of nitrogen in the plant tissues and the development of the lack of nitrogen in the tissues. Our results in a good deal with this have been obtained by Santosh (2011).

It could be concluded that applied boron had significant effect on flag leaf area cm^2 in both seasons, where the highest flag leaf area (25.41 and 25.89 cm^2) were obtained when boron was applied at a level of 100 ppm in both seasons, respectively. Boron plays an important role in the synthesis of DNA synthesis and root elongation as well as phenol metabolism. . The results of the effect boron on flag leaf area obtained in the study are in agreement with this obtained by Rawashdeh and Sala (2014).

All studied interactions had no significant effect on such character in the two seasons.

B- Yield and yield components:

1- Number of spikes/m^2.

The results presented in Table (6) revealed that the number of spikes/m^2 were significantly affected by sowing dates in the second season only. The highest means of no., of spikes/m^2 (315.28) were obtained on account of sowing wheat plants on 15th Nov. in the second season. However, the lowest one of this trait (310.52) in the second season was obtained from sowing on 1st Nov. The increase in the number of spikes due to sowing during 15th Nov. may be attributed to corresponding environmental conditions in order to maximum wheat growth and development. These results are in line with this obtained by Fadle *et al.* (2016)

The results revealed that the application of nitrogen fertilizer rates to wheat plants exerted a significant influence on number of spikes/m^2 in2016/2017 and 2017/2018 seasons. The highest values (328.09 and 333.23) were obtained when nitrogen was applied at 70 kg N/ fad. in both seasons, respectively. This may be due to the role N plays that in plant growth and development. Nitrogen shortage resulted in reduction in roots expansion and foliage, loss in photosynthetic efficiency and disturbance of all metabolic functions. This, in turn could enhance the plants to produce more assimilates which was reflected in high number of spikes. These results are in harmony with those obtained by Gehan *et al.* (2011) and Fadle *et al.* (2016).

The foliar application with boron to wheat plants exerted a significant influence on no., of spikes/m^2 in the first and the second seasons. In general, numbers of spikes/ m^2 were increased gradually with increasing boron levels from 0.0, 50 to 100 ppm in both seasons. These results could have been attributed to improved photosynthesis activity and activity. These results are consistent with this obtained Mahdi *et al.* (2013)

The presented Table (6) results show that number of spikes/m^2 were significantly affected by the interactions of nitrogen x boron in the second season only. The other interactions did not show significant effect on this trait.

Table 6. Number of spikes/ m^2 of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Number of spikes/m^2							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	269.01	285.83	332.26	295.69	264.59	290.14	311.47	288.73
	50	284.93	309.07	327.41	307.13	290.08	313.10	333.40	312.19
	70	306.03	330.10	340.74	325.62	310.54	335.52	345.85	330.63
Mean		286.65	308.23	333.47	309.48	288.04	312.92	330.24	310.52
November 15th	30	262.10	290.52	320.44	291.02	272.11	294.25	310.09	292.15
	50	290.45	313.38	332.45	312.09	294.24	318.80	340.15	317.73
	70	311.39	336.01	345.50	330.96	316.25	340.63	351.00	335.96
Mean		287.98	313.30	332.79	311.36	294.20	317.89	333.74	315.28
December 1st	30	262.62	287.23	309.11	286.32	263.15	263.15	292.00	289.45
	50	288.50	311.06	329.00	309.52	313.22	292.16	315.11	314.36
	70	308.64	332.10	342.32	327.68	312.32	338.14	348.85	333.10
Mean		286.58	310.13	326.81	307.84	289.21	315.08	332.62	312.30
Means of N-rates	30	264.57	287.85	320.60	291.01	266.61	292.13	311.59	290.11
	50	287.96	311.17	329.62	309.58	292.16	315.67	336.45	314.76
	70	308.68	332.73	342.85	328.09	313.03	338.09	348.56	333.23
Mean		287.07	310.58	331.02		290.60	315.29	332.20	
L.S.D. at 5% for		2016/2017				2017/2018			
Sowing dates (S)		NS				1.89			
Nitrogen (N)		6.46				0.17			
Boron (B)		6.73				2.01			
S X N		NS				NS			
S X B		NS				3.49			
N X B		NS				NS			
S X N X B		NS				NS			

2- Number of grains/spike.

Results in Table (7) showed that, sowing dates had a significant effect on this trait in 2016/2017 and 2017/2018 seasons. As seen from obtained results, sowing wheat plants on 15th Nov. achieved maximum increase in number of grains/spike (50.67 and 51.86) in the two seasons, respectively. On contrary of that, the lowest means of number of grains/spike (44.94 and 46.37) were product due to sowing wheat plants on 1st Nov. in the first and the second seasons, respectively. The influence factor in the highlands in the 15th Nov. on number of grains/spike to the environmental condition during this period. Calculation increase the accumulation of dry matter. These results are consistent with those obtained by Fadle *et al.* (2016) and Abd El-Hadi *et al.* (2018).

Results indicated that nitrogen rates had a significant effect on no., of grains/spike in both seasons. The highest number of grains/spike were (50.57 and 52.56) achieved by plants fertilized with the highest nitrogen rate (70 kg N/ fad.) in both seasons, respectively. This may be due to that nitrogen fertilizer increased the vegetative growth of wheat, in addition to the role of nitrogen fertilizer in enhancing the photosynthesis process. Furthermore, nitrogen might have encouraged wheat growth and caused the significant increase in number of grains/spike. These results are in agreement with those obtained Gehan *et al.* (2011) and Fadle *et al.* (2016).

The foliar with boron at 50 to 100 ppm had a significant increase in the number of grains/spike to untreated plants in the both seasons (Table 7). Boron plays an important role in cell wall synthesis, RNA metabolism and root elongation as well as phenol metabolism. The results of boron in number of grains/spike obtained in the study are in agreement with those obtained by Tahir *et al.* (2009) and Rehman *et al.* (2012).

Results in Table (7) indicated that, the interaction between sowing dates x nitrogen had significant effect on this trait the first season only where the highest value of 53.50 was obtained from sowing wheat in 15th November and received 70 N / fad., also, number of grains/spike were significantly affected by the interaction between nitrogen x boron in the first season only, where the highest value of 52.58 was obtained from when received 70 N / fad. and 100 ppm boron.

Table 7. Number of grains/spike of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Number of grains/spike							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	40.00	42.03	45.10	42.37	40.05	43.25	45.00	42.76
	50	42.75	44.24	46.11	44.36	44.22	46.39	48.14	46.25
	70	46.02	48.00	50.21	48.07	47.41	50.90	52.04	50.11
Mean		42.92	44.75	47.14	44.94	43.89	46.84	48.39	46.37
November 15th	30	46.00	49.50	51.73	49.07	45.46	49.52	51.40	48.79
	50	47.54	49.11	51.72	49.45	49.39	51.35	53.51	51.41
	70	51.55	53.41	55.54	53.50	53.09	55.39	57.62	55.36
Mean		48.36	50.67	52.99	50.67	49.31	52.08	54.17	51.86
December 1st	30	41.05	44.20	46.41	43.88	41.97	46.00	47.81	45.26
	50	44.18	46.87	48.51	46.52	46.02	48.98	50.14	48.38
	70	48.01	50.41	51.99	50.13	49.22	53.02	54.37	52.20
Mean		44.41	47.16	48.97	46.84	45.73	49.33	50.77	48.61
Means of N-rates	30	42.35	45.24	47.74	45.11	42.49	46.25	48.07	45.60
	50	44.82	46.74	48.78	46.78	46.54	48.90	50.59	48.68
	70	48.52	50.60	52.58	50.57	49.90	53.10	54.67	52.56
Mean		45.23	47.53	49.70		46.31	49.42	51.11	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	0.70	1.44
Nitrogen (N)	0.24	1.61
Boron (B)	0.41	0.68
S X N	0.41	NS
S X B	NS	NS
N X B	0.70	NS
S X N X B	NS	NS

3- 1000-grain weight (g).

Data in Table (8) showed that sowing dates of wheat plants had significant effect on 1000- grains weight in both seasons. It was detected that the highest values of 1000-grains weight g (39.75 and 40.84 g) in the first and the second seasons, respectively, were derived from sowing wheat on 1st Dec. in the first season, while in the second season its resulted from sowing on 15th Nov., respectively. The results may be due to the effect of environmental conditions i.e. temperature and light intensity which allow to better establishment and vegetative growth, hence formation good canopy to increasing photosynthesis process, which might interpret the increase grain yield /plant and this might account much for a good grain filling and subsequently higher grains index. These results are in line with those obtained by Fadle *et al.* (2016) and Abd El-Hadi *et al.* (2018)

Applications of nitrogen fertilizer to wheat plants had a significant effect on 1000- grains weight in two seasons.

The highest 1000- grains weight values (40.56 and 40.48 g) were obtained when nitrogen was applied at 70 kg N/ fad. in both seasons, respectively. This reflects the important of nitrogen in building up the photosynthetic area of wheat plants and consequently accumulation of more dry matter, which is reflected in 1000- grains weight. These results are in accordance with those found by Bayoumi and El-Demardash (2008), Gehan *et al.* (2011) and Fadle *et al.* (2016).

The application of boron to wheat plants exerted a significant influence on 1000- grains weight in both seasons.

In general, the highest 1000- grains weight were recorded when boron extract applied to wheat plants at rate of 100 ppm in 2016/2017 and 2017/2018 seasons. This may be due to that boron increased the vegetative growth of wheat, in addition to the role of boron in enhancing photosynthesis process. These results are in accordance with those found by Tahir *et al.* (2009), Rehman *et al.* (2012) and Mahdi *et al.* (2013).

The interaction between sowing dates x boron had significant effect on 1000- grains weight in the second season only, where the highest value of 44.47 g was obtained from sowing wheat in 1st December and 100 ppm boron, also, 1000- grains weight were significantly affected by the interaction between nitrogen x boron in the second season only. The second order interaction exerted significant effect on 1000- grains weight in 2017/2018 season only, where the highest value of 43.61 g was obtained from sowing wheat plants in 15th November when received 70 N / fad. and 100 ppm boron.

Table 8. 1000-grains weight (g) of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		1000-grains weight (g)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	32.33	33.24	35.95	33.84	33.85	34.51	46.63	38.33
	50	33.01	35.41	36.91	35.11	35.96	37.21	38.00	37.05
	70	35.10	36.93	38.36	36.79	36.01	38.90	39.71	38.20
Mean		33.48	35.19	37.07	35.24	35.27	36.87	41.44	37.86
November 15th	30	36.66	37.74	39.41	37.93	38.17	39.32	41.38	39.62
	50	38.42	39.80	41.25	39.82	39.23	41.05	42.00	40.76
	70	39.54	41.13	42.21	40.96	40.45	42.40	43.61	42.15
Mean		38.20	39.55	40.95	39.57	39.28	40.92	42.92	40.84
December 1st	30	36.13	36.99	38.56	37.22	36.83	36.87	48.99	40.89
	50	36.37	38.00	39.98	38.11	38.84	39.96	41.56	40.12
	70	39.00	51.41	41.38	43.93	39.32	41.08	42.86	41.08
Mean		37.16	42.13	39.97	39.75	38.33	39.30	44.47	40.70
Means of N-rates	30	35.04	35.99	37.97	36.33	36.28	36.90	45.66	39.61
	50	35.93	37.73	39.38	37.68	38.01	39.40	40.52	39.31
	70	37.88	43.15	40.65	40.56	38.59	40.79	42.06	40.48
Mean		36.28	38.96	39.33		37.62	39.03	42.74	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	2.78	1.97
Nitrogen (N)	1.92	2.43
Boron (B)	1.95	1.13
S X N	NS	NS
S X B	NS	1.96
N X B	NS	1.96
S X N X B	NS	3.40

4- Grain yield (ton/fad.).

The presented results in Table (9) indicated that, the sowing dates had significant effect on grain yield (ton/fad.) in the first season only. The highest means of grain yield (2.22 ton/fad.) was obtained on account of sowing wheat plants on 15th Nov. in the first seasons. However, the lowest one of this trait (1.91 ton/fad.) in the first season was obtained from sowing on 1st Nov. The desirable effect of sowing wheat on 15th Nov. on grain yield (ton/fad.) might be ascribed to the seasonal environmental condition during this period such as temperature, day length and light intensity which allow to rapid germination, establishment, vegetative growth, development and ripening consequently increasing dry matter accumulation, yield components as well as grain yield per unit area. It is worthy to mention that, these results are in good agreement with those obtained by Fadle *et al.* (2016) and Abd El-Hadi *et al.* (2018)

It could be concluded that varying the applied nitrogen rates had a significant effect on grain yield (ton/fad.) in 2016/2017 and 2017/2018 seasons, where the highest grain yield (ton/fad.) values (2.32 and 2.24 ton/fad.) were obtained when nitrogen was applied at a rate of 70 kg N/ fad. in both seasons, respectively. These results might be attributed to the role nitrogen plays in plant growth and development nitrogen shortage within plant tissue result might be reduction in foliage and roots expansion, loss in photosynthetic efficiency and disturbance of all metabolic functions. Our results are in good agreement with this obtained by Fadle *et al.* (2016).

It could be concluded that applied boron had significant effect on grain yield (ton/fad.) in two seasons, where the highest grain yield (ton/fad.) (2.25 and 2.41 ton/fad.) were obtained when boron applied at a level of 100 ppm in both seasons, respectively. This may be due to that boron increased the vegetative growth of wheat, in addition to the role of boron in enhancing photosynthesis process. It is worthy to mention that these results are in good agreement with those obtained by Tahir *et al.* (2009) and Rehman *et al.* (2012).

All studied interactions had no significant effect on such character in the two seasons.

Table 9. Grain yield (ton/fad.) of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Grain yield (ton/fad.)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	1.49	1.66	1.80	1.65	1.44	1.77	2.03	1.74
	50	1.63	2.00	2.19	1.94	1.85	2.02	2.14	2.00
	70	2.13	2.09	2.21	1.14	2.09	2.15	2.34	2.19
Mean		1.75	1.91	2.06	1.91	1.79	1.98	2.17	1.98
November 15th	30	1.83	2.04	2.10	1.99	2.00	2.14	2.31	2.15
	50	2.10	2.04	2.53	2.22	2.10	2.43	2.60	2.37
	70	2.21	2.49	2.67	2.45	2.34	2.63	2.81	2.59
Mean		2.04	2.19	2.43	2.22	2.14	2.40	2.57	2.37
December 1st	30	1.86	1.93	2.05	1.94	1.54	2.04	2.35	1.97
	50	1.83	2.18	2.25	2.08	2.14	2.36	2.44	2.31
	70	2.33	2.26	2.51	2.36	2.25	2.43	2.66	2.44
Mean		2.00	2.12	2.27	2.13	1.97	2.27	2.48	2.24
Means of N-rates	30	1.72	1.87	1.98	1.86	1.66	1.98	2.23	1.95
	50	1.85	2.07	2.32	2.08	2.03	2.27	2.39	2.23
	70	2.22	2.28	2.46	2.32	2.22	2.40	2.60	2.24
Mean		1.93	2.07	2.25		1.97	2.21	2.41	
L.S.D. at 5% for		2016/2017				2017/2018			
Sowing dates (S)		0.14				NS			
Nitrogen (N)		0.31				0.32			
Boron (B)		0.17				0.25			
S X N		NS				NS			
S X B		NS				NS			
N X B		NS				NS			
S X N X B		NS				NS			

5- Straw yield (ton/fad.).

Results in Table (10) showed that, the two studied sowing dates did not significantly differed in straw yield (ton/fed.) in 2016/2017 and 2017/2018 seasons.

The data in Table (10) illustrate that varying the applied nitrogen rates had a significant effect in the second season only, where the highest straw yield value (2.60 ton/fad.) was obtained when nitrogen applied at a rate of 70 kg N/ fad. in the second season. This may be due to that nitrogen fertilizer encouraged the vegetative growth of wheat plants for which plant height as well as tillering capacity could be taken as good criteria. This might interpret the increased straw yield due to nitrogen application. These results are in accordance with those Gehan *et al.* (2011) and Fadle *et al.* (2016).

Table 10. Straw yield (ton/fad.) of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Straw yield (ton/fad.)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	1.73	1.93	2.34	2.00	1.85	2.13	2.29	2.09
	50	2.01	2.17	2.34	2.17	2.10	2.38	2.61	2.36
	70	2.11	2.31	2.41	2.27	2.38	2.47	2.53	2.46
Mean		1.95	2.13	2.36	2.15	2.11	2.32	2.47	2.30
November 15th	30	2.20	2.44	2.58	2.64	2.22	2.42	2.53	2.39
	50	2.41	2.78	2.74	2.74	2.40	2.63	2.74	2.59
	70	2.65	2.76	2.81	2.36	2.53	2.75	2.86	2.71
Mean		2.42	2.66	2.71	2.59	2.38	2.60	2.71	2.56
December 1st	30	2.00	2.21	2.88	2.36	2.05	2.33	2.45	2.27
	50	2.26	2.56	2.72	2.51	2.31	2.50	2.63	2.48
	70	2.63	2.75	2.81	2.73	2.49	2.69	2.74	2.64
Mean		2.29	2.50	2.80	2.53	2.28	2.50	2.60	2.46
Means of N-rates	30	1.97	2.19	2.60	2.25	2.04	2.29	2.42	2.25
	50	2.22	2.50	2.60	2.44	2.27	2.50	2.66	2.47
	70	2.46	2.60	2.67	2.58	2.46	.2.63	2.71	2.60
Mean		2.22	2.43	2.62		2.26	2.47	2.59	
L.S.D. at 5% for		2016/2017				2017/2018			
Sowing dates (S)		NS				NS			
Nitrogen (N)		NS				0.13			
Boron (B)		0.23				0.22			
S X N		NS				NS			
S X B		NS				NS			
N X B		NS				NS			
S X N X B		NS				NS			

Table (10) indicated that application of boron to wheat plants exerted a significant influence on straw yield in 2016/2017 and 2017/2018 seasons. In general, the highest straw yield/fad. was recorded when applied boron of 100 ppm in the two seasons. Boron is one of the essential micronutrients required for plant growth and productivity. It plays an important role in cell wall synthesis, RNA metabolism and root elongation as well as phenol metabolism. These results agree with this obtained Rehman *et al.* (2012). All studied interactions had no significant effect on such character in the two seasons.

C-Grain quality:-

1-Protein percentage.

The results presented in Table (11) showed that, the two studied sowing dates did not significantly differed in protein percentage in 2016/2017 and 2017/2018 seasons.

The data indicated that nitrogen fertilizer had significantly increased protein percentage in both seasons. The highest values (10.76 and 10.83%) were obtained when nitrogen was applied at a rate of 70 kg N/fad. during 2016/2017 and 2017/2018 seasons, respectively. N plays a major role in plant growth and development, its shortage within plant tissue resulted in reduction in foliage and roots expansion, loss in photosynthetic efficiency and disturbance of all metabolic functions. These results are in accordance with those found by Bayoumi and El-Demardash (2008) and Gehan *et al.* (2011)

The results indicate that boron significantly increased protein content in wheat grains in both seasons. The highest values of 10.65 and 10.82 % were obtained when boron was applied at a level of 100 ppm in 2016/2017 and 2017/2018 seasons, respectively. In this respect, high content protein may be a direct result for high rates of photosynthesis with great efficiency. These results are in accordance with this found by Islam and Jahiruddin (2008)

The Results revealed that, protein content was not significantly affected by the interactions among experiment factors.

Table 11. Protein (%) of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Protein (%)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	8.01	8.93	9.82	8.92	8.88	9.32	9.63	9.27
	50	8.82	9.95	10.31	9.69	9.24	10.24	10.71	10.06
	70	9.51	10.87	11.21	10.53	9.65	10.81	11.70	10.72
	Mean	8.78	9.91	10.44	9.71	9.25	10.12	10.68	10.02
November 15th	30	8.42	9.47	9.74	9.21	9.02	9.81	10.00	9.61
	50	9.35	10.44	11.61	10.46	9.47	10.45	11.01	10.31
	70	10.10	11.33	11.70	11.04	9.83	11.02	11.86	10.90
	Mean	9.29	10.41	11.01	10.24	9.44	10.42	10.95	10.27
December 1st	30	8.11	9.10	9.75	8.98	9.01	9.53	9.80	9.44
	50	9.02	10.06	10.28	9.78	9.43	10.40	10.92	10.25
	70	9.69	11.00	11.47	10.72	9.83	10.95	11.81	10.86
	Mean	8.94	10.05	10.50	9.83	9.42	10.29	10.84	10.18
Means of N-rates	30	8.18	9.16	9.77	9.03	8.97	9.55	9.81	9.44
	50	9.06	10.15	10.73	9.98	9.38	10.36	10.88	10.20
	70	9.76	11.06	11.46	10.76	9.77	10.92	11.79	10.83
	Mean	9.00	10.12	10.65		9.37	10.28	10.82	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	NS	NS
Nitrogen (N)	0.27	0.43
Boron (B)	0.31	0.33
S X N	NS	NS
S X B	NS	NS
N X B	NS	NS
S X N X B	NS	NS

1- Carbohydrate percentage.

Illustrated results in Table (12) clearly indicated that, sowing dates significantly affected carbohydrate content in wheat grains in both seasons. As seen from obtained results, sowing wheat plants on 15th Nov. achieved maximum increase in carbohydrate content (57.73 and 57.67%) in the first and the second seasons, respectively. On contrary of that, the lowest means of carbohydrate content (57.14 and 54.86%) were product due to sowing wheat plants on 1st Nov. in the first and the second seasons, respectively.

The data in Table (12) illustrate that varying the applied nitrogen rates had significantly increased carbohydrate percentage in both seasons. The highest values (59.65 and 59.55%) were obtained when nitrogen was applied at a rate of 70 kg N/fad. during 2016/2017 and 2017/2018 seasons, respectively. Nitrogen plays a major role in plant growth and development, its shortage within plant tissue resulted in reduction in foliage and roots expansion, loss in photosynthetic efficiency and disturbance of all metabolic functions. These results are in accordance with those found by Bayoumi and El-Demardash (2008) and Gehan *et al.* (2011)

The results indicate that boron significantly increased carbohydrate content in wheat grains in both seasons. The highest values of 59.08 and 58.17 % were obtained when boron was applied at a level of 100 ppm in two seasons, respectively.

The presented Table (12) results show that carbohydrate content were significantly affected by the interactions of nitrogen x boron in the second season only. The other interactions did not show significant effect on this trait.

Table 12. Carbohydrate (%) of wheat plant as affected by sowing dates, nitrogen fertilization, boron spraying and their interaction in the two seasons.

Characters		Carbohydrate (%)							
Seasons		2016/2017				2017/2018			
Sowing dates	Nitrogen fertilizers (kg/fad.)	Foliar with boron (ppm) Cont.	50	100	Mean	Foliar with boron (ppm) Cont.	50	100	Mean
November 1st	30	52.63	55.01	56.10	54.58	50.01	50.20	51.63	50.61
	50	55.74	57.90	59.01	57.55	51.00	53.41	59.48	54.63
	70	57.60	59.32	61.01	59.31	57.68	59.14	61.20	59.34
Mean		55.32	57.41	58.70	57.14	52.89	54.25	57.43	54.86
November 15th	30	53.22	55.01	57.14	55.12	53.49	55.55	56.72	55.25
	50	55.50	58.69	59.74	57.97	55.91	58.53	59.68	58.04
	70	58.02	60.58	61.70	60.10	58.20	59.45	61.56	59.73
Mean		55.58	58.09	59.52	57.73	55.86	57.84	59.32	57.67
December 1st	30	52.99	55.20	56.36	54.85	50.40	50.48	51.95	50.94
	50	56.00	58.12	59.25	57.79	51.28	53.63	59.70	54.87
	70	57.71	59.54	61.43	59.08	57.81	59.35	61.62	59.59
Mean		55.56	57.62	59.01	57.40	53.16	54.48	57.75	55.13
Means of N-rates	30	52.94	55.07	56.53	54.85	51.30	52.07	53.43	52.27
	50	55.74	58.23	59.33	57.77	52.73	55.19	59.62	55.84
	70	57.77	59.81	61.38	59.65	57.89	59.31	61.46	59.55
Mean		55.59	57.70	59.08		53.97	55.52	58.17	

L.S.D. at 5% for	2016/2017	2017/2018
Sowing dates (S)	0.25	0.69
Nitrogen (N)	0.37	2.37
Boron (B)	0.35	0.89
S X N	NS	NS
S X B	NS	NS
N X B	NS	1.53
S X N X B	NS	NS

REFERENCES

A.A.C.C (2000). American Association of Cereal Chemists. Approved Methods of the AACC, 10th ed. St. Paul. Minnesota, USA.

Abd El-Hadi, S. M. H.; A. A-G. Ali; A. E. A. Omar and E. E. A .El-Sobky (2018). Influence of sowing date, varietal difference and planting density on productivity of wheat crop (*Triticum aestivum,* L.). Zagazig J. Agric. Res.,. 45 (1): 1- 21.

Bayoumi, T.Y. and I.S. El-Demardash (2008). Influence of nitrogen application on grain yield and end use quality in segregating generations of bread wheat (*Triticum aestivum L*). African J. of Biochemistry Research 2 (6): 132-140.

Dubois, M., Gilles, K.A., Hamilton, J.K., Robers, P.A., and F. Smith (1956). Colorimetric method for determination of sugar and related substances. Anal. Chem., 28 (3): 350–356.

Fadle, A. A. H.; A. Y. A. El- Bana; A. E. A. Omar and M. E. I. Abdul Hamid (2016). Response of some wheat cultivars to varying sowing dates and nitrogen fertilizer levels under sandy soil conditions. Zagazig J. Agric. Res., 43 (1): 29- 48.

Freed, R.S.P.; S.P. Eisensmith; S. Goetez; D. Reicosky; V.W. Smail and P. Wolberge (1989). Users guide to MSTAT-C.A software program for the design, moorage regiment and analyses of agronomic research experiments Michigan State University, U.S.A.

Gehan A.M. Amin, H.G. Geweifel, M.A. Gomaa, M. A. El-kholy and Magda, H. Mohamed (2011). Effect of sowing methods and fertilization on yield analysis and grain quality of wheat under new reclaimed sandy soil. J. of Applied Sci., Res., 7(12): 1760-1767.

Gheith, E. M. S.; O. Z. El-Badry and S. A. Wahid (2013). Response of growth and straw yield of some wheat genotypes to sowing dates and nitrogen levels. Zagazig J. Agric. Res.,. 40 (5): 809- 815.

Gomez, K. A. and A. A. Gomez (1984). Statistical Procedures for Agricultural Research 2nd ed. John Wiley and Sons, Inc. New York.

Islam, M. S. and M. Jahiruddin (2008). Effect of boron and sowing dates on the nutrients concentration and uptake in wheat (*Triticum aestivum* L.). The Agriculturists 6 (1&2): 15-22.

Mahdi, Z.; M. Zadehbagheri and A. Azarpanah (2013). Influence of potassium and boron on some traits in wheat (*Triticum aestivum* L. , cv. Darab-2). The International J. of Biotechnology, 2 (8):141-153.

Marschner, H.(1995). Mineral nutrition in Higher plants. Academic Press, London.

Palamiswamy, K.M and K.A. Gomex (1974). Length-width method for estimating leaf area of rice. Agron., J., 66:430-433.

Rawashdeh, H. M. and F. Sala (2014). Foliar application of boron on some yield components and grain yield of wheat. Acad. Res. J. Agric. Sci. Res., 2 (7): 97-101.

Rehman, S.U.; N. Hussain; M. Tariq; M. Hussain; M. Nasir and M. Ayaz (2012). Response of wheat to exogenous boron supply at various growth stages. Sarhad J. Agric., 28 (3): 411- 414.

Santosh, K. (2011). Yield response of uniculm wheat (*Triticum aestivum* L.) to early and late application of nitrogen: Flag leaf development and senescence. J.of Agric. Sci. 3 (1): 170-182.

Srivastava, P.C.; U.C.Gupta (1996). Trace Elements in crop production. Science Pub.Inc. Lebanon, NHO3766 USA. 366 P. P.

Tahir, M.; A. Tanveer; T. H. Shah; N. Fiaz and A. Wasaya (2009). Yield response of wheat (*Triticum aestivum* L.) to boron application at different growth stages. Pak. j. Life Soc. Sci., 7 (1): 39 - 42.

تأثير مواعيد الزراعة ومعدلات منخفضة من التسميد النيتروجيني والرش بالبورون علي إنتاجية وجودة القمح

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أجريت تجربتان حقليتان بمزرعة مركز البحوث الزراعية - جامعة الأزهر بأسيوط خلال موسمي ٢٠١٧/٢٠١٦ و ٢٠١٨/٢٠١٧م بهدف دراسة تأثير ثلاثة مواعيد للزراعة (١ نوفمبر، ١٥ نوفمبر و١ ديسمبر)، ثلاث معدلات من السماد النيتروجيني (٣٠, ٥٠ و ٧٠ كجم نيتروجين/ فدان) والرش الورقي بالزنك بتركيز (كنترول، ٥٠ و١٠٠ مليجرام/لتر) وأثر ذلك علي المحصول وجودة القمح. وقد إستخدم تصميم القطاعات الكاملة العشوائية في القطع المنشقة مرتين في ثلاث مكررات حيث وضعت مواعيد الزراعة في القطع الرئيسية بينما وضعت معدلات التسميد النيتروجيني وتركيزات البورون في القطع المنشقة و المنشقة مرتين علي الترتيب. و أظهرت النتائج المتحصل عليها أن تأثير مواعيد الزراعة كان معنوياً علي صفة طول النبات، مساحة ورقة العلم، عدد الحبوب/سنبلة ، وزن ١٠٠٠ حبة والنسبة المئوية للكربوهيدرات في كلا الموسمين، بينما كان التأثير معنويا في عدد السنابل/ م٢ في الموسم الثاني فقط ومحصول الحبوب /فدان في الموسم الأول فقط, أما عدد الأشطاء/نبات ، محصول القش/ فدان والنسبة المئوية للبروتين فكان التأثير غير معنوي في الموسمين, كما سجل موعد الزراعة في ١٥ نوفمبر في جميع الصفات المدروسة أعلي القيم فيما عدا صفة وزن ١٠٠٠ حبة في الموسم الأول فقط والتي سجلت بالزراعة في ١ ديسمبر. أدي زيادة معدلات التسميد النيتروجيني من ٣٠ , ٥٠ إلي ٧٠ كجم نيتروجين / فدان إلي زيادة معنوية في كل الصفات تحت الدراسة في كلا الموسمين، فيما عدا صفة محصول القش/ فدان في الموسم الثاني فقط.أدي الرش بالبورون إلي زيادة معنوية في طول النبات, عدد الأشطاء/نبات, مساحة ورقة العلم, عدد السنابل/ م٢, عدد الحبوب/سنبلة, وزن ١٠٠٠ حبة ومحصولي الحبوب والقش/فدان والنسبة المئوية للبروتين والكربوهيدرات في الحبوب في كلا الموسمين .أدي التفاعل بين مواعيد الزراعة والتسميد والنيتروجيني إلي تأثير معنوي في صفة عدد الحبوب/سنبلة في الموسم الأول فقط, كما أدي التفاعل بين مواعيد الزراعة والبورون تأثير معنوي في صفة طول النبات في الموسم الأول فقط, وعدد السنابل/ م٢ ووزن ١٠٠٠حبة في الموسم الثاني فقط، وكان التفاعل بين التسميد النيتروجيني والبورون معنوياً في صفة طول النبات وعدد الحبوب/سنبلة في الموسم الأول فقط ووزن ١٠٠٠حبة في الموسم الثاني فقط. أما التفاعل الثلاثي فكان معنوياً في صفة طول النبات في الموسم الأول فقط ووزن ١٠٠٠حبة في الموسم الثاني فقط.وبصفة عامة توصي الدراسة بزراعة القمح في ١٥ نوفمبر وإضافة السماد النيتروجيني بمعدل ٧٠ كجم نيتروجين/فدان مع الرش بالبورون بتركيز ١٠٠ مليجرام/لتر وذلك لتحقيق أعلي إنتاجية وجودة من محصول القمح تحت ظروف محافظة أسيوط.