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EFFECT OF SOWING DATES AND SEED TREATMENTS ON PRODUCTIVITY AND SEED QUALITY OF SOME WHEAT CULTIVARS

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ABSTRACT

A field trial and a laboratory experiment were conducted during 2011/2012 and 2012/2013 seasons. The main objective of this research was to study the performance of some wheat cultivars as affected by sowing dates and seed treatments and their effect on growth, yields and its components and seed quality. Each sowing date (10th November, 25th November and 10th December) was practiced in separate experiments. Every experiment was carried out in split-plot design with four replications. The main plots were occupied with wheat cultivars (Sakha 93, Sakha 94 and Gemmiza 10). The sub-plots were assigned to seed treatments (without seed treatment, treated seed with fungicide Vetavax and soaking seed in the mixture of Fe + Zn).

Results showed that early sowing date (10th November) markedly resulted in the highest values of growth, yields and its components, shoot and root length and seedlings dry weight. Whereas, sowing on 25th November came in the second rank and resulted in the highest values of germination % and speed of germination. While, delay sowing wheat up to 10th December came in the last rank and resulted in the highest values of protein %.

Gemmiza 10 cultivar surpassed other studied cultivars (Sakha 93, Sakha 94) and recorded the highest values of flag leaf area, spike length, number of grains/spike, grains weight/spike, 1000-grain weight, grain yield/fed, speed of germination, and seedlings dry weight. While, Sakha 94 cultivar recorded the highest values of plant height, number of spikes/m^2, straw yield/fed, shoot and root lengths. However, Sakha 93 cultivar recorded the highest values of protein % and germination %.

Soaking wheat seeds before sowing in the mixture of Fe + Zn surpassed other studied seed treatments and resulted in the highest means of all studied characters. Treated wheat seeds with fungicide "Vetavax" followed by aforementioned treatment.

It can be concluded that, sowing Gemmiza 10 cultivar on 10th November and treated its seeds before sowing with mixture of micronutrients (Fe + Zn) could be recommend to maximize wheat productivity and quality of grains and seeds under the environmental conditions of Dakahlia Governorate.

Keywords: Wheat, sowing dates, planting dates, cultivars, varieties, seed treatments, Vetavax, Fe, Zn, yield, seed quality.

INTRODUCTION

Wheat (*Triticum aestivum vulgare* L.) is considered as a strategic cereal crop and the main food for the Egyptians. In Egypt, the gap between wheat consumption and production is continuously increased due to steady increases in the country population with limited cultivated area. Thus, using suitable sowing dates, promising cultivars and seeds treatments are very important to increase wheat productivity.

Sowing dates of wheat is considered one of the most important cultural practices that influenced its growth, productivity and seed quality. Thus, sowing wheat on suitable date according to environmental conditions of region is best method to maximize growth, yields and quality characters of seed. In this respect, Amin *et al.* (2010) revealed that delaying sowing to 30th Nov. gave the tallest plants, greater number of spikes/m^2, heavier grains weight/spike. Early sowing date (15th Nov.) was more optimum to produce the highest grain yield. Jalota *et al.* (2010) showed that grain yields of wheat were more in early November planted. Seleiman *et al.* (2011) revealed that sowing date on 15th November surpassed the other sowing dates in all growth, yield and its components as well as grain quality characters. Gul *et al.* (2012) reported that highest standard germination, speed of germination, shoot and root lengths and seedling dry weight were recorded under 24th October sowing, but lowest values were obtained under delay sowing. Haroun, Samia *et al.* (2012) showed that sowing wheat on the control date (20th Nov.) surpassed the other sowing dates in all growth and yield and its components characters. Lak *et al.* (2013) showed that the highest grain yield (10.15 t/ha) produced from sowing on 15th November, whereas the lowest grain yield (6.1 t/ha) resulted from sowing on 30th December.

Chosen the high yielding ability cultivars undoubtedly is very important to raise wheat productivity per unit area. For this reason, this study is aiming to evaluate the new promising cultivars with the old traditional ones for scooping light on the best cultivars that can be used under the environmental conditions of study region. In this regard, Omar *et al.* (2011) reported that highly significant differences occurred among wheat genotypes for grain yield and its component characters. Sids 13 cultivar gave the highest number of spikes/m^2 as compared to the other genotypes, while Gemmieza 11 had the lowest value. Gemmieza 11 recorded the heaviest 1000-grain weight than those of other genotypes. On the other hand, Sids 13 recorded the lowest grain weight. Sids 12 recorded the highest grain yield as compared with other genotypes. El-Metwally *et al.* (2012) found that the largest flag leaf area was that of Sakha 93 and Gemmeiza 9. Sakha 94 cultivar significantly surpasses all cultivars in plant height, while Gemmeiza 10 gave the highest number of spikes/m^2, while 1000-grain weight of Sakha 93 was the largest. The highest grain yield was achieved with Sakha 94 and Gemmeiza 9. Gul *et al.* (2012) found that wheat crop responded differently to studied cultivars. Highest standard germination, speed of germination, shoot and root lengths and seedling dry weight were recorded from Khyber-87 cultivar. Harb *et al.* (2012) revealed that Gemmeiza 9 cultivar exceeded Sakha 93 cultivar significantly for number of spikes/m^2, weight of grains/spike, number of

grains/spike, 1000-grain weight and grain yield/fed. Haroun, Samia *et al.* (2012) revealed that significant differences were observed among used cultivars (Sakha 94, Gemmeiza 9 and Giza 168) as compared to the control cultivar (Sakha 93). Thus, Gemmeiza 9 gave the highest values of heading date, plant height, number of spikes/m^2, 1000-grain weight, grain, straw and biological yields/fed. Atia and Ragab (2013) found that wheat cultivars significantly differed in grain and straw yields, as well as protein content. Gemmeiza 9 cultivar had the highest mean value of grain and straw yields, protein content of grains. Lak *et al.* (2013) showed that Parsi cultivar has the highest grain yield (10.23 t/ha) and the Pishtaz cultivar has the lowest grain yield (8.59 t/ha). Noureldin, Nemat *et al.* (2013) showed significant differences among the tested wheat cultivars (Giza-168, Sakha-94, Gemmeiza-10, and Sids-12) for number of spikes/m^2, spike length, number of grains/spike, grains weight/spike, weight of 1000-grain, grain and straw yields/fed. Gemmeiza-10 along with Sids-12 produced the highest weight of 1000-grain surpassing the other cultivars. Gemmeiaza-10 was the superior cultivar for producing higher grain yield, but statistically leveled with Sakha-94. Moreover, straw yield of Giza-168 was higher than each of other cultivars. Seleem and Abd El –Dayem (2013) showed that the highest significant value of grain yield was obtained by Gemmeiza 9 followed by Misr 1 then Sakha 94 and Giza 168. Vice versa, the lowest ones were observed when the cultivar of Sakha 93 was sown.

The concept of seed treatment is the use and application of biological and chemical agents that control or contain primary soil and seed borne infestation of insects and diseases which pose devastating consequences to crop production and improving crop safety leading to good establishment of healthy and vigorous plants resulting better yields. Seed treatment with fungicides like, Vitavax sowing was better to maintain germination and to prevent fungal growth instead of treatment after sowing. Malaker and Mian (2009) found that seed treatment with either Vitavax-200 or Homai-80 WP significantly increased grain yield of wheat. Samobor *et al.* (2010) reported that treated wheat seed with Vitavax 200 FF treatment had higher grain yield than the other studied treatments. Šantavec and Kocjan Ačko (2011) found that seed treatment with fungicides Maxim 050 FS and Vitavax 200-FF had significantly improved the health status and consequently grain yield as compared to untreated processed seed. Seed treatments with micronutrient are an attractive and easy alternative method to give plant with requirements of micronutrient. Yadav *et al.* (2008) stated that among all seed treatments, seed soaked with 0.5 % zinc sulfate + 0.2 % urea + 2 % salt solution gave better and early germination, yield attributes and produced significantly highest grain yield. Farooq *et al.* (2012) reported that micronutrient application through seed treatments improves germination characters and increased yields. Kumar and Singh (2012) reported that significantly better growth of wheat was achieved in sprouted seed followed by water soaked seed and seed treated with $ZnSO_4$ as compared with dry seed. Rufino *et al.* (2013) concluded that wheat seeds treated with zinc is positively influenced germination characters. The grain yield was increased when seeds were treated before sowing with Zn.

Therefore, this investigation was established to determine the effect of sowing dates and seed treatments of some wheat cultivars as well as their interactions on growth, yields and its components as well as seed quality under the environmental conditions of Tag El-Ezz district, Dakahlia Governorate.

MATERIALS AND METHODS

Field studies:

Two field experiments were conducted at the Agricultural Research Station Farm in Tag Al-Ezz, Dakahlia Governorate, Agricultural Research Center, Egypt during the two winter seasons of 2011/2012 and 2012/2013 to determine the effect of sowing dates and seed treatments of some wheat cultivars as well as their interactions on growth, yields and its components and seed quality.

Each sowing date (10^{th} November, 25^{th} November and 10^{th} December) was practiced in separate experiments. Every experiment was carried out in split-plot design with four replications. The main plots were occupied with wheat cultivars (Sakha 93, Sakha 94 and Gemmiza 10). The sub-plots were assigned to seed treatments as follows: 1) Without seed treatment. 2) Treated seed with fungicide Vetavax at the rate of 3 g/1 kg seeds for 2 minutes. 3) Soaking seed in the mixture of iron (Fe) and zinc (Zn) at the rate of 500 ppm of each for 10 hours.

Each experimental unit area was 3 X 3.5 m occupying an area of 10.5 m^2 (*i.e.* 1/400 fed). The preceding summer crop was rice (*Oryza sativa* L.) in both seasons. The soil was clay loam in texture with an electrical conductivity (EC) of 2.30 dS/m and a pH of 7.68.

The experimental field was well prepared through two ploughings, compaction and then divided into the experimental units with dimensions as previously mentioned. Calcium super phosphate (15.5 % P_2O_5) was applied during soil preparation (after ploughing and before division) at the rate of 150 kg/fed.

Wheat seeds at the rate of 75 kg/fed were sown by using broadcasting Afir method in previously mentioned dates. The nitrogen fertilizer in the form of ammonium nitrate (33.5 % N) was applied at the rate of 80 kg N/fed as side – dressing in two equal doses before the first and the second irrigations. Potassium sulphate (48 % K_2O) at the rate of 50 kg/fed was broadcasted in one dose before the second irrigation. The first irrigation was applied at 25 days after sowing and then plants were irrigated every 21 days till the dough stage. The common agricultural practices for growing wheat according to the recommendations of Ministry of Agriculture were followed, except the factors under study.

After 120 days from sowing, one square meter was randomly choice from each sub – plot to estimate the following characters:

1- Flag leaf area (cm^2). 2- Plant height (cm).

At harvesting, one square meter was randomly selected from each sub – plot to estimate the following characters:

3- Number of spikes/m^2.
4- Spike length (cm).
5- Number of grains/spike.
6- Grains weight/spike (g).
7- 1000 – grain weight (g).
8- Grain yield (ardab/fed).
9- Straw yield (heml /fed).
10- Crude protein percentage in grains. It was estimated by the improved Kjeldahl – method according to A.O.A.C. method (1990).

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split – plot design to each experiment (sowing dates), then combined analysis was done between sowing dates as published by Gomez and Gomez (1984) by means of "MSTAT-C " computer software package. Least significant of difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described by Snedecor and Cochran (1980).

Laboratory studies:

A laboratory experiment was carried out to assess seed quality resulted from the field experiments. Random sample of 400 seeds per each treatment were sown on sand in sterilized Petri-dishes (14-cm diameter). Each Petri-dish contained 25 seeds, and four Petri-dishes kept close together and incubated at 20º C and 100 % relative humidity, then four replications were used to evaluate every seed test done on each treatment as the rules of International Seed Testing Association (ISTA, 1985) as follows:

1- Germination percentage. It was expressed by the percentage of seed germinating normally after 8 days from sowing.
2- Rate of germination: The four replications of germination test were used to evaluate rate of germination according to Barteltt(1937).
3- Shoot length (cm).
4- Root length (cm).
5- Seedling dry weight (g).

Collected data were subjected to the statistical analysis according to the technique of analysis of variance (ANOVA) as field experiment. Least significant of difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Effect of sowing dates:

Sowing dates caused significant effects on wheat growth, yields and its components in both seasons as shown from data presented in Tables 2 and 3. Early sowing date (10^{th} November) markedly resulted in the highest values of flag leaf area, plant height, number of spikes/m^2, spike length, number of grains/spike, grains weight/spike, 1000-grain weight, grain and straw yields/fed as compared with other studied sowing dates in both seasons. The intermediate sowing date (25^{th} November) was ranked secondly after early date without significant differences between them as to its effect on plant height, number of spikes/m^2 in both seasons, number of grains/spike and 1000-grain weight in the first season. Late sowing date (10^{th}

December) showed the lowest values of wheat growth, yields and its components in both seasons.

Table 2: Flag leaf area, plant height and number of spikes/m^2, spike length and number of grains/spike as affected by sowing dates and seed treatments of some wheat cultivars as well as their interactions during 2011/2012 and 2012/2013 seasons.

Characters / Seasons / Treatments	Flag leaf area (cm^2)		Plant height (cm)		Number of spikes/m^2		Spike length (cm)		Number of grains/spike	
	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013
A- Sowing dates:										
10th November	31.93	31.80	99.90	99.50	399.9	411.4	11.54	11.85	53.02	53.82
25th November	31.28	30.92	99.31	98.79	391.6	402.2	11.02	11.39	52.31	51.83
10th December	29.65	29.43	97.66	96.83	363.7	376.0	10.29	10.54	49.00	48.86
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.57	0.32	1.41	1.04	8.0	5.1	0.23	0.16	0.97	0.70
B- Cultivars:										
Sakha 93	29.88	29.90	101.18	99.59	363.4	389.1	9.30	9.40	48.31	48.25
Sakha 94	29.82	29.55	104.92	103.68	401.8	411.1	10.69	11.28	52.37	52.28
Gemmiza 10	33.15	32.69	90.78	91.86	390.0	389.5	12.86	13.09	53.64	53.98
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.61	0.48	1.46	1.17	9.7	7.7	0.28	0.17	1.09	0.75
C- Seed treatments:										
Without	28.48	27.81	95.48	94.49	334.9	359.9	9.83	10.24	43.45	43.75
Fungicide	30.84	30.68	97.86	97.40	378.9	378.7	10.69	10.89	47.90	47.96
Microelements	33.54	33.65	103.54	103.24	441.5	451.1	12.33	12.65	62.97	62.79
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.55	0.43	1.30	0.95	7.4	7.1	0.21	0.16	1.04	0.69
D- Interactions:										
A × B	*	*	NS	NS	*	*	NS	*	NS	NS
A × C	NS	*	NS	NS	NS	NS	NS	NS	NS	*
B × C	*	*	*	*	*	*	*	*	*	*
A × B × C	NS	NS	NS	NS	*	*	NS	NS	NS	*

There were significant differences among the three sowing dates on wheat quality in both seasons (Table 4). Early sowing date (10th November) produced the highest values of shoot and root length and seedlings dry weight in both seasons. Whereas, intermediate sowing date (25th November) resulted in the highest values of germination percentage and speed of germination in both seasons. While, delay sowing wheat up to 10th December (late sowing date) resulted in the highest values of protein percentage in both growing seasons.

The desirable effect of sowing wheat on 10th November might be ascribed to the seasonable environmental conditions during this period such as temperature, relative humidity, day length and light intensity which allow to rapid germination, establishment, vegetative growth, development and ripening consequently increasing growth, yield components as well as grain yield per unit area. Confirming these findings, Jalota *et al.* (2010), Seleiman *et al.* (2011), Haroun, Samia *et al.* (2012) and Lak *et al.* (2013).

Table 3: Grains weight/spike, 1000-grain weight, grain and straw yields/fed and protein percentage in grains as affected by sowing dates and seed treatments of some wheat cultivars as well as their interactions during 2011/2012 and 2012/2013 seasons.

Characters / Seasons / Treatments	Grains weight/spike (g)		1000-grain weight (g)		Grain yield (ardab/fed)		Straw yield (heml/fed)		Protein (%)	
	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013
A- Sowing dates:										
10th November	3.36	3.50	40.92	41.41	17.41	18.00	7.79	8.13	11.82	11.52
25th November	3.21	3.34	40.55	40.88	16.40	17.45	7.19	7.52	12.79	12.53
10th December	2.95	3.07	38.43	39.78	14.76	15.83	6.42	6.62	13.33	13.62
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.12	0.09	0.53	0.40	0.26	0.17	0.17	0.11	0.08	0.14
B- Cultivars:										
Sakha 93	2.85	3.08	39.08	39.99	15.77	16.63	7.34	7.75	12.69	12.75
Sakha 94	3.24	3.40	39.75	40.90	15.92	16.97	7.49	7.87	12.63	12.72
Gemmiza 10	3.44	3.43	41.06	41.17	16.88	17.68	6.57	6.65	12.62	12.20
F. test	*	*	*	*	*	*	*	*	NS	*
LSD at 5 %	0.10	0.07	0.37	0.26	0.35	0.30	0.20	0.16	-	0.25
C- Seed treatments:										
Without	2.46	2.68	37.59	37.91	13.26	14.71	6.12	6.32	10.61	11.36
Fungicide	2.99	3.11	40.35	41.17	16.75	17.57	7.21	7.39	12.78	12.37
Microelements	4.07	4.12	41.96	42.98	18.56	19.00	8.08	8.56	14.55	13.93
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.09	0.06	0.38	0.37	0.29	0.23	0.22	0.22	0.23	0.25
D- Interactions:										
A × B	NS	*	*	NS	NS	NS	NS	NS	NS	*
A × C	NS	NS	*	NS	*	*	NS	NS	*	NS
B × C	*	*	*	*	*	*	*	*	*	*
A × B × C	NS	*	*	NS	*	*	NS	NS	*	NS

Cultivars performance:

Significant differences among the three studied wheat cultivars *i.e.* Sakha 93, Sakha 94 and Gemmiza 10 were detected in flag leaf area, plant height, number of spikes/m^2, spike length, number of grains/spike, grains weight/spike, 1000-grain weight, grain and straw yields/fed in both seasons (Tables 2 and 3). Gemmiza 10 cultivar surpassed other studied cultivars (Sakha 93 and Sakha 94) in flag leaf area, spike length, number of grains/spike, grains weight/spike, 1000-grain weight, grain yield/fed, which recorded the highest values of these characters in the two growing seasons. While, Sakha 94 cultivar recorded the highest values of plant height, number of spikes/m^2 and straw yield/fed in the first and second seasons of this study.

The results exhibit significant differences among three wheat studied cultivars in seed quality characters *i.e.* protein percentage as well as germination percentages, speed of germination, shoot root lengths and seedling dry weight in both seasons, except protein content in grains in the first season only (Table 4). Gemmiza 10 cultivar surpassed other cultivars and produced the highest values of speed of germination, and seedlings dry weight in both seasons. While, Sakha 94 cultivar resulted in the highest

values of shoot and root lengths in both seasons. However, Sakha 93 cultivar recorded the highest values of protein percentage in grains and germination percentage in the two growing seasons.

These findings might be attributed to the differences in their genetical constitution and genetic factors makeup. These results are in agreement with those detected by Harb *et al.* (2012), Haroun, Samia *et al.* (2012), Atia and Ragab (2013) and Lak *et al.* (2013).

Table 4: Germination percentage, speed of germination, shoot and root lengths and seedlings dry weight as affected by sowing dates and seed treatments of some wheat cultivars as well as their interactions during 2011/2012 and 2012/2013 seasons.

Characters / Seasons / Treatments	Germination (%)		Speed of germination		Shoot length (cm)		Root length (cm)		Seedlings dry weight (g)	
	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013	2011 /2012	2012 /2013
A- Sowing dates:										
10th November	93.3	94.2	0.538	0.544	9.62	11.14	8.85	10.26	0.198	0.199
25th November	94.3	94.7	0.545	0.545	9.59	10.35	8.56	9.59	0.197	0.197
10th December	93.0	93.3	0.535	0.523	8.63	8.97	7.80	8.31	0.195	0.194
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.0	1.0	0.006	0.007	0.47	0.30	0.35	0.26	0.002	0.003
B- Cultivars:										
Sakha 93	94.0	94.4	0.538	0.536	8.67	9.11	7.75	8.58	0.184	0.184
Sakha 94	92.9	93.5	0.533	0.526	9.64	10.84	8.79	9.88	0.184	0.185
Gemmiza 10	93.7	94.3	0.547	0.550	9.53	10.51	8.67	9.69	0.222	0.221
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	0.8	0.7	0.009	0.011	0.36	0.27	0.22	0.21	0.003	0.004
C- Seed treatments:										
Without	91.0	92.3	0.519	0.509	7.59	8.84	7.58	8.14	0.194	0.194
Fungicide	93.5	93.7	0.532	0.545	8.83	9.94	8.24	9.30	0.196	0.196
Microelements	96.1	96.2	0.568	0.558	11.42	11.68	9.39	10.71	0.202	0.200
F. test	*	*	*	*	*	*	*	*	*	*
LSD at 5 %	1.4	1.3	0.018	0.013	0.30	0.27	0.28	0.24	0.004	0.004
D- Interactions:										
A × B	NS	NS	NS	NS	*	NS	NS	*	NS	NS
A × C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
B × C	NS	NS	NS	NS	*	NS	*	*	*	NS
A × B × C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Effect of seed treatments:

The obtained results clarified that seed treatments *i.e.* treated seeds before sowing with the mixture of micronutrients (Fe + Zn) and fungicide "Vetavax" as compared with treatment (without seeds treatment) had significant effects on flag leaf area, plant height, number of spikes/m^2, spike length, number of grains/spike, grains weight/spike, 1000-grain weight, grain and straw yields/fed in both seasons (Tables 2 and 3). Soaking wheat seeds before sowing in the mixture of iron (Fe) and zinc (Zn) at the rate of 500 ppm of each for 10 hours surpassed other studied seed treatments and resulted in the highest means of all studied characters in the first and second seasons. Treated wheat seeds with fungicide "Vetavax" at the rate of 3 g/1 kg seeds for 2 minutes followed by aforementioned treatment in both seasons. On the

contrary, the lowest means of all studied characters were produced from control treatment (without seed treatment) in the two growing seasons.

The effect of seed treatment on grain and seed quality characters *i.e.* protein percentage as well as germination percentages, speed of germination, shoot root lengths and seedling dry weight was significant in both seasons (Table 4). The maximum values of all studied characters were resulted from soaking wheat seeds before sowing in the mixture of iron (Fe) and zinc (Zn) at the rate of 500 ppm of each for 10 hours in the first and second seasons. However, treated wheat seeds with fungicide "Vetavax" at the rate of 3 g/1 kg seeds for 2 minutes ranked after former treatment concerning these characters in both seasons. On the other direction, the lowest of these characters were obtained from control treatment (without seed treatment) in both seasons.

These results can be ascribed to the role of Vetavax in prevent fungal growth and maintain germination, as well as the role of zinc as an enzymatic activator responsible for growth of the plant, therefore improvement early growth, more dry matter accumulation and stimulation the building of metabolic products, consequently enhancement yield components (number of spikes/m^2, spike length, number of grains/spike, grains weight/spike and 1000-grrain weight) and thus increasing grain yield per feddan. These findings are supported by Samobor *et al.* (2010), Šantavec and Kocjan Ačko (2011), Farooq *et al.* (2012), Kumar and Singh (2012) and Rufino *et al.* (2013).

Effect of interactions:

Regarding the effect of interactions, there are many significant effect of the interactions among studied factors on studied characters. We reported enough the significant interactions on grain yield only. All interactions among sowing dates, cultivars and seed treatments had a significant effect on grain yield/fed, except the interaction between sowing dates and cultivars in either growing seasons (Table 3).

The interaction between sowing dates of wheat and seed treatments had a significant effect on grain yield/fed in both seasons. Data presented in Table 5 show that, the highest values of grain yield/fed (19.46 and 19.71 ardab/fed) were obtained when sowing wheat on early date (10^{th} November) and treated seeds before sowing immediately with mixture of micronutrients (Fe + Zn) in the first and second seasons, respectively. Sowing wheat on 25^{th} November and treated seeds with mixture of micronutrients came in the second rank in both seasons. On the other hand, the lowest values of grain yield/fed were resulted from delay sowing up to 10^{th} December without treated seeds before sowing with any treatment, which were 11.99 and 13.52 ardab/fed in the first and second seasons, respectively.

Grain yield/fed was significantly affected by the interaction between wheat cultivars and seed treatments in both seasons. From data listed in Table 6 indicates that the highest values of grain yield/fed (18.91 and 19.41 ardab/fed) were obtained as a result of treated seeds of Gemmiza 10 cultivar before sowing immediately with mixture of micronutrients (Fe + Zn) in the first and second seasons, respectively. This treatment followed by treated seeds of Sakha 94 cultivar with mixture of micronutrients without significant

differences in both seasons. On the other hand, the lowest values of grain yield/fed were resulted from sowing Sakha 93 cultivar without seed treatment (control), which were 12.70 and 13.92 ardab/fed in the first and second seasons, respectively.

Table 5: Grain yield (ardab/fed) as affected by the interaction between sowing dates of wheat and seed treatments during 2011/2012 and 2012/2013 seasons.

Sowing dates	Seed treatments		
	Without	Fungicide	Microelements
2011/2012 season			
10th November	14.47	18.29	19.46
25th November	13.32	17.16	18.74
10th December	11.99	14.79	17.48
F. test	*		
LSD at 5 %	0.50		
2012/2013 season			
10th November	15.57	18.73	19.71
25th November	15.05	18.09	19.22
10th December	13.52	15.91	18.06
F. test	*		
LSD at 5 %	0.40		

Table 6: Grain yield (ardab/fed) as affected by the interaction between wheat cultivars and seed treatments during 2011/2012 and 2012/2013 seasons.

Wheat cultivars	Seed treatments		
	Without	Fungicide	Microelements
2011/2012 season			
Sakha 93	12.70	16.10	18.18
Sakha 94	13.03	16.45	18.60
Gemmiza 10	14.05	17.69	18.91
F. test	*		
LSD at 5 %	0.51		
2012/2013 season			
Sakha 93	13.92	16.93	18.39
Sakha 94	14.58	17.79	19.19
Gemmiza 10	15.64	18.00	19.41
F. test	*		
LSD at 5 %	0.41		

The interaction among sowing dates**,** cultivars and seed treatments excreted significant effect on grain yield/fed in both seasons. The highest values of grain yield/fed (19.87 and 20.20 ardab/fed) were obtained from sowing Gemmiza 10 cultivar on 10th November and treated its seeds before sowing immediately with mixture of micronutrients (Fe + Zn) in the first and second seasons, respectively (Table 7). This interaction treatment followed by sowing Sakha 94 cultivar on 10th November and treated seeds its seeds with mixture of micronutrients without significant differences among them in both seasons. On the other hand, the lowest values of grain yield/fed were resulted from sowing Sakha 93 cultivar on 10th December without seed

treatment, which were 11.34 and 12.95 ardab/fed in the first and second seasons, respectively.

Table 7: Grain yield (ardab/fed) as affected by the interaction among sowing dates, wheat cultivars and seed treatments during 2011/2012 and 2012/2013 seasons.

Sowing dates	cultivars	Seed treatments		
		Without	Fungicide	Microelements
2011/2012 season				
10th November	Sakha 93	13.97	18.08	19.12
	Sakha 94	14.02	18.15	19.38
	Gemmiza 10	15.42	18.63	19.87
25th November	Sakha 93	12.74	16.58	18.21
	Sakha 94	13.10	16.86	18.95
	Gemmiza 10	14.11	18.02	19.07
10th December	Sakha 93	11.34	13.63	16.94
	Sakha 94	12.01	14.34	17.72
	Gemmiza 10	12.63	16.41	17.79
F. test		*		
LSD at 5 %		0.88		
2012/2013 season				
10th November	Sakha 93	14.62	18.27	18.98
	Sakha 94	15.47	18.93	19.95
	Gemmiza 10	16.63	18.98	20.20
25th November	Sakha 93	14.20	17.84	18.72
	Sakha 94	14.80	17.98	19.44
	Gemmiza 10	16.16	18.45	19.49
10th December	Sakha 93	12.95	14.68	17.46
	Sakha 94	13.48	16.00	18.18
	Gemmiza 10	14.12	17.05	18.53
F. test		*		
LSD at 5 %		0.71		

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تأثير مواعيد الزراعة ومعاملات التقاوى على إنتاجية وصفات تقاوى بعض أصناف القمح

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أجريت تجربتان حقليتان خلال موسمى ٢٠١٢/٢٠١١ و ٢٠١٣/٢٠١٢ بمحطة التجارب والبحوث الزراعية بتاج العز (محافظة الدقهلية) - مركز البحوث الزراعية لدراسة تأثير مواعيد الزراعة ومعاملة التقاوى قبل الزراعة بالمطهرات الفطرية ومخلوط من العناصر الصغرى (حديد + زنك) على صفات النمو ومحصول البذور ومكوناته و نسبة البروتين وصفات التقاوى لبعض أصناف القمح. أجرى كل ميعاد زراعة (١٠ نوفمبر ، ٢٥ نوفمبر و ١٠ ديسمبر) فى تجربة مستقلة. وفى كل ميعاد زراعة أتبع تصميم القطع المنشقة مرة واحدة فى أربع مكررات. حيث إشتملت القطع الرئيسية على أصناف القمح (سخا ٩٣، سخا ٩٤ وجميزة ١٠). بينما إحتوت القطع الشقية على معاملات التقاوى (بدون ، معاملة التقاوى بالمطهر الفطرى فيتافاكس ونقع التقاوى فى مخلوط من الزنك والحديد). أجريت التجارب المعملية بوحدة بحوث تكنولوجيا البذور بالمنصورة ، قسم بحوث تكنولوجيا البذور ، معهد بحوث المحاصيل الحقلية ، مركز البحوث الزراعية لتقدير صفات التقاوى للحبوب الناتجة من التجربة الحقلية.

تشير النتائج المتحصل عليها أن أعلى القيم لصفات النمو والمحصول ومكوناته و طول الريشة والجذير والوزن الجاف للبادرات تم الحصول عليها عند الزراعة فى الميعاد المبكر (١٠ نوفمبر). أما الزراعة فى الميعاد المتوسط (٢٥ نوفمبر) فقد سجلت أعلى القيم لصفات النسبة المئوية للإنبات وسرعة الإنبات. فى حين أن الزراعة فى الميعاد المتأخر (١٠ ديسمبر) فقد أعطت أعلى نسبة مئوية للبروتين فى الحبوب.

تفوق صنف القمح جميزة ١٠ بشكل كبير على كلا الصنفين تحت الدراسة (سخا ٩٣ وسخا ٩٤) حيث سجل أعلى القيم لصفات مساحة ورقة العلم ، طول السنبلة ، عدد حبوب السنبلة ، وزن حبوب السنبلة ، وزن ١٠٠٠ حبة ، محصول الحبوب للفدان وسرعة الإنبات و الوزن الجاف للبادرات. أما الصنف سخا ٩٤ فقد سجل أفضل القيم لصفات ارتفاع النبات ، عدد السنابل/م٢ و محصول القش للفدان وطول الريشة والجذير. أما الصنف سخا ٩٣ فقد سجل أفضل القيم لصفات النسبة المئوية للبروتين في الحبوب.

أظهرت النتائج المتحصل عليها أن معاملة تقاوى القمح قبل الزراعة بمخلوط العناصر الصغرى (حديد وزنك) بمعدل ٥٠٠ جزء فى المليون لكل منهما لمدة ١٠ ساعات قد تفوقت على معاملات التقاوى الأخرى وأنتجت أعلى القيم لجميع الصفات المدروسة. تلى هذه المعاملة معاملة التقاوى بالمبيد الفطرى فيتافاكس بمعدل ٣ جم لكل كجم تقاوى لمدة دقيقتان في كلا الموسمين. على العكس من ذلك، تم الحصول على أقل القيم لجميع الصفات المدروسة من معاملة المقارنة.

توصى الدراسة بزراعة القمح صنف جميزة ١٠ فى العاشر من نوفمبر ومعاملة التقاوى قبل الزراعة مخلوط العناصر الصغرى (حديد وزنك) بمعدل ٥٠٠ جزء فى المليون لكل منهما لمدة ١٠ ساعات وذلك للحصول على أعلى إنتاجية وجودة للمحصول والتقاوى تحت ظروف محافظة الدقهلية.

قام بتحكيم البحث

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