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Response of Some Wheat Cultivars to Sowing Dates and Biofertilizers under North West Coast of Egypt

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TWO FIELD experiments were conducted during 2016/2017 and 2017/2018 winter seasons at Fuka Research Station, Faculty of Desert and Environmental Agriculture, Matrouh University, Matrouh Governorate (North West Coast of Egypt, N= 31° 04 ', E= 27° 54 '). This work aimed to evaluate the response of three wheat (*Triticum aestivum*, L.) i.e.; Misr 2, Giza 168 and Sids 12 cultivars under three sowing dates (15th November, 30th November and 15th December and three treatments of biofertilizer (Control, Blue green algae (BGA) "Gorn 19" and Micobine). A split-split plot design with three replicates was used in both seasons. The main plots were devoted to three wheat cultivars and the sub plots were occupied by the three sowing dates whereas, the sub-sub plots were assigned to the three biofertilizer treatment. Field experiment results indicated that under Matrouh condition, Sids 12 cultivar, gave higher values for plant height, No. of grains/spike, 100 grain weight, biological yield, grain yield and harvest index compare to other cultivars (Misr 2 and Giza 168). In addition, early sowing at Nov, 15 and using BGA as biofertilizer significantly increased all studied characters. Regression analysis for grain yield and yield components, results indicating that the highest effect for delayed sowing was detected for no. of spikes/m^2 (-1.37 and -1.40) while, the least effect was estimated for 100 grain weight (-0.86 and -1.54) for two seasons, respectively.

Keywords: Wheat, Sowing dates, Blue green algae, Microbein, Yield.

Introduction

Worldwide, wheat is the third most-produced cereal crop after maize and rice, according to its production, (FAO, 2018). In Egypt, wheat is the most important staple crop in the country and an essential component of the Egyptian diet. According to the Food and Agriculture Organization of the United Nations (FAO, 2018), the total planted area of wheat in Egypt is 1.37 million hectares with a total production of 9 million tons. The total wheat consumption in Egypt is around 19 million tons; this wide gap between consumption and actual production forces the country to import 10 million tons to close this gap. Increasing the acreage and productivity of wheat crop is a national necessity to overcome the shortage in wheat production compared to consumption (Milad et al., 2016).

Date of sowing is an important agriculture practice that is determined through the environmental requierments of the wheat crop (Shaaban et al., 2018). Early sowing at the recommended time results in increased productivity of wheat due to the prevalence of ideal conditions, i.e. temperature, rainfall etc. at that time (Ma et al., 2018). Generally, late sowing reduces N uptake and accumulation in wheat crops (Widdowson et al., 1987; Ehdaie & Waines, 2001). Sowing date plays a vital role in yield potential of wheat production. Refay (2011) investigated the effect of early (November, 21st) and late (December, 21st) sowing on different wheat cultivars and lines under North Sinai conditions. His findings revealed that late sowing caused significant decease in grain yield (about 8%) compared to early sowing. They also reported variable response for wheat genotype as affected by sowing date.

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El-Sarag et al. (2013) found that the 2nd sowing date (1st December) gave superiority of wheat grain yield and most of its components compared to sowing at Nov, 16 and Dec, 16. Meanwhile, Baloch et al. (2010) concluded that sowing wheat on October, 25 and November, 10 produced the highest number of tillers, spike length, plant height, 1000-grain weight and the grain yield, which subsequently decreased with successive sowing dates.

Blue green algae (also called Cyanobacteria) function as a biofertilizer due to the property of nitrogen fixation was increased grain yield by 10-30 % over the control (Mahato & Sahu, 2017). Pimratch et al. (2015), found that Application of BGA resulted in significantly higher phosphorus and potassium in seeds compared with untreated control. However, due to the biological nature of BGA, the results obtained from fields may vary according to season, and their effect, compared to application of chemical fertilizers, may not be clear cut. Paudel & Pradhan (2012), revealed that N content of the soil with BGA inoculated treatments was comparatively higher than application of compound NPK fertilizers. The utilization of biofertilizers as Blue green algae and biological nitrogen fixation technology can reduce usage of chemaical fertilizers and environmental pollution (Abd El-Lattief, 2012).

Biofertilizers are mixtures of microorganisms, essential plant nutrients and growth regulating substance (Bhardwaj et al., 2014; Shen et al., 2015). They improve soil physical and chemical properties, and promote plant growth, thus decreasing the need for inorganic fertlizers and reduce environmental pollution. Azotobacters were used for along time as biofertilizer for their nitrogen fixing ability and their role in phosphate solubilization and production of plant hormones. They also play a role in suppression of pathogens and increasing cereals yield (Das, 2019). In addition, many researchers showed the positive response of inoculation of wheat with *Azotobacter* and/or *Azospirillum* (Fayez & Makboul, 1985; Tawfik & Gomaa, 2005; Abbasdokht, 2008; Badr et al., 2009; Bahrani et al., 2010)

This study aimed to investigate the response of some wheat cultivars under different sowing dates, biofertilizer as blue green algae and microbein, regarding some agronomic, yield and yield components.

Materials and Methods

Field experiments and soil properties

The field experiments were conducted during 2016/2017 and 2017/2018 winter seasons at Fuka Research Station, Faculty of Desert and Environmental Agriculture, Matrouh Governorate (North West Coast of Egypt, N= 31° 04 ‘, E= 27° 54 ‘). The experimental site is classified as Mediterranean climate which are presented in (Table 1).

TABLE 1. Climatic conditions during the two seasons of the experimental site.

Month	Average temp.	Min temp.	Max temp.	Precipitation
		2016/2017 season		
November 2016	19.8°C	11°C - 20°C	19°C - 29°C	16.10
December 2016	14.3°C	7°C - 17°C	12°C - 22°C	16.30
January 2017	12.3°C	3°C - 13°C	14°C - 20°C	12.84
February 2017	14.3°C	7°C - 13°C	14°C - 22°C	6.31
March 2017	15.8°C	9°C - 14°C	17°C - 23°C	5.41
April 2017	17.9°C	5°C - 17°C	19°C - 34°C	0
May 2017	21.5°C	10°C - 22°C	21°C - 39°C	0
		2017/2018 season		
November 2017	18.0°C	9°C - 19°C	19°C - 27°C	15.90
December 2017	16.2°C	7°C - 18°C	14°C - 25°C	56.96
January 2018	14.2°C	8°C - 14°C	13°C - 21°C	11.72
February 2018	16.9°C	8°C - 17°C	16°C - 27°C	12.31
March 2018	17.9°C	8°C - 16°C	18°C - 35°C	0.30
April 2018	19.7°C	10°C - 22°C	20°C - 34°C	0
May 2018	22.4°C	15°C - 23°C	22°C - 42°C	0

Moreover, the experimental site soil (according to Chapman & Pratt, 1961) had the following properties: Texture= sandy (calcareous), pH= 8.1, total organic matter= 0.70 %, Ec= 3.3 dS/m, Ca^{++} = 35.4 meg/L, Mg^{++} = 15.2meg/L, Na^{+} = 49.4meg/L, K^{+} = 1.1meg/L, CO_3^{--} = 0.1meg/L, HCO_3^{-} = 3.7meg/L, Cl^{-} = 48.1 meg/L, $SO4^{--}$ = 52.3meg/L and SAR= 11.6 as an average of the two seasons.

Treatment

The aim of investigation was to evaluate the response of three wheat (*Triticum aestivum,* L.) i.e.; Misr 2, Giza 168 and Sids 12 cultivars under three sowing dates (15th November, 30th November and 15th December(and three treatments of biofertilizer: 1) Control (without adding biofertilizers) 2) Blue green algae (BGA) 3) Micobein (contain *Psedomonnas* sp., *Azotobacter* sp.*, Azospirillum* sp.and *B. megaterium*).

Blue green algae (known commercially as Gorn 19, Vera Chema Company) with the recommendation of one spraying at 45 days from sowing at the rate of 240cm^3/360 L water/ha. BGA contain: N= 15.4, P= 24.3, Ca= 1226, Fe= 7.38, Zn= 0.25, K= 2162, Mg= 658.8, MN= 3.95 and Cu= 0.06ppm. Also wheat grains were inoculated with microbein just before planting at the rate of 10kg/ha. Plot size was 5.4m^2 (9 rows X 0.2m between rows X 3.0 m row length). For nitrogen fertilization, control plots received 144kg N/ha, while BGA and microbein plots received 96 kg N/ha, in the form of ammonium sulphate (20.5 N) added in two equal doses, the first at sowing and the second at 30 days later. Also, phosphors was added during soil preparation at the rate of 37.5kg P_2O_5/ha in the form of calcium monophosphate (15.5% P_2O_5). Seeding rate for wheat cultivars was 96kg/ha. Sprinkler irrigation during wheat growth period was added as needed.

Experimental design and statistical analysis

A split-split plot design with three replicates was used in both seasons. The main plots were devoted to three wheat cultivars and the sub plots were occupied by the three sowing dates whereas, the sub-sub plots were assigned to the three biofertilizer treatment. Data were subjected to the proper analysis according to Gomez & Gomez (1984) using SAS (Statistical Analysis Systems) ver. 9.1.3 (2007). Means were compared using the least significant difference (LSD) value at 5% level of probability.

Recorded data

At harvest, the following characters were recorded for each sub plot: Plant height (cm), Number of spikes/m^2, Number of grains/spike, 100 grain weight (g), Biological yield (ton/ha), grain yield (ton/ha) and harvest index (%) was calculated.

Results and Discussion

Plant height

Data presented in Table 2 revealed significant variations in plant height among the investigated wheat cultivars. Cultivar Sids 12 had significantly tallest plants that reached, 89.73 and 85.20 cm for the first and second growing seasons, respectively. This might be due to genetic variability (Milad et al., 2016) resulting in significant differences between genotypes (durum and bread wheat).

Moreover, early sowing in November, 15 resulted in-significant increase in plant height, 82.19 and 81.70cm for the two respective growing seasons. Furthermore, biofertilization using BGA significantly increased wheat plant height (82.19cm) in the first season. It is evident that biofertilizers improve soil fertility and stimulate root growth in plants. In addition, they keep the soil in balanced conditions and consequently, nitrogen, potassium and phosphorus will be produced naturally (Abd-El Salam et al., 2014). Pimratch et al. (2015) reported similar results that application of BGA tended to increase plant height. Interaction between cultivars and biofertilizer treatments (Table 3) exerted a significant effect on plant height in the first season only. Using Sids 12 cultivar and BGA fertilizers gave the significantly tallest plant (90.55cm), which might be due to genetic variability between cultivars and their response to environmental conditions.

Number of spikes/m^2

Number of spikes per unit area showed significant variation due to different cultivars in both growing seasons. Giza 168 cultivar recorded the highest number of spikes (350.00 and 394.16) followed by Misr 2 and Sids 12 in the first and second seasons, respectively. Sowing dates significantly influenced number of spikes/m^2 in both seasons (Table 2). Highest values for such trait (321.95 and 351.10) were obtained by early sowing in November 15, which lead to more time for vegetative growth period to give a higher number of tillers per unit area (Seleiman et al., 2011; Bendidi et al., 2016). Additionally, data in (Table 2) indicated highly significant effect, on number of spikes/m^2, by applying BGA fertilizer in both seasons. BGA as fertilizer significantly increased number of spikes by 10.26 and 8.73% compared to control treatment. Data in Table 4 showed the interaction between cultivars, sowing dates and biofertilizer treatment for such trait in both study seasons. The highest number of spikes/m^2 (440.54, as an average of two seasons) was obtained by using Giza 168 and early sowing in November 15, with applying BGA fertilizer.

Number of grains/spike

The number of grains/spike was influenced by different cultivars in both seasons (Table 2). Sids 12 showed highest number of grains (55.67 and 54.86) in the first and second seasons, respectively. This might be due to the fact that Sids 12 is a long spiked cultivar. As for sowing dates, delaying sowing date to December 15, significantly decreased number of grains/spikes by (12.73 and 12.96%) compared to early sowing in November 15, in both seasons, respectively. This might be due to that late sowing shortened vegetative growth period and compelled wheat cultivars to complete life cycle earlier. Similar trend was observed by Xia et al. (2019) who found that delay sowing reduced number of grains per ear which led to reduction in grain yield. Three way interactions between cultivars, sowing dates and biofertilizer treatment, showed significant effect in both seasons (Table 4). Giza 168 cultivars suffered less reduction in number of grains/spike, under all fertilizer treatments, with delayed sowing from Nov, 15 to Dec, 15 compared to Misr 2 and Sids 12. That may be explained by the higher ability of Giza 168 to tolerant high temperature at grain development stage and maintain high fertility levels under heat stress (Milad et al., 2016).

100 grain weight

In the two seasons 2017 and 2018, significant difference were found between cultivars, sowing dates and biofertiliers where Sids 12 gave heaviest weight of grains (4.33 and 4.08g) compared to the other cultivars (Table 5). Meanwhile, data showed that delaying wheat sowing date from Nov, 15 to Dec, 15 reduced 100 grain weight by 6.40 and 7.31%, in the 1st and 2nd seasons, respectively. It seemed that prevailing weather during growing period may play a role for growth improvement and grain filling which may reflect on grain yield (El-Metwally et al., 2012). Fayed et al. (2015) revealed that 1000 kernel weight of all studied cultivars were progressively decreased by delaying sowing dates. Furthermore, using BGA significantly increased 100 grain weight from 3.98 to 4.11g, as average of two seasons, compared to using microbein fertlilizer.

TABLE 2. Mean values of plant height, No. spikes/m^2, No. grains/spike and panicle weight of wheat in 2016/2017 and 2017/2018 seasons.

Treatments \ Characters	Plant height (cm)		No. spikes/m^2		No. grains/spike	
	2016/17	2017/18	2016/17	2017/18	2016/17	2017/18
Cultivars						
Misr 2	71.03	71.00	302.11	344.21	46.44	46.69
Giza 168	75.84	76.50	350.00	394.16	47.74	47.14
Sids 12	89.73	85.20	248.09	249.40	55.67	54.86
LSD $_{0.05}$	**4.94**	**9.25**	**0.55**	**1.92**	**1.15**	**0.93**
Sowing dates						
Nov, 15	82.19	81.70	321.95	351.10	52.92	52.72
Nov, 30	77.88	74.40	299.79	331.59	49.98	49.30
Dec, 15	76.52	76.60	278.45	305.07	46.94	46.67
LSD $_{0.05}$	**2.54**	**5.65**	**0.76**	**1.69**	**0.66**	**0.75**
Biofertilizers						
Control	75.27	74.40	285.56	314.48	46.23	45.90
BGA	82.19	78.90	314.87	341.96	53.74	52.86
Microbein	79.14	79.30	299.77	331.33	49.88	49.94
LSD $_{0.05}$	**2.17**	**NS**	**0.72**	**1.45**	**0.65**	**0.49**

NS: Not significant.

TABLE 3. Mean values for plant height as affected by the interaction between wheat cultivars and biofertilizers in 2016/17 season.

Characters / Cultivars	Plant height (2016/17) (cm)		
	Biofertilizers		
	Control	BGA	Microbein
Misr 2	66.24	75.58	71.27
Giza 168	70.55	80.44	76.51
Sids 12	89.00	90.55	89.65
LSD $_{0.05}$		**5.13**	

Interaction between cultivars, sowing dates and biofertilizer treatment for 100 grain weight in 2017/2018 season, are presented in Table 6. Cultivars showed various response by using biofertilizers (BGA and microbein) at different sowing dates. Sids 12 cultivars indicated highest values (4.40 and 4.30g) by using BGA and microbein, respectively, at sowing on Nov, 15. The response of Sids 12 at sowing on Dec, 15, with BGA application, compared to microbein, gave the highest response percentage (6.97) compared to sowing at Nov, 30 (4.76%).

Biological yield

Mean values for biological yield, as influenced by wheat cultivars, sowing dates and biofertilizers are presented in Table 5. Sids 12 cultivar significantly surpassed the other two cultivars (14.90ton/ha) in the second season only. Moreover, sowing dates showed significant differences in both seasons. Early sowing at Nov, 15 significantly increased such trait from 13.37 for Dec, 15 to 14.50ton/ha, as an average of two seasons. This might be due to elongated vegetative growth period of cultivars to produce higher value of biological yield. Furthermore, biofertilization using BGA significantly increased biological yield (10.17 and 11.34%) compared to control in both seasons. EL-Beltagy et al. (2016) concluded that inoculating wheat with cyanobacteria under 75 % nitrogen increased dry weight of wheat plants and this result was not significantly different from those recorded by the treatment of 100% N. Also, Ghazal et al. (2018) found that inoculation with cyanobacteria generally encouraged the growth of wheat plants giving taller plants, higher no. of spikes, spike weight, straw yield, grain yield and 1000 grain weight.

Interaction between cultivars, sowing dates and biofertilizer treatment for biological yield was significant in 2017/2018 season only (Table 6). Cultivars showed various response using biofertilizers (BGA and microbein) at different sowing dates. Sids 12 cultivars gave highest values (16.30 and 15.90ton/ha) using algae and microbein, respectively, when sowing at Nov, 15. Misr 2 showed insignificant response to BGA or microbein additions at the different dates of sowing. However, Giza 168 responded significantly to microbein addition, only. In general, the response was negative with delaying sowing date.

Grain yield

Mean values for grain yield, as influenced by wheat cultivars, sowing dates and biofertilizers are presented in Table 5. Sids 12 revealed highest significant values (4.69 and 4.60ton/ha) for such trait in both seasons, respectively. Early sowing in Nov, 15 compared to delay sowing at Dec, 15 significantly increased grain yield from 4.08 and 4.04 to 4.48 and 4.50ton/ha in the first and second seasons, respectively, indicating that delay sowing reduces the duration of both vegetative growth and grain development and consequently reducing grain yield. The accumulated heat units of the late sowing may be not sufficient for completing phenological stages of wheat growth and exerted such depression in growth and productivity of wheat plant.

Using BGA, compared to microbein, increased grain yield by 4.15 and 4.80 percent in both seasons, respectively. Paudel et al. (2012) revealed that BGA increased grain yield up to 7% - 20.9% and straw yield up to 7.2 % -18.1%, respectively. Also, Mishra & Pabbi (2004) found that yield increased by 12.3-19.5% on BGA inoculation in rice field. Prasad (2005) found 7.53- 21.2% increased in grain yield and 6.57-21.6% increased in straw yield with BGA inoculation.

As for the interaction between cultivars and sowing dates in second season, (Table 7) results indicated that cultivars responded differently to sowing dates, where Misr 2 and Sids 12 showed significant decrease in grain yield with delay in sowing beyond Nov, 15, whereas Giza 168 suffered significant decrease in grain yield when sown after Nov, 30. The cultivars*biofertilizers interaction (Table 8) indicated that Sids 12 showed similar response to addition of BGA or microbein, whereas both Misr 2 and Giza 168 yielded higher with BGA than microbein.

TABLE 4. Mean values for No. of spikes/m² and No. of grains/spike as affected by the interaction between wheat cultivars, sowing dates and biofertilizers in 2016/17 and 2017/18 seasons.

Treatments / Characters		No. of spikes/m²						No. of grains/spike					
		2016/17			2017/18			2016/17			2017/18		
Cultivars	Dates	Biofertilizers						Biofertilizers					
		Control	BGA	Microbein	Control	BGA	Microbein	Control	BGA	Microbein	Control	BGA	Microbein
Misr 2	Nov, 15	288.63	329.79	308.20	329.57	371.10	357.33	44.66	54.00	51.00	46.00	52.00	51.30
	Nov, 30	289.96	316.03	301.73	329.27	362.12	345.57	42.00	50.66	47.00	42.33	50.30	46.66
	Dec, 15	286.93	305.03	292.73	325.75	341.50	335.67	38.33	47.00	43.33	40.33	47.33	44.00
Giza 168	Nov, 15	383.70	413.53	394.73	428.70	467.55	450.53	43.33	53.66	49.66	41.66	55.33	50.66
	Nov, 30	330.00	371.63	351.73	375.30	419.43	400.23	43.00	54.00	47.00	42.66	52.00	46.00
	Dec, 15	290.03	316.56	298.10	317.23	350.53	337.90	40.66	54.00	44.33	39.33	51.00	45.66
Sids 12	Nov, 15	249.50	270.30	259.19	236.00	260.40	258.70	58.60	62.00	59.40	57.50	60.30	59.80
	Nov, 30	221.10	265.30	250.70	245.10	255.90	251.40	55.10	55.9	55.20	53.50	55.70	54.60
	Dec, 15	230.19	245.70	240.81	243.40	249.10	244.60	50.40	52.4	52.00	49.8	51.80	50.8
$LSD_{0.05}$			**2.05**			**4.39**			**1.99**			**1.69**	

TABLE 5. Mean values of 100 grain weight, biological yield, grain yield and harvest index of wheat in 2016/2017 and 2017/2018 seasons.

Characters / Treatments	100 grain weight (g)		Biological yield (ton/ha)		Grain yield (ton/ha)		Harvest index (%)	
	2016/17	**2017/18**	**2016/17**	**2017/18**	**2016/17**	**2017/18**	**2016/17**	**2017/18**
Cultivars								
Misr 2	3.88	3.90	13.57	13.47	4.13	4.15	30.33	30.80
Giza 168	3.89	3.91	13.28	13.37	4.08	4.15	30.67	31.02
Sids 12	4.33	4.08	15.13	14.90	4.69	4.60	30.96	30.92
LSD $_{0.05}$	**0.12**	**0.09**	**NS**	**1.04**	**0.11**	**0.15**	**0.28**	**NS**
Sowing dates								
Nov, 15	4.16	4.11	14.53	14.48	4.48	4.50	30.91	31.17
Nov, 30	4.04	3.96	14.03	13.93	4.33	4.37	30.80	31.31
Dec, 15	3.91	3.83	13.42	13.33	4.08	4.04	30.25	30.25
LSD $_{0.05}$	**0.08**	**0.06**	**0.27**	**0.16**	**0.06**	**0.08**	**0.38**	**0.20**
Biofertilizers								
Control	3.96	3.85	13.15	12.97	3.94	3.96	29.78	30.46
BGA	4.13	4.09	14.64	14.63	4.57	4.58	31.36	31.37
Microbein	4.02	3.95	14.19	14.13	4.38	4.36	30.81	30.91
LSD $_{0.05}$	**0.04**	**0.06**	**0.33**	**0.30**	**0.06**	**0.07**	**0.21**	**0.20**

NS: Not significant.

Harvest index

Data revealed that harvest index was significantly influenced by studied factors in both seasons except for cultivars in the second season (Table 3). Sids 12 gave highest value (30.96 %), followed by Giza 168 (30.67%) and Misr 2 (30.33%). Meanwhile, early sowing at Nov, 15 showed highest values (30.91 and 31.17%) for harvest index in both seasons, respectively. Biofertilization with BGA significantly increased harvest index (31.36 and 31.37% in both seasons, respectively) compared to microbein or control. This might be due to the increase in dry weight and attaining more photosynthetic matters to grain (Abd El-Lattief, 2012). Interaction between cultivars, sowing dates and biofertilizer treatment for harvest index, in both season, is presented in Table 7. Non of the three cultivars showed significant response to BGA application at the different sowing dates. On the other hand, addition of microbein gave significant increase in harvest index at earlier sowing dates (Nov, 15 and 30) in Misr 2 and Giza 168 compared to Dec, 15 sowing date, while Nov, 30 was significantly superior to Nov, 15 in Sids 12 cultivar.

Regression analysis for grain yield and yield components 0n sowing dates showed a significant negative relationship in both seasons (Fig 1). The relationship were of high r^2 values ranging from 0.81 to 0.99, indicating that sowing date was the detrimental factor in the expression of those characters. The highest effect for delayed sowing was detected for no. of spikes/m^2 (-1.37 and -1.40 for the first and second season, respectively) while, the least effect was estimated for 100 grain weight. Decrease in yield components, with different magnitudes, resulted in decrease in grain yield linearly and quadratically, where the quadratic effect was related primarily to the decrease in 100 grain weight.

Conclusion

In conclusion, the results of the present investigation showed that the use of biofertilizers such as BGA and microbein (nitrogen fixation organisms) are important in agriculture to reduce the application of chemical fertlizers (33%) and maintain high grain yield, thus reducing environmental pollution and costs of production.

TABLE 6. Mean values for 100 grain weight, biological yield and harvest index as affected by the interaction between wheat cultivars, sowing dates and biofertilizers in 2016/17 and 2017/18 seasons.

Treatments \ Characters		100 grain weight (g)			Biological yield (ton/ha)			Harvest index (%)					
		2017/18						2016/17			2017/18		
Cultivars	**Dates**	**Control**	**BGA**	**Microbein**	**Control**	**BGA**	**Microbein**	**Control**	**BGA**	**Microbein**	**Control**	**BGA**	**Microbein**
	Nov, 15	3.99	4.08	3.99	12.75	14.52	14.32	29.60	31.49	31.01	30.71	31.39	32.25
Misr 2	Nov, 30	3.83	3.94	3.93	12.65	14.22	13.40	28.88	31.34	31.36	30.03	30.72	32.22
	Dec, 15	3.76	3.80	3.83	12.67	13.38	13.35	28.32	30.85	30.18	28.93	31.01	29.96
	Nov, 15	3.94	4.17	3.93	13.10	14.47	14.08	30.66	31.90	31.55	30.23	32.52	31.85
Giza 168	Nov, 30	3.84	4.07	3.86	12.58	14.23	13.58	29.66	31.87	31.12	30.19	34.87	31.41
	Dec, 15	3.73	3.90	3.76	12.24	13.37	12.68	27.25	32.12	29.91	26.87	31.72	29.57
	Nov, 15	4.20	4.40	4.30	14.90	16.30	15.90	30.81	30.91	30.33	31.44	30.02	30.15
Sids 12	Nov, 30	4.00	4.20	4.00	14.00	15.70	15.00	31.10	30.79	31.14	31.34	30.46	30.63
	Dec, 15	3.40	4.30	4.00	11.90	15.50	14.90	31.82	31.05	30.75	34.45	29.63	30.18
LSD $_{0.05}$			**0.16**			**1.15**			**0.76**			**0.62**	

TABLE 7. Mean values for grain yield as affected by the interaction between wheat cultivars, sowing dates in 2017/2018 season.

Cultivars \ Character	Grain yield (ton/ha)		
	Nov, 15	**Nov, 30**	**Dec, 15**
Misr 2	4.36	4.16	3.94
Giza 168	4.35	4.35	3.78
Sids 12	4.80	4.60	4.40
LSD $_{0.05}$		**0.17**	

TABLE 8. Mean values for grain yield and as affected by the interaction between wheat cultivars and biofertilizers in 2016/2017 or 2017/2018 season.

Cultivars \ Characters	Grain yield (2016/17) (ton/ha)			Grain yield (2017/18) (ton/ha)		
	Biofertilizers			Biofertilizers		
	Control	**BGA**	**Microbein**	**Control**	**BGA**	**Microbein**
Misr 2	3.74	4.40	4.25	3.81	4.35	4.31
Giza 168	3.66	4.46	4.13	3.69	4.62	4.16
Sids 12	4.43	4.88	4.77	4.40	4.77	4.63
LSD $_{0.05}$		**0.12**			**0.16**	

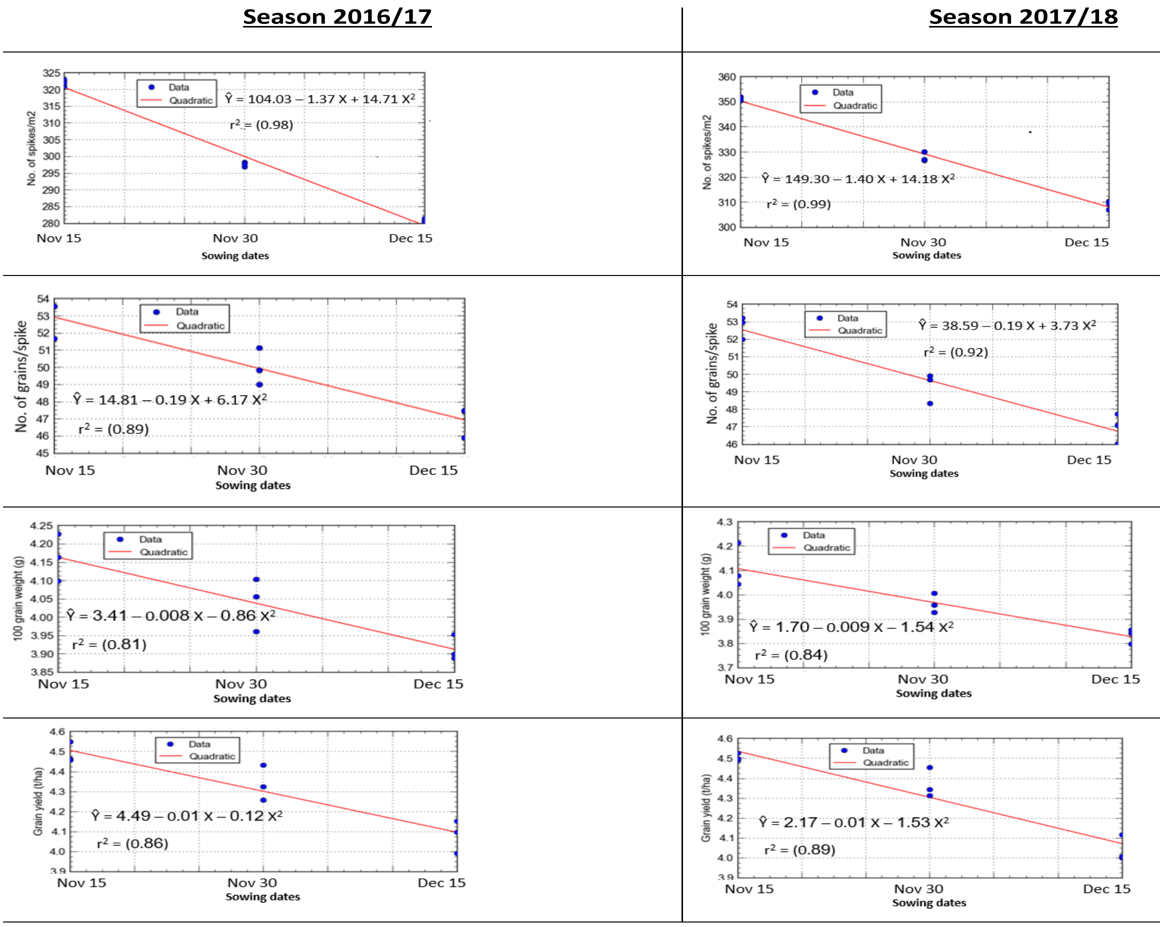

Fig. 1. Graphical representation of regression analysis of No. of spikes/m², No. of grains/spike, 100 grain weight and grain yield on sowing dates in 2016/2017 and 2017/2018 seasons.

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أستجابة بعض اصناف من القمح لمواعيد الزراعة والتسميد الحيوى تحت ظروف الساحل الشمالى الغربى لجمهورية مصر العربية

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أجريت تجربتان حقليتان خلال الموسم الشتوى 2016/2017 ، 2017/2018 بالمزرعة البحثية بكلية الزراعة الصحراوية والبيئية – جامعة مطروح - محافظة مرسى مطروح بهدف دراسة استجابة ثلاثة اصناف من القمح (مصر 2، جيزة 168، سدس 12) تحت ثلاثة مواعيد زراعة (15 نوفمبر، 30 نوفمبر، 15 ديسمبر) و ثلاثة معاملات من التسميد الحيوى (كنترول، الطحالب الخضراء المزرقة، الميكروبين) . استخدم تصميم القطع تحت المنشقة فى ثلاثة مكررات حيث استخدمت الأصناف للقطع الرئيسية ومواعيد الزراعة للقطع الفرعية بينما استخدمت معاملات التسميد الحيوى للقطع تحت الفرعية. أوضحت النتائج تحت ظروف الساحل الشمالى الغربى لمحافظة مطروح بأنه اعطى الصنف سدس 12 أعلى القيم لصفات طول النبات، عدد الحبوب للسنبلة، وزن 100 حبة، الوزن البيولوجى، محصول الحبوب ومعامل الحصاد بالمقارنة بباقى الأصناف (مصر 2، جيزة 168). بالإضافة إلى أن الزراعة المبكرة خلال 15 نوفمبر والتسميد بالطحالب الخضراء المزرقة (جورن 19) أعطى زيادة معنوية لكل الصفات تحت الدراسة. كما أوضح تحليل الأرتباط لصفات المحصول ومكوناته أن التأخير فى الزراعة يؤثر بشكل أعلى على عدد السنابل/المتر^2 وبشكل أقل على وزن 100 حبه.