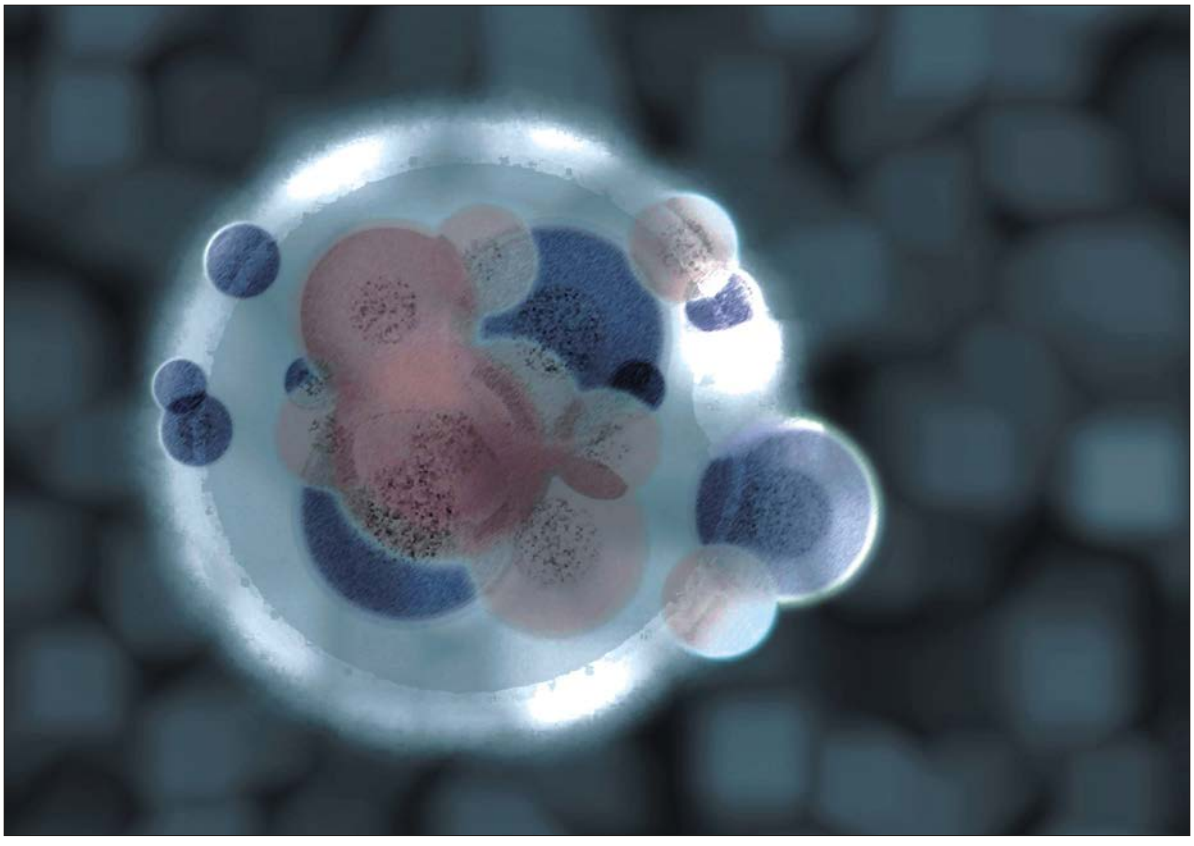

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Response of Seed Yield and its Components of Safflower to Sowing Dates, Nitrogen Fertilizer Levels and Times of Foliar Application with Milagrow

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Abstract: The high productivity of safflower is outcome of many agronomical practices such as sowing dates, N-levels and times of foliar fertilization. Thus, the objective of this study was to determine the effect of sowing dates (1st Sept., 1st Oct. and 1st Nov.), N-levels (40, 60 and 80 kg N fed^{-1}) and times of foliar application with Milagrow (without, one and two times) on seed yield of safflower. Each sowing date was practiced in separate experiment. Every experiment was carried out in strip plot design with three replications. Sowing safflower at 1st October gave the highest values of seed yield and its components in both seasons. The lowest means of seed yield and its components were resulted from sowing at 1st September in both seasons. Raising N-levels markedly accompanied with obvious increase in all studied characters in both seasons. Application of 80 kg N fed^{-1} significantly resulted in the highest values of all studied characters of safflower. Spraying safflower plants with Milagrow two times after 30 and 70 days from sowing produced the highest values of seed yield and its components in both seasons. On the other wise, control treatment gave the lowest values of these characters in both seasons. From the obtained data, it can be concluded that sowing safflower on 1st October and mineral fertilizing with 80 kg N fed^{-1} beside twice foliar application with Milagrow as a natural growth promoter in order to maximizing its seed yield and its components under the environmental conditions of Dakahlia Governorate, Egypt.

Key words: Safflower, *Carthamus tinctorius* L., sowing dates, nitrogen fertilizer levels, times of foliar application with natural growth promoters, milagrow foliar application times

INTRODUCTION

Safflower (*Carthamus tinctorius* L.) is considered as multi-purpose crop. It was used for extract dyes from petals that use for food and clothes coloring. It also used for extract oil from seeds that used as edible oil or in the paint industry. There are other common uses of safflower such as medicinal tea, bird seed, poultry and ruminant feed, cosmetics, spice, vegetable and forage (Farran *et al*., 2009).

The effective role of the agronomical processes such as sowing dates, nitrogen fertilizer levels and foliar application with natural growth promoters plays considerable effects on safflower productivity. Sowing dates means the effect of edaphic factors and all environmental conditions in large scale on growth and yield of all field crops, which differ widely from region to another. Moreover, sowing dates is considered the most important affecting factor for all field crops generally and safflower specially. An optimal sowing date will lead to increase safflower yield, but little research on safflower sowing date has been conducted in Egypt. In this concern, Badawi *et al*. (1996) found that early sowing (1st October) caused marked increases in number of heads/plant, number of seeds/head, 100-seed weight, seed yield/plant and seed oil content as well as seed and oil yields/fed. There were significant differences in most characters between sowing of 1st October and that of 1st November or 1st December. Kaffka and Kearney (1998) found that safflower planting in the spring in order to prevent excessive vegetative growth, which lead to reduce seed yield. Uslu (2003) found that the November sowing produced higher values of heads per plant (9.5) seeds per head (37.7) seed oil percentage (38.28%) and seed yield per plant (33.75 g plant^{-1}) compared to the April sowing (2.2 heads plant^{-1}, 27.5 seeds head^{-1}, 35.93% and 8.30 g plant^{-1}, respectively. Dadashi and Khajehpour (2004) reported that delay in planting from March 12 to May 10 reduced plant dry weight per unit area, number of heads per plant, number of seeds per head, seed yield per unit area and petal yield. The above traits increased as planting were further delayed from May 10 to June 8. Alinaghizadeh *et al*. (2008) found that May 16 and June 16 sowing dates had minimum (1129 kg ha^{-1})

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and maximum (1372 kg ha^{-1}) seed yield, respectively. Nikabadi *et al.* (2008) showed that the number and weight of seeds per head, diameter and weight of head and seed yield were decreased significantly as the sowing dates were delayed. The second sowing date (March 21) produced the highest seed yield (2306.2 kg ha^{-1}), whereas, the 7th sowing date (June 6) produced the lowest seed yield (622 kg ha^{-1}).

Nitrogen is one of the most important nutrients for crop production because it affects dry matter production by influencing leaf area development and maintenance as well as photosynthetic efficiency. There are many reports indicated that nitrogen is one of the important factors affecting growth, yield and its components of safflower. In this respect, Mandal *et al.* (1990) reported that nitrogen application increased number of heads $plant^{-1}$, seed index, seed yield/plant and seed yield ha^{-1}. El-Nakhlawy (1991) reported that the highest seed yield, 100-seed weight, number of heads $plant^{-1}$ and seeds weight/head were resulted from using 92 kg N ha^{-1} as compared to 46 and 138 kg N ha^{-1}. Leilah *et al.* (1992) indicated that increasing nitrogen levels significantly increased plant height and number of heads $plant^{-1}$. They added that the highest seed yield/fed was obtained with adding 60 and 80 kg N fed^{-1}. Bansal and Katara (1993) investigated the effect of different levels of nitrogen i.e., 0, 30, 60 and 90 kg N ha^{-1} on safflower yield. They found that 1000-seed weight and seed yield were reached to maximum values by fertilizing safflower plants with 90 kg N ha^{-1}. Patel *et al.* (1994) found that nitrogen fertilization of 50 kg N ha^{-1} recorded highest seed yield of safflower more than control and 25 kg N ha^{-1} by 55.05 and 20.53%, respectively. Also, the nitrogen application increased the yield attributes such as number of seeds $head^{-1}$ and seed yield/plant. Singh *et al.* (1994) investigated the effect of different levels of nitrogen i.e., 0, 20, 40 and 60 kg N ha^{-1} on safflower yield. They observed that the highest value of seed yield in safflower plant was resulted by using 40 kg N ha^{-1}. Siddiqui and Oad (2006) revealed that all the crop parameters were affected significantly due to different levels of nitrogen. Application of 120 kg N ha^{-1} was considered as the optimum level for getting maximum seed yield of safflower, further increase in N-levels remained uneconomical by producing adverse effects on all crop parameters. Christos and Sioulas (2008) found that nitrogen fertilization increased seed yield by an average of 19%, the seed weight per plant by 60%, the seed weight per head by 18%, the number of heads per plant by 32%, and the number of seeds per plant by 41% as compared with the control. Elfadl *et al.* (2009) studied the effect of nitrogen rates (0, 40 and 80 kg ha^{-1}) on production of the newly introduced safflower. Application of 40 and 80 kg N ha^{-1} did not significantly affect most of the investigated traits. Nitrogen rates provided significant increases in seed yield at high seed density as compared to low seed density.

Milagrow is natural growth promoter extracted from pollen of cabbage flowers. It has great effectiveness of many field crops. Milagrow is combined effects of oxen, cytokines, gibberellins, ethylene and hydrogen cyanamid. The chemical composition of milagrow is 20% phosphorus, 10% potassium, 3% boron and 0.2% brassinolide. Natural brassinolides (0.2%) is natural plant growth promoter for all crops, which promotes growth, increases yield, improves quality, increases percentage of fruit setting, spraying before flowering can promote formation of flower buds and spraying during flowering stage can resist fruit dropping and flower dropping. Very little researches have been conducted to evaluate the effects of times of foliar application with natural growth promoters on seed yield and its attributes of safflower. In this regard, Dholekar *et al.* (2001) stated that application of 10 ppm kinetin at 20 Days After Sowing (DAS) stage was found significantly superior for seed yield and other, number of heads $plant^{-1}$, number of seeds $head^{-1}$. Although, TIBA inhibited stem elongation, but it showed significant increase in yield and yield contributing characters. The other treatments like 50 ppm GA_3 and 1% SA applied at 30 DAS stage, showed that the increase in seed yield was about 6.74 and 4.24%, respectively over the control treatment. These increases in seed yield due to application of growth regulators might be attributed to the increment in number of branches/plant and number of heads $plant^{-1}$. Ebrahimzadeha *et al.* (2009) found that both SA and PB increased number of heads $plant^{-1}$, weight and diameter of head, number and weight of seeds $head^{-1}$, 1000-seed weight and seed yield. The effect of SA was more pronounced at 0.1 mM and increased number of flowers/head (108%), number of seeds $head^{-1}$ (72%) and seed yield (83%) as compared with the controls. PB was more effective at 100 mg L^{-1} and increased number of flowers/head (66%), number of seeds $head^{-1}$ (48%) and seed yield (56%) as compared with control treatment. Khandagale *et al.* (2009) reported that the varietals differences due to spray of growth regulators significantly influenced the yield and yield contributing characters such as number of heads $plant^{-1}$, number of seeds $head^{-1}$, 100-seed weight and harvest index.

Therefore, the objectives of this study were to determine the effects of sowing dates, nitrogen fertilizer levels and times of foliar application with natural growth promoter (milagrow) as well as their interactions on yield and its components of safflower under the environmental conditions of Dakahlia Governorate, Egypt.

MATERIALS AND METHODS

Two field experiments were conducted at the experimental station, faculty of agriculture, Mansoura University, during the two successive winter seasons of 2009/2010 and 2010/2011 to determine the effect of sowing dates, nitrogen fertilizer levels and times of foliar application with natural growth promoter (milagrow) on seed yield and its components of safflower cv. Giza 1.

Treatments and experimental design: Each sowing date (1st Sept., 1st Oct. and 1st Nov.) was practiced in separate experiment. Every experiment was carried out in strip plot design with three replications.

The vertical plots were assigned to three nitrogen fertilizer levels i.e., 40, 60 and 80 kg N fed^{-1}. Nitrogen fertilizer in the forms of urea (46% N) was applied as a side-dressing in two equal doses, one half after 30 days from sowing and the other after 70 days after sowing.

The horizontal plots were occupied with times of foliar application with natural growth promoter (milagrow) as follows:

- Without foliar application (control treatment)
- Foliar application with milagrow after 30 days from sowing (DFS) at the rate of 50 ppm (10 g milagrow/ 200 L water fed^{-1})
- Foliar application with milagrow after 30 and 70 days from sowing (DFS) at the rate of 50 ppm (10 g milagrow/200 L water fed^{-1})

Each experimental basic unit included three ridges, each 70 cm apart and 4.0 m length, resulted an area of 8.4 m^2 (1/500 fed) in both seasons. The preceding summer crop was maize (*Zea mays* L.) in both seasons.

Soil properties: The soil of the experimental site was clayey in texture with an Electrical Conductivity (EC) of 1.65 dS m^{-1} and a pH of 7.88.

Agricultural practices: The experimental field well prepared through two ploughing, leveling, compaction, ridging, division and then divided into the experimental units. Calcium super phosphate (15.5% P_2O_5) was applied during soil preparation at the rate of 100 kg fed^{-1}. Potassium in the form of potassium sulphate (48% K_2O) was added at the rate 50 kg fed^{-1} after 30 days from sowing (at the first dose of nitrogen fertilizer).

Safflower seeds were hand sown 3-5 seeds/hill using dry sowing method on two sides of the ridge in hills 30 cm apart during the aforementioned dates in the first and second seasons. Plants were thinned at the age of 30 days from sowing obtain two plant $hill^{-1}$ (80000 plants fed^{-1}).

Plants were kept free from weeds, which were manually controlled by hand hoeing at two times. The common agricultural practices for growing safflower according to the recommendations of Ministry of Agriculture were followed, except the factors under study.

Data recorded: Five guarded plants were randomly obtained from the first ridge of each plot at harvest (210 days from sowing) to study the following character:

- Number of heads $plant^{-1}$
- Weight of head (g)
- Diameter of head (cm)
- Number of seeds $head^{-1}$
- Weight of seeds $head^{-1}$ (g)
- 1000-seed weight (g).

Seed yield (kg fed^{-1})was obtained from the second and third ridge in each plot.

Statistical analysis: All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the strip plot design to each experiment (sowing dates), then combined analysis was done between sowing dates by means of "MSTAT-C" computer software package as published by Gomez and Gomez (1984). Least Significant Difference (LSD) method was used to test the differences between treatment means at 5% level of probability as described by Waller and Duncan (1969).

RESULTS AND DISCUSSION

Effect of sowing dates: Sowing dates of safflower showed significant effect on seed yield and components (number of heads $plant^{-1}$, weight and diameter of heads, number and weight of seeds $head^{-1}$, 1000-seed weight and seed yield) in both seasons as shown in Table 1 and 2.

Generally, the optimum sowing date that produced the highest values of seed yield and its components was intermediate sowing date i.e., 1st October, which resulted in the highest values of number of heads $plant^{-1}$ (30.55 and 34.74 heads $plant^{-1}$), weight (4.14 and 4.82 g) and diameter (3.01 and 3.63 cm) of heads, number (49.03 and 55.29 seeds $head^{-1}$) and weight (3.01 and 3.41 g) of seeds $head^{-1}$, 1000-seed weight (57.92 and 63.18 g) and seed yield (755.1 and 828.2 kg fed^{-1}) in the first and second seasons, respectively. Late sowing date (1st November) came in the second rank in this regard in both seasons. On the contrast, the lowest means of number of heads $plant^{-1}$ (18.40 and 20.88 heads $plant^{-1}$),

Table 1: Effect of sowing dates, nitrogen fertilizer levels and times of foliar application with milagrow on yield parameters during 2009/2010 and 2010/2011 seasons

	No. of heads plant^{-1}		Weight of head (g)		Diameter of head (cm)		No. of seeds head^{-1}	
Treatments	2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011
Sowing dates								
1st September	18.40	20.88	2.95	3.43	2.04	2.49	29.03	33.37
1st October	30.55	34.74	4.14	4.82	3.01	3.63	49.03	55.29
1st November	25.96	30.22	3.75	4.27	2.64	3.14	41.96	48.51
LSD at 5%	0.92	0.66	0.13	0.16	0.09	0.06	0.62	0.73
Nitrogen fertilizer levels								
40 kg N fed^{-1}	18.85	22.85	2.83	3.38	1.94	2.42	31.59	37.51
60 kg N fed^{-1}	24.96	28.48	3.60	4.07	2.49	3.09	40.07	45.55
80 kg N fed^{-1}	31.11	34.51	4.42	5.05	3.26	3.76	48.37	54.11
LSD at 5%	0.92	0.66	0.13	0.16	0.09	0.06	0.62	0.73
Times of foliar application with milagrow								
Without	22.96	26.70	3.33	3.87	2.33	2.87	36.92	42.66
One (30 DFS)	24.92	28.51	3.61	4.14	2.58	3.08	39.92	45.44
Two(30 and 70 DFS)	27.03	30.63	3.90	4.50	2.80	3.31	43.18	49.07
LSD at 5%	0.28	0.31	0.05	0.04	0.06	0.03	0.37	0.62
Interactions								
A×B	*	*	*	*	*	*	*	*
A×C	*	*	*	*	ns	*	*	*
B×C	*	*	*	*	*	ns	*	*
A×B×C	*	*	ns	ns	ns	ns	*	*

DFS: Days from sowing, *Significant at 0.05 level of probability, ns: Non-significant at 0.05 level of probability

Table 2: Effect of sowing dates, nitrogen fertilizer levels and times of foliar application with milagrow on seed parameters during 2009/2010 and 2010/2011 seasons

	Weight of seeds head^{-1} (g)		1000-seed weight (g)		Seed yield (kg fed^{-1})	
Treatments	2009/2010	2010/2011	2009/2010	2010/2011	2009/2010	2010/2011
Sowing dates						
1st September	2.21	2.73	44.18	49.48	592.9	642.5
1st October	3.01	3.41	57.92	63.18	755.1	828.2
1st November	2.61	3.09	53.77	58.63	671.9	777.5
LSD at 5%	0.03	0.05	0.58	0.60	8.4	6.8
Nitrogen fertilizer levels						
40 kg N fed^{-1}	2.12	2.61	45.92	52.07	612.0	698.3
60 kg N fed^{-1}	2.61	3.08	52.18	57.14	671.0	742.1
80 kg N fed^{-1}	3.11	3.53	57.77	62.07	736.9	807.7
LSD at 5%	0.03	0.05	0.58	0.60	8.4	6.8
Times of foliar application with milagrow						
Without	2.45	2.91	49.96	55.37	649.2	725.8
One (30 DFS)	2.61	3.08	52.03	57.11	673.5	749.2
Two(30 and 70 DFS)	2.77	3.24	53.88	58.81	697.2	773.1
LSD at 5%	0.02	0.02	0.25	0.27	4.4	6.5
Interactions						
A×B	*	*	*	ns	*	*
A×C	ns	*	ns	ns	*	*
B×C	ns	*	*	ns	*	*
A×B×C	*	*	ns	ns	*	*

DFS: Days from sowing,*Significant at 0.05 level of probability, ns: Non-significant at 0.05 level of probability

weight (2.95 and 3.43 g) and diameter (2.04 and 2.49 cm) of heads, number (29.03 and 33.37 seeds head^{-1}) and weight (2.21 and 2.73 g) of seeds head^{-1}, 1000-seed weight (44.18 and 49.48 g) and seed yield (592.9 and 642.5 kg fed^{-1}) were achieved as a results of early sowing of safflower on 1st September in the first and second seasons, respectively. The desirable effect of sowing safflower on 1st October on seed yield and its components 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 dry matter accumulation, yield components as well as seed yield per unit area. These results were in agreement with those reported by Badawi *et al.* (1996), Uslu (2003), Dadashi and Khajehpour (2004) and Nikabadi *et al.* (2008).

Effect of nitrogen fertilizer levels: From obtained results, nitrogen fertilizer levels significantly affected seed yield and its components i.e., number of heads plant^{-1}, weight and diameter of heads, number of seeds head^{-1} (Table 1),

weight of seeds head^{-1}, 1000-seed weight and seed yield fed^{-1} (Table 2) at harvesting time in both growing seasons.

It can be easily consider that raising nitrogen levels markedly accompanied with obvious increase in all studied characters in both seasons. Application of 80 kg N fed^{-1} significantly resulted in the highest values of number of heads plant^{-1} (31.11 and 34.51 heads plant^{-1}), weight (4.42 and 5.05 g) and diameter (3.26 and 3.76 cm) of heads, number (48.37 and 54.11 seeds head^{-1}) and weight (3.11 and 3.53 g) of seeds head^{-1}, 1000-seed weight (57.77 and 62.07 g) and seed yield (736.9 and 807.7 kg fed^{-1}) in the first and second seasons, respectively. In addition, application of 60 kg N fed^{-1} produced the best results after aforementioned level in both seasons. However, the lowest values of number of heads plant^{-1} (18.85 and 22.85 heads plant^{-}), weight (2.83 and 3.38 g) and diameter (1.94 and 2.42 cm) of heads, number (31.59 and 37.51 seeds head^{-1}) and weight (2.12 and 2.61 g) of seeds head^{-1}, 1000-seed weight (45.92 and 52.07 g) and seed yield (612.0 and 698.3 kg fed^{-1}) were resulted from application of 40 kg N fed^{-1} in the first and second seasons, respectively.

The increase in seed yield and its components as a result of increasing nitrogen fertilizer levels could be easily ascribed to the low soil content of available nitrogen, phosphorus and potassium, where the nitrogen is considered as one of the major elements for plant nutrition and it increases the vegetative cover for plant and forms strong plants with highest number of heads. Moreover, nitrogen encouraged plant to uptake other elements and activating growth of plants, consequently, enhancement most growth measurements and yield components that mentioned and demonstrated formerly. These results are in agree with those reported by many workers including Patel *et al.* (1994), Singh *et al.* (1994), Siddiqui and Oad (2006), Christos and Sioulas (2008) and Elfadl *et al.* (2009).

Effect of times of foliar application with milagrow: All seed yield and its components under study i.e., number of heads plant^{-1}, weight and diameter of heads, number and weight of seeds head^{-1}, 1000-seed weight and seed yield were significantly responded due to times of foliar application with milagrow one or two times as well as control treatment (without foliar application) in both seasons as presented in Table 1 and 2.

Spraying safflower plants with milagrow as a natural growth promoter two times after 30 and 70 days from sowing produced the highest values of number of heads plant^{-1} (27.03 and 30.63 heads plant^{-1}), weight (3.90 and 4.50 g) and diameter (2.80 and 3.31 cm) of heads, number (43.18 and 49.07 seeds head^{-1}) and weight (2.77 and 3.24 g) of seeds head^{-1}, 1000-seed weight (53.88 and 58.81 g) and seed yield (697.2 and 773.1 kg fed^{-1}) in the first and second seasons, respectively. On the other wise, control treatment gave the lowest values of number of heads plant^{-1} (22.96 and 26.70 heads plant^{-1}), weight (3.33 and 3.87 g) and diameter (2.33 and 2.87 cm) of heads, number (36.92 and 42.66 seeds head^{-1}) and weight (2.45 and 2.91 g) of seeds head^{-1}, 1000-seed weight (49.96 and 55.37 g) and seed yield (649.2 and 725.8 kg fed^{-1}) in the first and second seasons, respectively. However, plants sprayed with milagrow one time after 30 days from sowing came in the second rank after those sprayed twice with milagrow in both seasons.

Such effects of number of foliar application times with milagrow on seed yield and its components might have been due to the improvement in early growth. Which lead to more dry matter accumulation and stimulation the building of metabolic products accompanied with increasing foliar application time with milagrow which combined effects of oxen, cytokines, gibberellins, ethylene and hydrogen cyanamid. Similar results were reported by several researchers such as Dholekar *et al.* (2001), Ebrahimzadeha *et al.* (2009) and Khandagale *et al.* (2009).

Effect of interactions: Regarding the effect of interactions, it could be noticed that there are many significant interactions between studied factors on most studied characters as shown in Table 1 and 2. But, we reported herein the interactions among studied factors on seed yield/fed only. It could be noticed that from obtained results, seed yield fed^{-1} was significantly influenced by the different interactions among studied factors in both seasons.

The optimum interaction treatment that produced the highest values of seed yield (831.3 and 900.7 kg fed^{-1}) was sowing safflower on 1st October and fertilized with 80 kg N fed^{-1} in the first and second seasons, respectively (Table 3). On the other side, the lowest values of this trait (550.3 and 603.5 kg fed^{-1}) were followed from sowing on 1st September and using 40 kg N fed^{-1} in the first and second seasons, respectively. Similar results were established by Badawi *et al.* (1996).

As shown from data in Table 4, the highest values of seed yield (787.0 and 851.7 kg fed^{-1}) were produced from the interaction treatment of sowing safflower on 1st October in combination with twice foliar application with milagrow in the first and second seasons, respectively. On the contrary of that, the lowest ones (576.8 and 630.1 kg fed^{-1}) accompanied with sowing on 1st September and without foliar application with milagrow in the first and second seasons, respectively.

Table 3: Seed yield as affected by the interaction between sowing dates and nitrogen fertilizer levels during 2009/2010 and 2010/2011 seasons

	2009/2010			2010/2011		
	N-level (kg N fed^{-1})			N-level (kg N fed^{-1})		
Sowing dates	40	60	80	40	60	80
1st September	550.3	597.5	631.0	603.5	646.3	677.8
1st October	682.1	751.8	831.3	776.3	807.5	900.7
1st November	603.6	663.6	748.5	715.3	772.5	844.7
LSD at 5%	14.5			11.8		

Table 4: Seed yield as affected by the interaction between sowing dates and times of foliar application with milagrow during 2009/2010 and 2010/2011 seasons

	2009/2010 (kg fed^{-1})			2010/2011 (kg fed^{-1})		
	Milagrow			Milagrow		
Sowing dates	Without	One (30 DFS)	Tow (30 and 70 DFS)	Without	One (30 DFS)	Tow (30 and 70 DFS)
1st September	576.8	596.3	605.6	630.1	640.8	656.6
1st October	725.5	752.8	787.0	802.3	830.5	851.7
1st November	645.3	671.5	699.0	745.0	776.5	811.0
LSD at 5%	7.7			11.3		

DFS: Days from sowing

Table 5: Seed yield as affected by the interaction between nitrogen fertilizer levels and times of foliar application with milagrow during 2009/2010 and 2010/2011 seasons

	2009/2010 (kg fed^{-1})			2010/2011 (kg fed^{-1})		
	Milagrow			Milagrow		
N-levels (kg N fed^{-1})	Without	One (30 DFS)	Two (30 and 70 DFS)	Without	One (30 DFS)	Two (30 and 70 DFS)
40	590.8	614.1	631.1	675.1	699.0	721.0
60	651.3	673.0	688.6	731.3	742.6	752.3
80	705.5	733.5	771.8	771.0	806.2	846.1
LSD at 5%	7.8			11.4		

DFS: Days from sowing

Table 6: Seed yield as affected by the interaction among sowing dates, nitrogen fertilizer levels and times of foliar application with milagrow during 2009/2010 and 2010/2011 seasons

		2009/2010 (kg fed^{-1})			2010/2011 (kg fed^{-1})		
		Milagrow			Milagrow		
Sowing dates	N-levels (kg N fed^{-1})	Without	One (30 DFS)	Two (30 and 70 DFS)	Without	One (30 DFS)	Two (30 and 70 DFS)
1st September	40	532.5	554.5	564.0	589.5	602.0	619.0
	60	576.5	602.0	614.0	634.0	645.5	659.5
	80	621.5	632.5	639.0	667.0	675.0	691.5
1st October	40	650.5	683.0	713.0	760.5	778.5	790.0
	60	739.5	749.0	767.0	796.0	809.0	817.5
	80	786.5	826.5	881.0	850.6	904.0	947.6
1st November	40	589.5	605.0	616.5	675.5	716.5	754.0
	60	638.0	668.0	685.0	764.0	773.5	780.0
	80	708.5	741.5	795.5	795.5	839.6	899.1
LSD at 5%		13.4			19.7		

DFS: Days from sowing

Fertilizing safflower plants with the highest level of nitrogen fertilizer (80 kg N fed^{-1}) and twice foliar application with milagrow was the optimum interaction treatment that produced the highest values of seed yield, where data were 771.8 and 846.1 kg fed^{-1} in the first and second seasons, respectively (Table 5). It was followed by the treatment of using 80 kg N fed^{-1} and once foliar application with milagrow with lower differences as compared with other treatments in both growing seasons.

With connection the effect of the triple interaction on seed yield (kg fed^{-1}), it was significant in the two seasons of study (Table 6). The highest means of seed yield (881.0 and 947.6 kg fed^{-1}) were resulted from sowing safflower during the first of October and utilization of 80 kg N fed^{-1} in addition to twice foliar application with milagrow in the first and second seasons, respectively. The best interaction ranked after formerly treatment was sowing on 1st October+80 kg N fed^{-1}+once foliar application with milagrow in both growing seasons.

CONCLUSION

From the obtained data in this study, it can be concluded that sowing safflower on 1st October and

mineral fertilizing with 80 kg N fed^{-1} beside twice foliar application with milagrow as a natural growth promoter in order to maximizing its productivity under the environmental conditions of Dakahlia Governorate, Egypt.

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