Response of Some Wheat Cultivars to Seeding Rate and Foliar Nutrition with Nofatrein in Reclaimed Sandy Soil

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Abstract: *Response of four wheat cultivars viz, sids 1, Sakha 93, Gemmiza 9 and Giza 168 to three seeding rates i.e. 65, 85 and 105 kg/fad. and foliar nutrition with Nofatrein were investigated during 2002/2003 and 2003/2004 growing seasons in an extension field at El-Salhia region, Sharkia Governorate, Egypt. A split-split plot design with three replicates was used in both seasons.*

Increasing seeding rate from 65 to 105 kg/fad. caused significant increases in plant height, number of spikes/m^2, grain yield, straw yield and biological yield/fad. The increments in grain yield/fad. were 4.41% and 7.90% over the two studied seasons due to increasing seeding rate from 65 to 85 and from 65 to 105 kg/fad., respectively. On the other hand increasing seeding rate caused a reduction in flag leaf blade area, no. of grains/spike and 1000-grain weight.

There were significant differences for all studied traits owing to varietal differences, Sakha 93 surpassed the other tested cultivars (Sids 1, Gemmiza 9 and Giza 168) in all studied traits. Generally, in regard to grain yield/fad., cultivars could be arranged in a descending order as following: Sakha 93, Sida 1, Giza 168 and Gemmiza 9. Grain yield over the two seasons ranged from 2.435 to 2.276 tons / fad. while straw yield ranged from 3.116 tons for Gemmiza 9 to 3.304 tons for Sakha 93 cv. Treatment with Nofatrein in both seasons had favorable significant effect on all studied traits. Grain yield/fad. increased significantly by 4.46% over the two seasons due to this treatment. Grain yield/fad. was significantly correlated with plant height, no. of spikes/m^2, spike length, no. of spikelets/spike, no. of grains/spike, 1000-grain weight, straw yield and biological yield/fad. Also, path analysis of the combined data showed that number of spike/m^2 was the main source of yield variation. Number of spikes/m^2, number of grains/spike and 1000 grain weight contributed together 78.41% of the total grain yield/fad.

Key Words: wheat cultivars, seeding rates, foliar nutrition, Nofatrein.

INTRODUCTION

Wheat crop is one of the most important cereal crops in Egypt. It occupied an acreage of about 2.6 million faddans with total production of grain yield about 6 million tons. The food gap, caused by the ever-growing population will ever exist and widen unless efforts are made to overcome it. In this respect, increasing cultivated area as well as increasing the productivity per unit area are main objectives to overcome this gap. Therefore, extension of wheat cultivation in the newly reclaimed sandy lands is a must.

Increasing the productivity of wheat by applying the most optimum cultural practices on such areas, is considered main goal for researchers. Growing new released wheat cultivars with the suitable seeding rates are considered a great importance in this respect.

Historically seeding rates have received much attention from researchers in wheat producing countries. This factor plays the important role affecting quantity of grain yield and its components. Grain and straw yields were increased as seeding rates had been increased (Bassiouny *et al.*, 1993; Salem *et al.*, 1994; Mazurek and Sulek, 1995; Fontes *et al.*, 1997. Hassan (1999), found that increasing seeding rate of wheat from 50 to 65 to 80 kg/fad. caused significant increases in grain and straw yields. Increasing the crowdenss of wheat plants to certain level increased number of spike per unit land area. These findings were

reported by Salem *et al.*, (1994); Gulzar *et al.*, (1995); Fontes *et al.*, (1997); El-Bana (1999) and Gaballah and Bassiouny (2001). While Abd El-Maksoud, (1999) reported that increasing number of wheat plants per unit land area either by seed number/m^2 (300 to 400 seeds/m^2), or rate of seeding decreased grains weight/spike. Bassiouny *et al.*, (1993), Abd-Allah Maha and Bassiouny, (1994), Gulzar *et al.*, (1995), Shah and Ayazs, (1996), Yakout *et al.*, (1998), Hassan, (1999) as well as Gaballah and Bassiouny, (2001) found that increasing the crowdness of wheat plants decreased 1000-grain weight. But Abd El-Aleem and Sabry, (1994), El-Bana and Basha, (1994) and Salem *et al.*, (1994), concluded that thousand grain weight was not affected by raising seeding rate up to 90 kg/fad. Gulzar *et al.*, 1995 and Sun-Yuan *et al.*, 1996 confirmed that harvest index was decreased with increasing planting density, while El-Bana, (1999) reported that harvest index was insignificantly affected by varying planting density.

Saleh (2003) found that the lower seeding rate of 60 kg seeds/ha. had favourable effect on the number of grains/spikelet and number of grains/spike, but grain yield and number of spikes/m^2 were increased significantly with increasing seeding rate to 120 kg seeds/ha.

Significant differences in yield and yield attributes of Egyptian cultivars were reported by Taha *et al.*, (1990), El-Sayed *et al.*, (1992), Hassan (1999), Abd El-Maksoud (1999), Mwaffy (1999), Iskandar (2000) and Gaballah and Bassiouny (2001). Abo Warda (1997) reported significant differences among the tested long spike lines; Sids 4, Sids 5, Sids 6, Sids 7, Sids 8, Sids 9 and Sids 1 in straw yield, number of spikes/m^2, number of grains/spike and 1000-grain weight. Sids 5 produced the highest number of grains/spike (59.62), while Sids 7 gave the highest 1000-grain weight (55.08). Similar findings were shown by Hassanein *et al.*, (1997), Gaballah and Bassiouny, (2001) and Ali *et al.*, (2004).

Foliar spraying with urea alone or in combination with certain macro and micronutrient elements was found to have a pronounced effect on the yield capacity of wheat (Hassan and Gaballah, 1999). Mahmoud and El-Mandoh, (1982), found that urea + micronutrients namely B, Zn, Mn, Cu and Fe had a significant effect on most yield components and grain quality. Saad *et al.*, 1984 indicated that the highest grain yield was obtained by spraying wheat with urea + Zn or with urea + Cu + Zn. Abd El-Hadi *et al.*, (1990) indicated that wheat responded to the foliar fertilization of Fe, Mn and Zn and they reported that the increase in grain yield ranged between 1.2 to 2.6 ardab/fad. Salwau (1994) found that plant height, no. of spikes/m^2, spike length, number of spikelets/spike, 1000-grain weight and grain and straw yield/fad. were significantly increased by spraying urea alone or with different micronutrients. Similar results were obtained by El-Kalla *et al.*, 1994, Hassan and Bassiouny, 1995 and El-Kabbany *et al.*, 1996. Hassan and Gaballah, 1999 stated that the treatment with Full-Nutrient 2000 in two seasons and over them had favourable significant effect on all studied traits except, number of spikes/m^2.

Sarhan *et al.*, (2004), found that the level of nitrogen (3% N) as foliar application with 15 kg N fed^{-1} as activated dose, increased plant height, leaf area, spike length, grain and straw yield. Also this levels increased the grain and straw yields by 16.89 and 8.44%, respectively, over the recommended dose and at the same time saved the quantity of soil application N by 40.5 kg N/fed^{-1}.

Thus, the aim of this work was to investigate the effect of seeding rate and the efficiency of spraying foliar nutrition by Nofatrein on yield and yield components of some wheat cultivars under sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were carried out at demonstration field at El-Salhia, Sharkia governorate, Egypt during two Winter seasons (2002/2003 and 2003/2004) to study the response of four Egyptian wheat cultivars viz. Sids 1, Sakha 93, Gemmiza 9 and Giza 168 to three seeding rates (65, 85 and 105 kg/faddan) and foliar nutrition with Nofatrein (consists of 5% N, 5% P, 5% K, 0.15% Fe, 0.10% Mn, 0.15% Zn, 0.05% B and 0.02% Mo). The soil of the experimentation site is sandy. The mechanical and chemical analyses of the soil are given in Table 1.

Table 1: Some physical and chemical properties of the experimental soil.

Characters	2002/2003	2003/2004
Coarse sand %	21.26	20.02
Fine sand %	69.82	70.58
Silt %	6.42	7.03
Clay %	2.50	2.37
Texture	Sandy	Sandy
PH	8.20	8.11
Available N (ppm)	11.01	11.6
Available P (ppm)	3.83	3.75
Available K (ppm)	90.34	92.17

The split-split plot design with three replicates was used in both seasons. The three seeding rates 65, 85 and 105 kg/fad. were assigned to the main plots. The sub plots included wheat cultivars, while foliar nutrition treatments (treated and untreated) were distributed in the sub-sub plots. Plot size was 9 m^2 (3×3) including 15 rows 20 cm. apart and 3 m. length. Wheat seeds were sown by hand drilling on November 13th and 15th in both seasons, respectively.

Foliar treatment with Nofatrein at rate of one liter/fad. was added to 300 liter water and this spray volume was applied at three stages, namely after 45, 65 and 85 days from sowing. Surface irrigation was followed. Nitrogen fertilization (Ammonium sulphate 20.6 %) was applied at a rate of 75 kgs N/fad. in three equal doses. Normal agronomic practices were adopted as usually done by local growers.

After ear emergence the flag leaf blade area (cm^2) was recorded. At harvest ten competitive plants were randomly taken from the second inner rows of each plot to determine plant height (cm), spike length (with awns), number of spikelets/spike, number of grains/spike. Also a fixed area of $2m^2$ was harvested from each plot to determine number of spikes/m^2, 1000-grain weight, grain yield, straw yield and biological yield/fad. Data of both seasons were statistically analyzed according to Snedecor and Cochran (1967).

For comparison between means, Duncan's multiple range test was applied (Duncan, 1955).

RESULTS AND DISCUSSION

I) Effect of seeding rate:

Results in Tables 2, 3 and 4 indicated that seeding rate significantly affected all studied traits except, no. of spikelets/spike in both seasons and over seasons.

Increasing seeding rate from 65 to 105 kg/fad. significantly increased plant height. This increase is not indicative of vigorous growth. It could be attributed to the competition in the dense planting for light as its intensity decreased which enhanced elongation of the internodes of plants and consequently increased plant height.

Number of spikes per square meter was consistently significantly increased by increasing seeding rate. The increases amounted to 5.58% and 8.46% as the seeding rate was raised from 65 to 85 to 105 kg/fad., respectively (over the two seasons). On the other hand, blade area of flag leaf (cm^2), number of grains/spike and 1000-grain weight were consistently and significantly decreased by increasing seeding rate. The decrements in yield components were attributed to the increase of competition among wheat plants for growth when seeding rate increased from 65 to 105 kg/fad.

Increasing seeding rate from 65 to 85 and to 105 kg/fad. resulted significant increases in grain, straw and biological yields/fad. Comparing to 65 kg, seeding rates 85 and 105 kg/fad. recorded increments in grain yield 4.38% and 7.66% in the first season and 4.45% and 8.20% in the second season as well as 4.41% and 7.90% over the two studied seasons, respectively. These findings are in accordance with those of Abdel-Gawad, (1990) Salem, (1993), Abd-Allah, Maha and Bassiouny, (1994), El-Bana and Basha, (1994), Abdel-Gawad *et al.*, (1997) Gomaa, (1997) Hassan, (1999) and Gaballah and Bassiouny, (2001).

II) Cultivar differences:

Results in Table 2 show the differences among wheat cultivars in plant height, flag leaf blade area and number of spikes/m^2. The obtained results indicated significant differences among studied wheat cultivars, i.e., Sids 1, Sakha 93, Gemmiza 9 and Giza 168. However, wheat cultivar Sakha 93 surpassed the other three cultivars in plant height, while Gemmiza 9 was the shortest cultivar. Also, Giza 93 surpassed significantly in flag leaf blade area (cm^2) the other three cultivars which did not

differ significantly from each other in this respect. This held true in each season and over the two seasons . Regarding the no. of spikes /m^2, the highest values were recorded for Sakha 93 followed by Sids 1 followed by Giza 168 followed by Gemmiza 9 in a descending order. The differences among the four cvs. in this trait were significant in the two seasons and their combined. Over the two seasons, Sakha 93 surpassed in number of spikes/m^2 , Sids 1 Giza 168 and Gemmiza 9 by 1.65%, 5.46% and 7.01%, respectively .

Results in Table 3 indicated that wheat cultivars were significantly different in their spike length, number of spikelets/spike, number of grains/spike and 1000-grain weight. Sakha 93 cultivar produced the longest spikes with the highest number of spikelets, no. of grains per spike and 1000-grain weight, while Gemmiza 9 had the shortest spikes and gave the lowest number of spikelets, no. of grains/spike and 1000-grain weight. It could be concluded that differences existed between wheat cultivars, may be due to genetical differences.

The results reported in Table 4 indicate that there were significant differences among the studied wheat cultivars in yield of grains, straw and biological /fad. It is clear from the combined results that Sakha 93 produced the highest grain, straw and biological yields/fad, while Gemmiza 9 cv. gave the lowest grain, straw and biological yields. In this respect, the studied cultivars could be arranged in a descending order as follows: Sakha 93, Sids 1, Giza 168 and Gemmiza 9. Over the two seasons, Sakha 93 surpassed Sids 1, Giza 168 and Gammiza 9 cvs. by 2.35%, 3.57% and 7.00% in grain yield, 2.16%, 2.51% and 6.03% in straw yield and 2.26%, 2.96% and 2.46% in biological yield, respectively. It is worthy to mention that Sakha 93 recorded the highest values of yield components namely no. of spikes/m^2 , number and weight of grains/spike and 1000 grain weight which interpreted the superiority of its productivity. These results are in harmony with those obtained by Taha *et al.*, (1990), El-Sayed *et al.*, (1992), Hassan, (1999) Mwaffy, (1999) Gaballah and Bassiouny, (2001) and Ali *et al.*, (2004).

III) Foliar nutrition effect:

Foliar application of Nofatrein over the three seeding rates and four studied cultivars, had significant favourable effects on plant height, flag leaf blade area, number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, 1000-grain weight and grain, straw and biological yields/fad (Tables 2,3 and 4). This was true in both seasons and in the combined data. Grain yield/fad. increased significantly by 4.43% in the first season, 4.50% in the second season and by 4.46% over the two studied seasons. The tested foliar mixture contains the main macronutreints; namely N, P and K as well as several micronutrients which are important to increase yield and yield components of wheat.

These results are in accordance with those of Abd El-Hadi *et al.*, (1990) El-Kalla *et al.*, (1994), Salwau, (1994), Hassan and Bassiouny (1995) El-Kabbany *et al.*, (1996) Hassan and Gaballah (1999) and Sarhan *et al.*, (2004).

IV) Interaction effect:

The interaction between wheat cultivars and sowing dates had not significant effects on all studied traits i.e. the main factors affected all traits independently, except number of spikes/m^2 and number of spikelets/spike (combined data) as shown in Table 5. In general, Sakha 93 cultivar gave the highest values of number of spikes/m^2 and number of spikelets/spike at seeding rate 105 kg/fad. (334.33 and 22.1 respectively) and surpassed the other studied cultivars under every seeding rate.

Furthermore, significant interaction effects were found between seeding rates and foliar nutrition on flag leaf blade area and number of spikes/m^2 (combined data). However, the highest value of flag leaf blade area (cm^2) was recorded for plants raized from 65 kg seeds/fad. and treated with foliar nutrition, while the lowest value of this trait was recorded for plants grown with seeding rate 105 kg/fad and untreated with foliar nutrition. On the other hand the highest value of number of spikes/m^2 (333.7) was recorded by seeding rate 105 kg/fad. under treated plants by foliar nutrition (Table 6).

V) Correlation study:

V-a) Simple correlation:

Table 2: Effect of seeding rates, cultivars and foliar nutrition on some yield attributes of wheat.

Main effects and interactions	Plant height (cm)			Flag leaf blade area (cm^2)			No. of spikes / m^2		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Seeding rate (S):									
65 kg / fad.	90.1 [c]	87.9 [c]	89.0 [c]	19.93 [a]	19.21 [a]	19.57 [a]	305.3 [c]	297.3 [c]	301.3 [c]
85 kg / fad.	92.0 [b]	90.6 [b]	91.3 [b]	19.28 [b]	18.40 [b]	18.84 [b]	323.1 [b]	313.1 [b]	318.1 [b]
105 kg / fad.	93.9 [a]	92.3 [a]	93.1 [a]	18.43 [c]	17.49 [c]	17.95 [c]	332.0 [a]	321.7 [a]	326.8 [a]
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *
Cultivars (C):									
Sids 1	92.5 [b]	89.5 [b]	91.0 [b]	19.04 [b]	18.21 [b]	18.62 [b]	326.4 [b]	316.5 [b]	321.4 [b]
Sakha 93	94.1 [a]	92.9 [a]	93.5 [a]	20.04 [a]	18.95 [a]	19.50 [a]	331.7 [a]	321.6 [a]	326.7 [a]
Gemmiza 9	90.1 [d]	89.1 [b]	89.6 [c]	18.85 [b]	18.13 [b]	18.49 [b]	308.6 [d]	298.9 [d]	303.8 [d]
Giza 168	91.3 [c]	89.6 [b]	90.5 [b]	18.92 [b]	18.16 [b]	18.54 [b]	313.8 [c]	305.8 [c]	309.8 [c]
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *
Foliar nutrition (F):									
Untreated	91.1 [b]	88.7 [b]	89.9 [b]	18.60 [b]	17.79 [b]	18.20 [b]	312.8 [b]	303.1 [b]	307.9 [b]
Treated	92.9 [a]	91.8 [a]	92.4 [a]	19.83 [a]	18.93 [a]	19.38 [a]	327.5 [a]	318.4 [a]	322.9 [a]
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *
Intertactions:									
S × C	N.S	N.S	N.S	N.S	N.S	N.S	* *	N.S	* *
S × F	N.S	N.S	N.S	N.S	N.S	*	* *	N.S	*
C × F	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 3: Effect of seeding rate , wheat cultivars and foliar nutrition on spike length, number of spikelets / spike, number of grains / spike and 1000 grain weight of wheat.

Main effects and interactions	Spike length (cm)			No. of spikelets / spike			No. of grains / spike			1000 – Grain weight (g)		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Seeding rate (S):												
65 kg / fad.	17.4	17.2	17.3 ^{b}	20.5	20.0	20.2	48.6 ^{a}	47.9 ^{a}	48.2 ^{a}	47.2 ^{a}	46.7 ^{a}	47.0 ^{a}
85 kg / fad.	17.3	17.3	17.3 ^{ab}	20.4	19.9	20.1	47.4 ^{b}	46.7 ^{b}	47.1 ^{b}	46.1 ^{b}	45.3 ^{b}	45.7 ^{b}
105 kg / fad.	17.6	17.4	17.5 ^{a}	20.6	20.0	20.1	47.0 ^{b}	46.6 ^{b}	46.8 ^{b}	45.8 ^{c}	45.0 ^{b}	45.4 ^{c}
F. test	N.S	N.S	*	N.S	N.S	N.S	* *	* *	* *	* *	* *	* *
Cultivars (C):												
Sids 1	17.7 ^{b}	17.5 ^{b}	17.6 ^{b}	20.6 ^{b}	20.1 ^{b}	20.4 ^{b}	47.3 ^{b}	46.9 ^{b}	47.1 ^{b}	47.4 ^{b}	46.8 ^{b}	47.1 ^{b}
Sakha 93	18.4 ^{a}	18.3 ^{a}	18.4 ^{a}	22.0 ^{a}	21.4 ^{a}	21.7 ^{a}	50.4 ^{a}	49.7 ^{a}	50.1 ^{a}	48.6 ^{a}	48.2 ^{a}	48.4 ^{a}
Gemmiza 9	16.7 ^{c}	16.7 ^{c}	16.7 ^{c}	19.4 ^{d}	19.0 ^{d}	19.2 ^{d}	45.7 ^{c}	45.4 ^{d}	45.5 ^{d}	43.9 ^{d}	43.0 ^{d}	43.4 ^{d}
Giza 168	16.9 ^{c}	16.8 ^{c}	16.9 ^{c}	19.8 ^{c}	19.3 ^{c}	19.5 ^{c}	47.2 ^{b}	46.2 ^{c}	46.7 ^{c}	45.7 ^{c}	44.7 ^{c}	45.2 ^{c}
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *
Foliar nutrition (F):												
Untreated	17.1 ^{b}	16.9 ^{b}	17.0 ^{b}	19.8 ^{b}	19.4 ^{b}	19.6 ^{b}	46.9 ^{b}	46.4 ^{b}	46.6 ^{b}	45.9 ^{b}	45.1 ^{b}	45.5 $_{b}$
Treated	17.8 ^{a}	17.7 ^{a}	17.8 ^{a}	21.1 ^{a}	20.5 ^{a}	20.8 ^{a}	48.4 ^{a}	47.7 ^{a}	48.1 ^{a}	46.9 ^{a}	46.2 ^{a}	46.6 ^{a}
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *	* *
Intertactions:												
S × C	N.S	N.S	N.S	* *	* *	* *	N.S	N.S	N.S	N.S	N.S	N.S
S × F	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
C × F	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 4: Effect of seeding rates, cultivars and foliar nutrition on grain, straw and biological yields of wheat.

Main effects and interactions	Grain yield (ton / fad.)			Straw yield (ton / fad.)			Biological yield (ton / fad.)		
	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.	2002/2003	2003/2004	Comb.
Seeding rate (S):									
65 kg / fad.	2.376 ^{c}	2.158 ^{c}	2.267 ^{c}	3.220 ^{c}	2.959 ^{c}	3.090 ^{c}	5.596 ^{c}	5.117 ^{c}	5.356 ^{c}
85 kg / fad.	2.480 ^{b}	2.254 ^{b}	2.367 ^{b}	3.368 ^{b}	3.083 ^{b}	3.226 ^{b}	5.848 ^{b}	5.337 ^{b}	5.593 ^{b}
105 kg / fad.	2.558 ^{a}	2.335 ^{a}	2.446 ^{a}	3.487 ^{a}	3.197 ^{a}	3.342 ^{a}	6.045 ^{a}	5.531 ^{a}	5.788 ^{a}
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *
Cultivars (C):									
Sids 1	2.499 ^{b}	2.258 ^{b}	2.379 ^{b}	3.408 ^{b}	3.060 ^{bc}	3.234 ^{b}	5.906 ^{b}	5.318 ^{b}	5.612 ^{b}
Sakha 93	2.563 ^{a}	2.306 ^{a}	2.435 ^{a}	3.471 ^{a}	3.137 ^{a}	3.304 ^{a}	6.035 ^{a}	5.443 ^{a}	5.739 ^{a}
Gemmiza 9	2.370 ^{d}	2.182 ^{c}	2.276 ^{d}	3.214 ^{d}	3.017 ^{c}	3.116 ^{c}	5.584 ^{d}	5.199 ^{c}	5.391 ^{c}
Giza 168	2.453 ^{c}	2.249 ^{b}	2.351 ^{c}	3.341 ^{c}	3.105 ^{ab}	3.223 ^{b}	5.794 ^{c}	5.354 ^{b}	5.574 ^{b}
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *
Foliar nutrition (F):									
Untreated	2.418 ^{b}	2.199 ^{b}	2.309 ^{b}	3.291 ^{b}	3.017 ^{b}	3.154 ^{b}	5.708 ^{b}	5.217 ^{b}	5.463 ^{b}
Treated	2.525 ^{a}	2.298 ^{a}	2.412 ^{a}	3.426 ^{a}	3.142 ^{a}	3.284 ^{a}	5.951 ^{a}	5.440 ^{a}	5.696 ^{a}
F. test	* *	* *	* *	* *	* *	* *	* *	* *	* *
Intertactions:									
S × C	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
S × F	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
C × F	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 5: Number of spikes / m^2 and number of spikelets / spike as affected by the interaction between seeding rates and cultivars (combined data).

Cultivars	No. of spikes / m^2			No. of Spikelets / spike		
	Seeding rates Kg / fad.					
	65	85	105	65	85	105
Sids 1	C 314.29 a	B 230.25 b	A 329.79 b	C 20.0 b	B 20.4 b	A 20.8 b
Sakha 93	C 316.67 a	B 328.96 a	A 334.33 a	B 21.5 a	B 21.6 a	A 22.1 a
Gemmiza 9	C 285.58 b	B 307.88 d	A 317.88 c	A 19.7 c	B 19.0 d	B 18.9 d
Giza 168	C 288.67 b	B 315.42 c	A 325.38 b	A 19.8 bc	A 19.6 c	B 19.2 c

Table 6: Flag leaf blade area (cm^2) and number of spikes / m^2 as affected by seeding rates × foliar nutrition interaction (combined data).

Foliar nutrition	Flag leaf blade area cm^2			No. of Spikes / m^2		
	Seeding rates Kg / fad.					
	65	85	105	65	85	105
Untreated	A 19.12 a	B 18.24 b	C 17.23 b	C 295.8 b	B 307.9 b	A 319.9 b
Treated	A 20.02 a	B 19.43 a	C 18.68 a	C 306.8 a	B 328.3 a	A 333.7 a

* Capital and small letters were used to compare rows and columns means, respectively.

Table7: Simple correlation coefficients between grain yield (ton/fad.) and its components of wheat (combined data).

Character	1	2	3	4	5	6	7	8	9
Y-Grain yield (ton/fad.)	0.857**	0.154	0.820**	0.705**	0.654**	0.437**	0.424**	0.983**	0.994**
1-Plant height		0.113	0.749**	0.651**	0.577**	0.402**	0.426**	0.852**	0.858**
2-Flag leaf blade area			0.104	0.506**	0.544**	0.727**	0.622**	0.086	0.115
3-No.of spikes/m^2				0.599**	0.508**	0.269*	0.347**	0.818**	0.823**
4-Spike length					0.848**	0.746**	0.731**	0.668**	0.686**
5-No.of spikelets/spike						0.787**	0.743**	0.612**	0.632**
6-No.of grains/spike							0.825**	0.380**	0.405**
7- 1000-grains weight								0.403**	0.413**
8-Straw yield (ton/fad.)									0.997**
9-Biological yield (ton/fad.)									-------

Table 8: Partitioning of simple correlation coefficients between grain yield (ton/ fad.) and its components of wheat (combined of both seasons).

Sources	Values
Number of spikes/m^2:	
Direct effect	0.7712
Indirect effect via number of grains/spike	0.0847
Indirect effect via 1000-grains weight	-0.0358
Total (ry1)	0.8200
Number of grains/spike:	
Direct effect	0.3147
Indirect effect via 1000-grains weight	0.2074
Indirect effect via number of spikes/m^2	-0.0852
Total (ry2)	0.4370
1000-grains weight:	
Direct effect	-0.1033
Indirect effect via number of spikes/m^2	0.2676
Indirect effect via number of grains/spike	0.2597
Total (ry3)	0.4240

Table 9: Direct and joint effects of grain yield components presented as a percentage of variation of wheat.

Sources	C.D.	%
Number of spikes/m^2	0.2245	22.45
Number of grains/spike	0.0965	9.65
1000-grains weight	0.0734	7.34
Number of spikes/m^2 x Number of grains/spike	0.1896	18.96
Number of spikes/m^2 x 1000-grains weight	0.0986	9.86
Number of grains/spike x 1000-grains weight	0.1014	10.14
R^2	0.7841	78.41
Residual	0.2159	21.59
Total	0.10000	100.00

C.D. = Coefficient of determination
% = Percentage contributed

The interrelationships between grain yield/fad. and yield contributing characters measured as simple correlation coefficients are shown in Table 7.

Grain yield showed positive and significant correlation with each of plant height, number of spikes/m^2, spike length, number of spikelets/spike, number of grains/spike, 1000-grain weight and both straw and biological yields/fad. The correlation coefficient between grain yield/fad. and flag leaf blade area did not reach the significance level. Similar results were reported by Gomaa, 1997; Gaballah and Bassiouny, 2001 and Abd El-Maksoud and Maha Abd Alla, 2005.

V-b) Path analysis:

Partitioning of simple correlation coefficients between grain yield on one hand and on the other hand each of number of spikes/m^2, number of grains/spike and 1000-grain weight are shown in Table 8.

It is clear from the results that grain yield was correlated with number of spikes/m^2 (r = 0.820). The highest direct relationship with grain yield was shown by number of spikes/m^2 and by number of grains/spike. These results in this case indicate the importance of partitioning the correlations values to its components. The greatest indirect association to grain yield was due to the number of grains/spike through number of spikes/m^2.

It was found from Table 9 that number of spikes/m^2, number of grains/spike and 1000-grain weight contributed together 78.41% of total grain yield variation. However, the most directly and / or jointly contributing component was number of spikes/m^2 22.45% followed by 1000-grain weight (7.34%) then number of grains/spikes (9.65%) in the respective order. Gaballah and Bassiouny, 2001 found that number of spikes/m^2, number of grains/spike and 1000-grain weight contributed together 81.77% of total grain yield variation.

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استجابة بعض أصناف القمح لمعدل التقاوى والتغذية الخضرية بالنوفترين تحت ظروف الأراضى الرملية المستصلحة

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أقيمت تجربتان حقليتان خلال موسمى ٢٠٠٢/٢٠٠٣ ، ٢٠٠٣/٢٠٠٤ بمنطقة الصالحية – محافظة الشرقية لدراسة استجابة أربعة أصناف مصرية حديثة من القمح هى سدس ١، سخا ٩٣، جميزة ٩ وجيزة ١٦٨ لثلاث معدلات تقاوى هى ٦٥، ٨٥، ١٠٥ كجم للفدان والتغذية الخضرية بمركب نوفترين وصممت التجربة بنظام القطع المنشقة مرتين فى ثلاث مكررات تحت ظروف الأراضى الرملية المستصلحة وتتلخص أهم النتائج فيما يلى:

١- زيادة معدل التقاوى من ٦٥ إلى ١٠٥ كجم / فدان أدى إلى زيادة ارتفاع النبات، عدد السنابل / م٢، محصول الحبوب ومحصول القش والمحصول البيولوجى للفدان وكانت الزيادة فى محصول الحبوب للفدان ٤,٤١% و ٧,٩٠% فى متوسط الموسمين نتيجة زيادة معدل التقاوى من ٦٥ إلى ٨٥ كجم/فدان ومن ٦٥ إلى ١٠٥ كجم/فدان على التوالى. بينما أدى زيادة معدل التقاوى إلى انخفاض فى مساحة نصل ورقة العلم، عدد الحبوب بالسنبلة ووزن ألف حبة.

٢- اختلفت الأصناف معنوياً فى جميع الصفات المدروسة وتفوق الصنف سخا ٩٣ على باقى الأصناف فى جميع الصفات المدروسة.

ترتب الأصناف تنازلياً تبعاً لمحصول الحبوب للفدان كالتالى: سخا ٩٣ – سدس ١ – جيزة ١٦٨ وجميزة ٩ وتراوح محصول الحبوب من الفدان ٢,٤٣٥ إلى ٢,٢٧٦ طن/فدان بينما تراوح محصول القش كمتوسط للموسمين ما بين ٣,١١٦ طن للفدان للصنف جميزة ٩ و ٣,٣٠٤ طن للفدان للصنف سخا ٩٣.

٣- التغذية الورقية بمركب نوفترين أدت إلى تحسين كل الصفات المدروسة وحققت زيادة معنوية فى محصول الفدان من الحبوب بنسبة ٤,٤٣% فى الموسم الأول و ٤,٥٠% للموسم الثانى و ٤,٤٦% لمتوسط الموسمين نتيجة المعاملة بهذا المركب.

٤- أرتبط محصول الحبوب معنوياً بارتفاع النبات ، عدد السنابل / م٢ ، طول السنبلة ، عدد السنيبلات / سنبلة ، وزن الألف حبة ، محصول القش والمحصول البيولوجى للفدان.

٥- أوضح معامل المرور أن عدد السنابل / م٢ كان المصدر الرئيسى لاختلاف المحصول وساهم عدد السنابل / م٢ وعدد الحبوب بالسنبلة ووزن الألف حبة بنحو ٧٨,٤١% فى إجمالى محصول الحبوب للفدان.

توصى هذه الدراسة من خلال النتائج المتحصل عليها بزراعة الصنف سخا ٩٣ واستخدام معدل تقاوى ١٠٥ كجم / فدان تحت ظروف الأراضى الرملية مع التغذية الخضرية بمركب نوفترين للحصول على إنتاجية عالية من المحصول .