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RESPONSE OF TWO WHEAT CULTIVARS TO ROW SPACING AND NITROGEN FERTILIZATION LEVELS UNDER RECLAIMED SANDY SOILS

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ABSTRACT

Two field experiments were carried out in a private farm at Wadi El-Mollak region, Abo-Hammad District, Sharkia Governorate, during two winter seasons [2007/ 2008 and 2008/2009] in à reclamid sandy soil. This study aimed to invstigate the response of two wheat cultivars [Giza168 and Sakha 93] to row spacing (12,15 and 18 cm between rows] and nitrogen fertilization levels [50, 70, 90 and 110 kgN/fad]. The split-split plot design with four replicates was followed.

The important findings of this study could be summarized as follows:

Wheat cultivars under this study differed significantly in the most of their studied characters. Sakha 93 cv was superior than Giza 168 one in grain yield in t/fad. The obtained results showed that the average values of plant height (cm), number of tillers/ plant, leaf area cm^2/plant, flag leaf area(cm^2), spike length (cm), number of grains/ spike and 1000- grain weight(g) increased significantly with increasing row spacing from 12 to 18 cm, but mortality%, number of spikes/m^2, grain yield and straw yield in t/ fad were decreased.

Growth characters, yield and its components were increased significantly due to increasing nitrogen fertilization level from 50 up to110kgN/fad, meantime the mortality of tillers% was decreased with increasing the applied N levels to90kgN/fad. The significant interaction effect between the studied factors indicated that. The highest grain yield could be scored, when the plants grown at 12cm row spacing received 90kgN/fad.

Key words: Row Spacing, Mortality, Tillering, Growth, Yield.

INTRODUCTION

In Egypt, the local production of wheat (*Triticum aestivum., L.*) is not sufficient to meet the increase in consumption. Therefore, attempts for rising wheat production are considered a matter of most importance. Thus a great attention should be paid to extendeing area cultivated with wheat in a newly reclaimed soil and to raise its productivity per unit area. This could be achieved through development of high yielding varieties and by a package of proper agronomic practices to maximize their productivity. Productive tillers is one important components of yield that affect (to a great extent) the productivity of the crop. Though, wheat crop has certain degrees of compensatory nature yet, row spacing becomes a very important tool to increase number of spikes produced in an unit land area by the weak tillering capacity cultivars. Row spacing governs the use of soil, as well as, efficient light use, through its effect on crop canopy architecture in the field. Plant density plays an important role in wheat productivity and it is a factor of particular importance in wheat production system because it can be controlled and this was reported in several studies, El-Kholy (2000) and Abo-Shatia *et al.* (2001) noticed that increasing planting density significantly increased number of spikes/m^2 and grain and straw yields/ fad, but significantly decreased number of grains/ spike, 1000 grain weight and grain weight/ spike. Similar reported were found by Omar (2007) and Mowfy (2008).

Nitrogen is a component of many important organic compound in plants ranging form proteins to nucleic acid (Fagerria *et al*., 1997). Also, nitrogen is a key element in wheat nutrition, therefore, an adequate supply of nitrogen is essential to maximize yield, many investigators concluded that nitrogen fertilizer is important in controlling the growth and yield characteristics of wheat. Several workers found a significant increase in yield of wheat due to the increase in N-levels up to 75 kg N/fad [Shaaban 2006 and Weber et al., 2008] and up to 80 kg N/ fad (Bassiouny, 2008 and Mansour and Bassiouny, 2009). However, Towfelies and Tamman 2005 got similar response when they added 105 kg N/fad. Also, others got yield response when they added 120 Kg N/fad (Mowafy, 2008 and Mansour *et al*., 2009).

Further more, Allam (2003) got higher response when added 125 kg N/fad. Soliman (2000) reported similar higher response but due to nitrogen addition of 180kg N/ fad.

The aim of this study was to enhance productivity of wheat using deferent row spacings and nitrogen fertilization levels under sandy soils.

MATERIALS AND METHODS

Two field experiments were conducted at private farm at Wadi El-Mollak region, Abo-Hammad District, Sharkia Governorate, during the two winter seasons 2007/2008 and 2008/2009 in a reclaimed sandy soil. This study aimed to investigate response of two wheat cultivars viz Giza 168 and Sakha 93 to row spacing and nitrogen fertilization levels. Three row spacings12,15 and 18 cm were studied, at seeding rate of 90 kg/ fad was used in order to get a variation in crowdness of plant within rows.

Four nitrogen fertilization levels (50, 70, 90 and 110 kg N/fad) were applied, inform of amonam sulphate 20.5% N. The nitrogen fertilizer was applied in three equal doses in three times at sowing, tillering and just before elongation.

A split- split plot design with four replicates was followed where wheat cultivars occupied the main plots, whereas row spacings were allotted to sub-plots and the four nitrogen levels were assigned at random in the sub- sub plots.

Each sub- sub plots (3× 3m) included 25,20 and 17 rows for the 12, 15 and 18 cm spacing in respective order. The preceding crop was corn in the two seasons. Other recommended agronomic practices expect the studied both factors were followed.

The soil of the experimental fields were sandy in texture having a pH 7.8, 0.096 organic matter content and containing 7.33 ppm available nitrogen, 3.24 ppm available phosphurs and 66.42 ppm available potassium for the upper 30 cm of the soil surface (These data were the average of the two growing seasons, respectively.

Data recorded

a) Growth characters:

At heading date ten guarded plants were randomly taken form the third row in each sub-sub polt and the following growth characters were determined :

1- Plant height cm 2- Leaf area (cm^2/ plant and

3- Flag leaf area cm^2 [only the blacke leaf area].

b-Tillering Pattern:

In each sub-sub plot three meters length were bounded at random in the 4^{th}, 5^{th} and 6^{th} rows and 20 plants were labeled after 20 days from sowing to complete heading: Count total number of tillers/ plant, as well as number of spikes/ plant [productive tillers]. The mortality of tillers was calculated according to Ali (1998) as follows:

$$\text{Mortality of tillers \%} = \frac{No.of\ \text{nan productive tillers/ plant}}{No.of\ \text{total tillers/ plant.}} \times 100$$

C: yield and yield components

At harvest, ten guarded plants were randomly taken from the 8^{th} row in each sub-sub plot and the following characters were recorded:

(1) Spike length (cm) (2) Grain number/ spike

(3)Grain weight (g/spike) (4) 1000-grain weight (g)

(5) Spike number/m^2

(6) Grain yield (t/fad) and straw yield (t/fad) were determined from a central area of 1.8(1m in length ×1.8m in width)

The obtained data of both seasons were subjected to proper statistical analysis according to Snedecor and Cochran (1980). For comparison of means, Duncan's multiple range test was used (Duncan, 1955). In the interaction tables, capital and small letters were used to compare rows and columns, respectively.

RESULTS AND DISCUSSION

A) Growth:

Average of growth characteristics as affected by cultivars, row spacing and nitrogen fertilization are shown in Table1.

Plants of Giza 168 cv were taller than those of Sakha 93one only in the first season only. Whereas, leaf area per Sakha 93 cv plant was larger than that of Giza 168 one in both growing seasons. This may be due to the differences between the two cultivars in genetic make up and their interaction with environmental conditions. But the two cultivars attain similar flag leaf area. Thses results are in agreement with those obtained by El-kholy 2000, Abo-Shatia et al 2001 and Abd El Maksoud 2002.

The widest row spacing (18cm) produced the tallest plants whereas, the narrowest (12cm) row spacing produced the shortest ones. This was observed in the first season and the combined data. Leaf area per plant was larger of the narrow and wider spacings than that of the

medium one in the first season. While, in the second season the narrow spacing (12cm) produced the smaller leaf area/plant. The combined data demonstrated that the wider spacing produced the larger leaf area than that of the middle and narrow ones.

Flag leaf area was significantly and continuously increased due to widening of row spacing form the narrow (12cm) to the medium (15cm) and to the wide spacing (18cm). This was a fact in the second season and the combined data. While, in the first season, the flag leaf area was gradually increased by widding of row spacing. The similar results were reported by Abdul, Galil *et al*., (2000), Abd El. Maksoud (2002) and Ali *et al*. (2004).

The results in Table 1 showed that, plant height and flag leaf area in both growing seasons and their combined as well as leaf area per plant in the first season significantly and positively responded to nigrogen fertilization only up to 90 kg N/fad. However, leaf area/ plant in the second season as well as the combined continuously and positively responded up to the highest nitrogen level (110kgN/fad). The increases in growth characters with increasing of nitrogen fertilization may be due to the fact that nitrogen is generally deficient in Egyptian soils and especially in the new reclaimed sandy soil and therefore its addition enables the plants to absorb balanced nutrients, which promotes the synthesis of photosynthates. The same trend was found by Mowafy (2008), Allam (2005), Shaaban (2006) and Mansour & Bassiouny (2009).

B) Tillering Pattern:

Total number of tillers produced by the studied cultivars showed significant variation in the first season and the combined (Table 2). Giza 168 cultivar surpassed Sakhà 93 one in total number of tillers as well as number of productive tillers in the first season only. Whereas, mortality percentage take the opposite trend in the first season and the combined. So, Sakha 93 cv gave higher tillers mortality percentage than Giza 168 one.

Changing the row spacing from the narrow (12cm) to the wide spacing (18cm) significantly affected the behavior of the single plant. Total number of tillers was the highest under the medium spacing(15cm) while, the lowest number of tillers per plant was recorded under the narrow spacing. This was a true in the first season and the combined.

Number of productive tillers per wheat plant positively and significantly responded to widening row spacing from 12 to 15 and then to 18 cm in the first season. However, in the second season and the combined this response was up to the medium row spacing only.

Concerning the tillers mortality percentage, the results of the first season and the combined stated that Giza 168cv gave higher percentage then Sakha93 one. In addition to the wide spacing (18cm) recorded the lowest percentage, whereas, the medium spacing (15cm) gave te highest morality percentage negatively and significantly responded to adding nitrogen fertilizer up to 90 kgN/fad in the first season and the combined while, in the second season this percent responded up to the highest N rate (110kg/fad)

Both total and productive tillers of wheat plant positively and significantly responded to any increment of nitrogen fertilizer up to 110 kg N/fad. Also, tillers mortality percentage positively responded to nitrogen fertilizer up to 90kgN/fad only. The present results sustained those reported by Abd-El Maksoud (2002).

C) Grain yield and its components:

Average of grain yield, its attributes and straw as influenced yield by cultivars, row spacing and nitrogen fertilization are shown in Tables 3 and 4.

In general, Sakha 93 cultivar surpassed Giza 168 one in grain yield/fad of both seasons and the combined. This may be due to the superiority of the first cultivar in leaf area per plant (Table 1) and number of grains per spike (Table 3) comparing with those of the second one. Meanwhile, Giza 168 cultivar have more total tillers per plant and lower mortality percentage but, these superiorities could not compensate for the reduced number of grains per spike.

The single spike produced under the wide spacing (18cm) was longer, having more grains and heavier grains however, all of these superiorities could not compensate for the reduced number of spikes/m^2 and finally significantly reduced both grain yields and straw in tons/fad. The narrowest spacing (12cm) achieved higher grain yield comparing with the two wider spacings.

Widening the row spacing form 12 to 15cm or to 18cm reduced grain yield/fad by 23.4% and 23.6% respectively.

Straw yield (t/fad) was continuously and significantly reduced by any increment of row spacing form 12 to 15 then to 18 cm. this was a true in both seasons and the combined, in spite of plant height, leaf area/ plant, flage leaf area, number of productive tillers and tillers mortality took the opposite trend with those obtained by Singh and Guliani (1983), Tompkins *et al*. (1991), Malik *et al*. (1997) and Abd El-Maksoud (2002).

In general, it could be noted that, both spike length and number of grains/ spike as well as 1000-grain weight positively and significantly responded to N fertilization up to 90 kg N/fad only. Meanwhile, number of spikes m^2, grain and straw yields (t/fad) continuously and significantly responded up the highest N level (110kg/fad) under the study conditions. The higher responses for both grain and straw yield/fad may be due to deficient in the experimented soil (sandy soil) as well as due to as a reflect for the higher responses of leaf area, total tillers and number of productive tillers per plant, and which it was finally stated in number of spikes/m^2.These results are in agreement with those obtained by Abd El-Madsoud (2002), Ali *et al*. (2004), Gafaar (2007), Omar (2007), Mowafy (2008), Bassiouny (2008) and Mansour & Bassiouny (2009).

Interaction:

1000-grain weight was significantly affected by the interaction between wheat cultivars and row spacing (Table 5):

In the narrow spacing Giza168cv had heavier grains then sakha93. the opposite was the case in the medium spacing. Where, the IST cv recorded lightest but the 2^{nd} cv recorded the heaviest grain weight at the medium spacing.

Table (5): Interaction effect between wheat cultivars and row spacing on 1000-grain weight (combined data).

Wheat cultivars	**Row spacing**		
	12 cm	**15 cm**	**18 cm**
		1000-grain weight	
Giza 168	A 45.465a	B 46.454b	A 46.864a
Sakha 93	C 44.661b	A 47.280a	B 46.906a

Also, 1000-grain weight was significantly affected by the interaction between row spacing and N-fertilizer levels (Table7).

Under the lowest and highest nitrogen levels, 1000-grain weight positively responded to row spacing up to 18cm. Whereas under the two middle nitrogen levels[70 and 90 kg N/fad] this weight was the heaviest under the medium row spacing (15cm).

Table 6. Interaction effect between row spacing and nitrogen fertilizer levels on no. of tillers/plant, mortality%, 1000-grain weight and grain yield/fad (combined data).

Row spacing	Nitrogen fertilization levels (KgN/fad.)			
	50 kgN/fad	**70 kgN/fad**	**90 kgN/fad**	**110 kgN/fad**
	Number of productive tillers/plant			
	D	C	B	A
D1	3.273c	3.941b	4.308b	4.438b
	D	C	B	A
D2	3.645b	4.112a	4.508a	4.700a
	D	C	B	A
D3	3.817a	4.100a	4.492a	4.946a
	Mortality (%)			
	A	C	C	B
D1	44.70a	34.10c	33.40b	37.60a
	A	A	B	C
D2	41.50b	41.40a	37.30a	34.30b
	B	A	B	C
D3	36.20c	38.20b	36.00a	30.50c
	1000-grain weight (g)			
	C	B	A	A
D1	42.221b	44.568c	47.806c	46.658c
	C	B	A	A
D2	44.160b	47.317a	47.958a	48.217b
	D	C	B	A
D3	44.813a	46.543b	47.430b	48.754a
	Grain yield t/fad			
	D	C	B	A
D1	2.400a	2.723a	3.269a	3.437a
	C	B	A	A
D2	1.732b	2.131b	2.515c	2.680b
	C	B	A	A
D3	1.649b	2.252b	2.559b	2.577b

The interaction effect between row spacing and nitrogen fertilization on both number of productive tillers/plant and mortality % were significant (Table 6).

Under the lowest nitrogen level (50 kgN/fad), widening row spacing from 12 to 15 then to 18cm followed with a significant increase in number of productive tillers/ plant and mortality %. Meanwhile, under the higher three nitrogen levels number of productive tillers/ plant was lowest with the narrowest space, compared with the other two row spacings (15 and 18cm). In addition to, mortality % was highest under both 70 and 90 kg N/fad with the narrowest row space (12cm). Whereas, under the highest nitrogen fertilizer level (110kgN/fad).

Number of productive tillers/ plant continuously and positively responded to nitrogen fertilizer levels up to 110kgN/fad under the three row spacings.

The highest mortality percentage was recorded under the narrowest row space with the lowest N rate (50 kg/fad) meanwhile, the lowest percentage was recorded under the widens row space (18cm) with the highest N rate (11kg/fad). In addition to, mortality pe4rcentage under the narrowest row space was significantly and sharply reduced when plants received of 70 or 90 kg N/fad. Also, the interaction effect between row spacing and nitrogen fertilizer levels on grain yield ton/fad. was highly significant (Table 6).

Though the same amount of seeds was used under the various row spacings, the effect of competition between plants within the row and between rows was different with the different row spacing. The narrow rows (12cm) gave the highest grain yield/fad under the four studied nitrogen levels. Whereas, the two others row spacings [15 and 18cm] were at par in grain yield/ fad under 50,70 and 110 kg N/fad.

Grain yield/fad under the narrow spacing (12cm) positively and significantly responded to nitrogen fertilizer level up to 110 kg N/fad. However, under the two wide spacings (15 and 18cm) this yield responded only up to 90 kg N/fad.

The interaction effect between wheat cultivars and nitrogen fertilizer levels on grain yield ton/fad was significant (Table 7).

Table 7. Interaction effect between wheat cultivars and nitrogen fertilization levels on grain yield/fad (combined data).

Wheat cultivars	**Nitrogen fertilization levels (kgN/fad.)**			
	50 kgN/fad	**70 kgN/fad**	**90 kgN/fad**	**110 kgN/fad**
	Grain yield ton/fad			
	C	B	A	A
Giza 168	1.825a	2.219b	2.643b	2.847a
	C	B	A	A
Sakha 193	2.029a	2.518a	2.919a	2.949a

Conclusively, Sakha 93 cultivar surpassed Giza 168 one in grain yield ton/fad under the two medium nitrogen fertilizer levels (70 and 90 kg N/fad) only. Meanwhile, Giza 168 cv achieved an increase in grain yield/fad about 56% by increasing N levels from 50 up to 110 kg N/fad, but the other cultivar achieved an increase about 45% only, in this respect.

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إستجابة صنفين من القمح للمسافة بين السطور والتسميد الأزوتى تحت ظروف الأراض الرملية المستصلحة

على عبدالعظيم سرحان - مجدى فتحى عبدالمقصود
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أقيمت تجربتان حقليتان فى مزرعة خاصة بوادى الملاك- مركز ابوحماد- محافظة الشرقية خلال موسمين ٢٠٠٨/٢٠٠٧ و٢٠٠٩/٢٠٠٨ وذلك تحت ظروف الأراضى الرملية المستصلحة. بهدف دراسة استجابة صنفين من أصناف القمح [جيزة ١٦٨ وسخا٩٣] للمسافة بين السطور [١٢، ١٥، ١٨ سم بين السطور] وكذلك لأربعة مستويات للتسميد النيتروجينى [٥٠، ٧٠،٩٠، ١١٠ كجم ن/فدان] وذلك فى تصميم القطع المنشقة مرتين فى أربعة مكررات.

وكانت اهم النتائج المتحصل عليها من خلال هذه الدراسة:

١- كان هناك إختلاف معنوى بين الصنفين المستخدمين فى هذه الدراسة فى معظم الصفات تحت هذه الدراسة وتفوق الصنف سخا٩٣ فى محصول حبوب الفدان.

٢- أوضحت النتائج أن كلا من إرتفاع النبات- عدد الأشطاء/ نبات- مساحة أوراق النبات- مساحة ورقة العلم- طول السنبلة- عدد حبوب السنبلة- وزن الالف حبه زادت معنوياً بزيادة المسافة بين السطور من ١٢سم إلى ١٨سم بينما تنقصاً معنوياً نسبة الأشطاء الميتة- عدد السنابل/م٢ وكذلك محصول الفدان من الحبوب والقش بزيادة المسافة بين السطور.

٣- كما أوضحت النتائج المتحصل عليها أن زيادة معدل التسميد الأزوتى من ٥٠ إلى ١١٠ كجم ن/ فدان أدى الى زيادة معنوية فى كل من صفات النمو- المحصول وكذلك صفات مكونات المحصول تحت هذه الدراسة.

٤- كان هناك إرتباط موجب ومعنوى فى معظم الصفات تحت الدراسة وكمية محصول الفدان من الحبوب بينما كان هناك إرتباط سالب ومعنوى بين كل من عدد السنابل /م٢ وإرتفاع النبات وعدد الحبوب/ السنبلة من ناحية ومحصول الفدان من الحبوب من ناحية أخرى.

التوصيـــــــة: توصى هذه الدراسة عند زراعة القمح [اصناف جيزة ١٦٨ أو سخا ٩٣] فى سطور أن تكون المسافة بين السطور ١٢سم و يتم تسميد القمح بمعدل ٩٠ كجم نيتروجين/ فدان وذلك تحت ظروف الأراضى الرملية المستصلحة حديثاً وذلك للحصول على أعلى محصول حبوب من الفدان.