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RESPONSE OF SOME BREAD WHEAT VARIETIES GROWN UNDER DIFFERENT LEVELS OF PLANTING DENSITY AND NITROGEN FERTILIZER

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ABSTRACT: ***Two field experiments were carried out at the Experimental Farm, Faculty of Agriculture, Minufiya University to study the effect of nitrogen fertilizer levels (0, 30, 60 and 90 kg N/fed), planting density rates (200, 300 and 400 grain/m^2) and four wheat varieties (Sids 1, Sids 7, Sakha 69 and Gemmeiza 9) on growth, yield and its components and quality during 2003/2004 and 2004/2005 seasons. The obtained results could be summarized as follows:***

Significant differences among the tested nitrogen levels were observed among characters studied. In this respect, application of 60 kg N/fad surpassed the other N levels in No. of spikelets/spike, No. of kernels/spikelet, No. of kernels/spike, 1000-kernels weight, spike yield and grain and biological yields/fad, while 90 kg N/fad gave the highest values of 50% heading date, plant height, spike length, No. of spikes/m^2, straw yield/fad and protein percentage in grains.

Increasing planting density from 200 to 300 or 400 grains/m^2 significantly increased plant height, number of spikes/m^2, grain, straw and biological yields/fad, but significantly decreased days to heading, spike length, No. of spikelets/spike, No. of kernels per spikelet and spike, 1000-kernels weight, spike yield and protein percentage in both seasons.

Wheat varieties were differed significantly in all characters during both seasons, where Gemmeiza 9 gave the highest values of No. of spikes/m^2 and grain, straw and biological yields/fad. Meanwhile, Sids 7 recorded the highest plant height, spike length, No. of spikelets/spike, No. of kernels/spikelet, No. of kernels/spike, 1000-kernels weight, spike yield and protein percentage in both seasons.

Key words: ***Wheat, Nitrogen fertilizer, Planting density and Varieties.***

INTRODUCTION

Bread wheat (*Triticum aestivum L.*)is one of the major cereal crops in world and Egypt. Raising wheat production through increasing the productivity of unit area is the most important national target to minimize the gap between the Egyptian production and annual local demand. Improving productivity can be achieved by cultivating high yield cultivars paralleled with improved agronomic practices such as fertilization and planting densities.

Nitrogen is one of the most important plant nutrients needed to obtain high yield of wheat. Numerous studies showed a beneficial effect for nitrogen application to wheat. Abdel Gawad et al. (1993) ; Kheiralla et al. (1993); Sharaan and El-Samie (1999); Mowafy (2002) and Saleh (2002), indicated that plant height, spike length, weight of spike, number of grains/spike, 1000-grain weight, number of spikes /m2, grain and straw yields/fad were significantly increased with increasing nitrogen level.

Planting density rate is a factor of prime importance affecting wheat productivity. Several studies showed that increasing seeding rates significantly increased plant height, number of spikes and grain and straw yields per area unit (El-Karamity, 1998 and Ali et al., 2004), while spike length, number of grains/spike and 1000-grain weight were decreased (El-Banna, 1999 and Sharaan and El-Samie, 1999).

The new long spike cultivars namely Sids group and Gemmeiza are known to have weak tillering capacity. Productive tillers is an important component of yield that effect productivity of wheat plants. Many studies showed that wheat cultivars were significantly different in grain yield and its components (Abd El-Maksoud, 2002 and Saleh, 2003).

Therefore, the main objective of this study was to determine the productivity of some wheat cultivars under different rates of planting density and N-fertilization.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm, Faculty of Agriculture, Minufiya University to study the effect of nitrogen fertilizer levels, planting density and varieties on growth, yield and its components and quality of wheat during 2003/2004 and 2004/2005 winter seasons. The experiment included 48 treatments which were the combination of four levels of nitrogen fertilizer (0, 30, 60 and 90 kg N/fed), three rats of planting density (200, 300 and 400 grains/m^2) and four bread wheat varieties, i.e. Sids 1, Sids 7, Sakha 69 and Gemmeiza 9. The treatments were arranged in a split split plot design with four replications. Nitrogen fertilizer levels were arranged at random in the main plots. Plant densities were allocated at random in the sub-plots. Varieties were assigned to the sub-sub-plots. The basic plot size was 10.5 m^2 (3.5 m length and 3.0 m width). Pre-sowing calcium superphosphate was added at the rate of 15.5 kg P_2O_5/fed. The planting was done in 15 rows (20 cm apart) on 15th and 18th November for first and second seasons, respectively. Nitrogen fertilizer was applied in the form of urea (46.5% N) in two equal doses at 25 and 50 days after sowing. Potassium sulphate was added at the rate of 48 kg K_2O/fed before the first irrigation. The preceding crop was maize in both seasons. The plots were irrigated six times and

irrigation was held three weeks before harvesting. Mechanical and chemical analyses of the experimental soil are presented in Table (1).

Table (1): Mechanical and chemical properties of the experimental soil during 2003/2004 and 2004/2005 seasons.

Properties / Seasons	Sand %	Silt %	Clay %	pH	E.C. Mmhos/cm	O.M. %	N ppm
2003/2004	29.10	29.40	41. 50	7.9	0.41	1.7	30.00
2004/2005	25.80	32.10	42.10	7.8	0.42	1.8	34.00

Studied characters

I- Growth characters:

1- plant height (cm)

2- heading date (number of days from planting to 50 % heading of plot).

II- Yield and yield components:

At harvest time, twenty spikes were taken at random from the inner rows of each experimental plot to determine spike length (cm), number of spikes/m^2, number of spikelets/spike, number of kernels per spikelet and spike, 1000- kernel weight (g.), spike yield (g.). A fixed area of 4 m^2 was harvested from each plot to determine grain yield/fad (ton.), straw yield/fad (ton.), biological yield/fad (ton.) and harvest index (%).

III- Grain quality:

Protein percentage in the dry grains was calculated by multiplying N% by the factor of 5.75, N% was determined using the Micro-Kjeldahl method as described by A.O.A.C (1975).

The data were statistically analyzed according to the method described by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

A- Nitrogen fertilizer

The results of all studied characters, i.e. growth (heading date, plant height and spike length), yield and its components (number of spikes/m^2, number of spikelets/spike, number of kernels per spikelet and spike, 1000-kernel weight, spike yield, grain, straw, biological yields/fad and harvest index) and quality (protein percentage) as affected by nitrogen fertilizer levels

(0, 30, 60 and 90 kg N/fad) in both seasons, are shown in Table (2).

Results in Table (2) showed that there was significant increase in heading date with increasing nitrogen application in the first and second seasons. The increase in heading date of wheat plant with increasing nitrogen fertilization might be due to the role of nitrogen in building the amino acids, proteins and protoplasm of the new tissues and this, in turn, prolonged the vegetative growth period and consequently delayed the flowering of wheat plants. In this concern, Attia and Sulttan (1987) found that increasing nitrogen levels increased number of days to heading.

The results showed that plant height was significantly increased with addition of nitrogen fertilizer up to 90 kg N/fad in the first and second seasons. This superiority of N might be due to the great importance of this element in the physiological process inside the plants in early vegetative growth, which probably resulted from the increase of cell division and elongation of the new growth. These results are in full agreement with those obtained by several investigators of them Morsy and Abdel-Razik (1993) and Ismail (2002) who found an increase in plant height with increasing nitrogen levels.

With regard to the effect of nitrogen fertilization on spike length, it could be noticed that increasing the amount of nitrogen significantly increased spike length up to 90 kg N/fad. Similar results were obtained by many researchers who found that spike length tended to increase with increasing nitrogen fertilization up to 60 kg N/fad (Gab-Alla et al., 1986) and 90kg N/fad (Omar et al., 1997).

The number of spikes/m^2 was gradual1y and significantly increased by increasing nitrogen fertilizer levels. As an average of the two seasons 30, 60 and 90 kg N/fad produced number of spikes/m^2 amounted to 7.07, 13.36 and 16.73% more than 0 kg N/fad, respectively. This increase might be attributed to the increase in the number of fertile tillers/m^2. This result is in harmony with those obtained by many researchers who found that number of spikes/m^2 tended to increase with increasing nitrogen fertilization up to 60 kg N/fad [Gab-Alla et al., (1986)] and up to 90 kg N/fad [Omar et al., (1997)].

Data in the same Table indicated that the number of kernels/spike and its two main components (number of spikelets/spike and number of kernels/spikelet) were significantly increased with increasing the nitrogen fertilizer from zero up to 60 kg N/fad in both seasons. Wheat plants supplied with 60kg N/fad, produced higher (18.54 and 5.59%) number of spikelets /spike, (19.13 and 9.70%) number of kernels/spikelet, (22.07 and 21.31%) number of kernels/spike than those received non nitrogen fertilizer (zero treatment) in the first and second seasons, respectively. On the contrary, it is obvious that increasing nitrogen fertilization from 60 to 90 kg N/fad decreased

the number of kernels/spike and its two components in both seasons. The decrease in the number of kernels/spike and its components with the high addition of nitrogen might be attributed to the moderate available nitrogen in the experimental soil (see Table 1). Similar results were obtained by many researchers such as El-Banna and Ali (1993) and Mohamed (1997).

The data of 1000-kernel weight showed a pronounced increase in the seed index by increasing nitrogen levels from 0 to 60 kg N /fad in the two seasons. However, further increase in the nitrogen level of 90 kg N/fad caused reduction of such trait. In this concern, other researchers found that 1000-kernel weight was increasing with N level up to 60 kg N/fad [Morsy and Abdel-Razik (1993)] and up to 80 kg N/fad [Abd El-Maksoud (2002)].

Spike yield of wheat plants was significantly increased with increasing nitrogen levels from 0 to 60 kg N /fad in the two seasons. This increase amounted to 35.45 and 32.00% in first and second seasons, respectively as compared with unfertilized plants (0 kg N/fad). However, it is clear that increasing N levels from 60 to 90 kg N/fad significantly decreased spike yield in the two seasons. This reduction might be attributed to the decrease in both of number of kernels/spike and 1000-kernel weight. In this concern, Gab-Alla et al. (1986) found that spike yield was increased with increasing nitrogen fertilizer level up to 60kg N/fad.

With regard to grain yield/fad, the results showed the same trend of change as that of spike yield. Adding nitrogen fertilizer at a rate of 60kg N/fad produced the highest values of grain yield/fad in both seasons. The relative increases by adding 60kg N/fad amounted 29.89 and 30.80% in the first and second seasons over 0 kg N/fad, respectively. This increase was mainly due to the increase in its both components, i.e. number of spikes/m^2 and spike yield. On the contrary, the reduction in the grain yield/fad obtained when the plants were fertilized by 90 kg N/fad was mainly due to the decrease in the spike yield. These results are in agreement with El-Sayed and Esmail (1988), El-Sherbieny et al. (1999) and Abd El-Maksoud (2002).

As shown in Table (2), there was a gradual increase in the straw and biological yields/fad with increasing the level of nitrogen fertilizer up to 60 kg N/fad in both seasons. However, raising the level of nitrogen fertilizer up to 90 kg N/fad increased the straw yield but decreased the biological yield in both seasons. From these results, it could be suggested that adding 60kg N/fad was more favorable treatment for the biological yield/fad. In this concern, Mosalem (1993), Mohamed (1997) and Ali et al. (2004) found that straw and biological yields/unit area were increased with increasing nitrogen fertilizer.

The result of harvest index showed that the differences among the tested nitrogen levels were significant in the two seasons. Nevertheless, it could be noted that adding 90 kg N/fad, produced the highest values of harvest index without significance with 60 kg N/fad in the first and second seasons. This

means that the application of 60 or 90 kg N/fad might encourage the translocation of photosynthates to developing grains compared to the other nitrogen levels. In this concern, Basilious and Mosaad (1988) and Mostafa et al. (1997) found that harvest index was significantly increased with increasing N levels up to 60 and 120kg N/fad, respectively.

The high values of protein percentage were obtained by adding 60 and 90 kg N/fad in the two seasons, as compared with other treatments. The favorable effect of N on protein percentage might be due to that macronutrient occurs in nucleic acids which are necessary for protein synthesis. In this respect, El-Sherbieny et al. (1999) revealed that increasing nitrogen rates significantly increased protein percentage in grains.

B- Planting densities

The results of all studied characters, i.e. growth, yield and its components and grain quality as affected by planting density rates (200, 300 and 400 grains/m^2) in both seasons are shown in Table (3).

The data of heading date showed that wheat plants were not significantly affected by increasing seeding rate from 200 to 300 grains/m^2 in both seasons. However, further increase in seeding rate up to 400 grains/m^2 led to a significant decrease in heading date in the two seasons. This means that dense sowing might lead to decreasing the vegetative growth period and enhancing the translocation of metabolites to fruiting organs. In this concern, Saleh (2002) found that heading date was significantly decreased as affected by increasing seeding rates.

The data of plant height showed significant differences, where dense planting of 400 grains/m^2 appeared to produce the tallest plants followed by middle density of 300 grains/m^2. However, the lighter ones, i.e. 200 grains/m^2 had the shortest plants. Such clear trend was observed annually at both seasons. The increase in plant height might be attributed to the mutual shading and competition among wheat plants in dense sowing on light which caused an increase in some growth substances such as auxins and consequently more plant elongation was produced. Similar results were obtained previously by Ghanem and El-Khawaga (1991) and Sharaan and El-Samie (1999).

With regard to spike length, the data showed that the differences between planting density rates 300 and 400 grain/m^2 were not great enough to reach the 5% level of significance. Nevertheless, it is clear that the values of spike length were consistently decreased with increasing seeding rate up to the highest rate in both growing seasons. In this concern, Ghanem and El-Khawaga (1991) and Mohamed (1997) found that increasing seeding rates led to decreasing spike length, while Mosalem (1993) found that spike length was not significantly affected by increasing seeding rates.

Likely, planting density resulted highly significant differences in number of spikes/m^2, where increasing planting density from 200 to 400 grains/m^2 gradually increased number of spikes/m^2. The superiority of dense planting over low and middle densities reached around to 12.96 and 3.44%, respectively in the average of both seasons. From previous results, it could be said that increasing number of spikes/m^2 resulting from dense sowing is a logic result of increasing the number of grown plants and tillers/m^2. This conclusion agreed with that previously obtained by Abd-Alla (2002) who reported that the number of spikes/m^2 was increased by increasing the planting densities.

Reversely, the values of number of kernels/spike and its two main components, i.e. number of spikelets/spike and number of kernels/spikelet as well as 1000-kernel weight took negative trend compared to that of the number of spikes/m^2 as shown in Table (3). The data showed that increasing seeding rate from 200 to 400 grains/m^2 led to a reduction in the number of kernels/spike and its two components as well as 1000-kernels weight in both growing seasons. This reduction in the abovementioned characters might be attributed to that the wheat plants in dense planting suffered from the deficiency of light, water and nutrient elements and this, in turn, causes a depression in the photosynthetic activity and consequently there are no enough assimilates translocated to the different fruiting organs such as spike, spikelets and kernels. The reduction in the different fruiting organs in wheat plant due to the increase in seeding rate was previously reported by Lafond (1994) and Mohamed (1997).

Regarding the effect of planting density on spike yield, the results revealed highly significant differences, where the low density of 200 grains/m^2 gave the heaviest spike yield followed by middle density, then the dense planting of 400 grains/m^2 which recorded the lowest spike yield. The reduction in grain weight of spike might be due to the reduction in number of spikelets and kernels per spike and 1000-kernel weight which could be resulted from the competition between individual plants struggling for available nutrients in the surrounding media. Similar results have been reported by Mosalem (1993) and Abo Shataia et al. (2001).

With regard to grain yield/fad, the data showed that the increase in planting densities significantly increased grain yield/fad up to 300 grains/m^2 which produced 10.59 and 10.80% over the planting density rate of 200 grains/m^2 in the first and second season, respectively. This superiority under middle density (300 grains/m^2) might be attributed to the increase in one of its components, i.e. number of spikes/m^2 , spike yield as well as 1000-kernel weight. On the contrary, grain yield tended to decrease significantly under dense planting rate (400 grains/m^2). This reduction might be mainly due to the depression in the spike yield and 1000-kernels weight. In this concern, Abo Shataia et al. (2001) and Abd-Alla (2002), reported that grain yield was

increased by increasing planting density. However, Sharaan and El-Samie (1999) noticed that no significant effect on grain yield by increasing planting density rates.

With regard to straw and biological yields/fad, the data showed that the increase in planting density rates, significantly increased straw yield/fad and biological yield in both growing seasons. The high straw and biological yields/fad values in dense sowing might be attributed to the increase in each of plant height and number of tillers/m^2. In this concern, many researchers found that wheat straw and biological yields/unit area were increased by increasing seeding rate [Mosalem (1993), Mohamed (1997) and Ali et al. (2004)].

The data in the same Table showed that the highest values of harvest index were obtained by middle density (300 grains/m^2) in the first and second seasons, but the differences were decreased significantly with increasing planting densities from 300 to 400 grains/m^2. This indicated that growing wheat plants in dense sowing was more suitable for straw than for grain production. Similar results were obtained by Mosalem (1993) who showed that increasing seeding rate increased harvest index, while Campbell et al. (1990) found that harvest index was not significantly affected by raising seeding rates.

With regard to protein percentage in grains, the data showed that there were significant differences among planting density rates, where the low density gave the highest values, while the dense ones recorded the lowest values in both seasons. This might be attributed to the competition among wheat plants in dense sowing on light and nutrients. Similar results were obtained by Mohamed (1997).

C- Varietal differences

The data of all studied characters, i.e. growth, yield and its components and quality of grains as affected by varietal differences (Sids 1, Sids 7, Sakha 69 and Gemmeiza 9) in both seasons, are shown in Table (4).

Data showed that Gemmeiza 9 and Sids 7 varieties had the highest values of heading date and plant height, respectively in both seasons, while Sakha 69 variety recorded the lowest ones for heading date and plant height in both seasons. Several researchers reported that wheat varieties differed widely in their plant height [Abd El-Maksoud (2002) and Ali et al. (2004)]. However, Saleh (2002) reported that no significant effect was detected by different varieties on heading date.

On the other hand, the data showed that Sids 7 followed by Sids 1 had the longest spike in the first and second seasons, while Sakha 69 gave the shortest ones in both seasons. Similar results were obtained by Abd El-Maksoud (2002) who found that Sids 7 gave the longest spike as compared with the other tested varieties. On the contrary, Saleh (2002) reported that no significant effect was found by different varieties on spike length.

Number of spikes/m^2 differed significantly during the two growth seasons. Gemmeiza 9 variety significantly exhibited higher number of spikes/m^2 followed by Sakha 69 and Sids 7, while the lowest value was obtained from Sids 1 variety. In this concern, Saleh (2002) and Ali et al. (2004) reported that wheat varieties differed in their number of spikes/m^2.

Number of spikelets/spike exhibited positive response to varietal differences in both seasons. The highest number was obtained by Sids 7 variety but without significant differences with Sids 1 and Gemmeiza 9 varieties in both seasons. Sakha 69 ranked the last in this respect. Similar results were obtained by Abd El-Maksoud (2002) and Saleh (2002).

Number of kernels/spike and its two main components, i.e. number of spikelets/spike and number of kernels/spikelet as well as 1000 kernel weight were significantly differed among the tested varieties. Sids 7 variety had the higher values of all previous characters than the other varieties, while Sakha 69 variety recorded the lowest one. This was true in both seasons. It means that the superiority of Sids 7 might be due to the high fertility of its flowers at each spikelet and longest spike. Similar results were obtained by Abd El-Maksoud (2002).

With regard to spike yield, the data indicated that Sids 7 which had higher number of kernels/spike as well as heavier 1000-kernel weight, had also the highest spike grain weight, while Gemmeiza 9 and Sakha 69 varieties seemed to be the lowest in this respect in the two growing seasons. Similar results were obtained by Ibrahim and Abdel-Aal (1991)

The data showed also that Gemmeiza 9 produced higher grain yield/fad than the other tested varieties in both seasons. However, the differences between Sids 1 and Sids 7 were not significant in both seasons. Sakha 69 ranked the last in this respect. On the average of both seasons, the superiority of Gemmeiza 9 amounted to 13.50, 8.56 and 19.05% than Sids 1, Sids 7 and Sakha 69, respectively. The superiority of Gemmeiza 9 in number of spikes/m^2 might be mainly attributed to its superiority in grain yield/fad. Several researchers reported that wheat varieties differed in their grain yield such as Mowafy (2002) and Ali et al. (2004).

It is obvious from the data in Table (4) that Gemmeiza 9 variety produced the highest straw and biological yields/fad than the other tested varieties in both seasons. However, the differences between Sids 1 and Sids 7 varieties didn't reach the level of significance for both trait in both seasons. This

superiority of Gemmeiza 9 might be due to its highest number of spikes/m^2. On the other hand, Sakha 69 seemed to be lowest than the other tested varieties in both yields. This low potentiality to produce straw and biological yields/fad might be mainly due to the shortness in plant height and spike length. Many researcheres found that wheat varieties differed in their straw and biological yields such as Mosalem (1993) and Mohamed (1997).

It could be noticed that Sids 1, Sids 7 and Sakha 69 exhibited the greatest values of the harvest index compared to Gemmeiza 9 which ranked the last in this respect. Many investigators found variation among different wheat varieties in their harvest index such as Mostafa et al. (1997).

In dissimilarity with the values of grain yield/fad, the results obtained herein indicated that the variety which had the highest grain yield had the lowest protein percentage. Sids 1 and 7 varieties exhibited higher values of protein percentage, while Gemmeiza 9 and Sakha 69 varieties ranked the second in this respect. The increase in protein percentage might be attributed to the superiority of varietal capability in transporting metabolites from the vegetative organs to storage centers in the grains and this, in turn, led to the appreciable increase in protein content. Similar results were obtained by Ibrahim and Abdel-Aal (1991).

D- Interaction effect

D-1 Interaction of nitrogen levels and planting densities

Figure (1) showed that the wheat plants grown at planting density 400 grains/m^2 and fertilized with 90 kg N/fad, produced the highest number of spikes/m^2 compared to the other studied treatments during 2003/2004 season.

Figure (2) illustrated that the highest values of grain yield/fad were obtained when wheat plants were grown under middle density and fertilized with 60 kg N/fad. However, the untreated plants (0 kg N/fad) under lighter density had the lowest values in a descending order during 2003/2004 season.

D-2 Interaction of planting densities and varieties

Data in Fig (3) indicated that Gemmeiza 9 variety had number of spikes/m^2 more than the other varieties under any planting density rates. However, all tested varieties produced the highest values when the plants grow under dense density followed by middle and lighter densities in a descending order during 2004/2005 season.

D-3 Interaction of Nitrogen levels and varieties

With regard to grain yield/fad, Figure (4) showed that Gemmeiza 9 variety was superior to the other varieties under any nitrogen levels. The highest values of grain yield/fad were obtained when growing Gemmeiza 9 plants under 60 kg N/fad. However, the untreated plants (0 kg N/fad) had the lowest values in all tested varieties during 2004/2005 season.

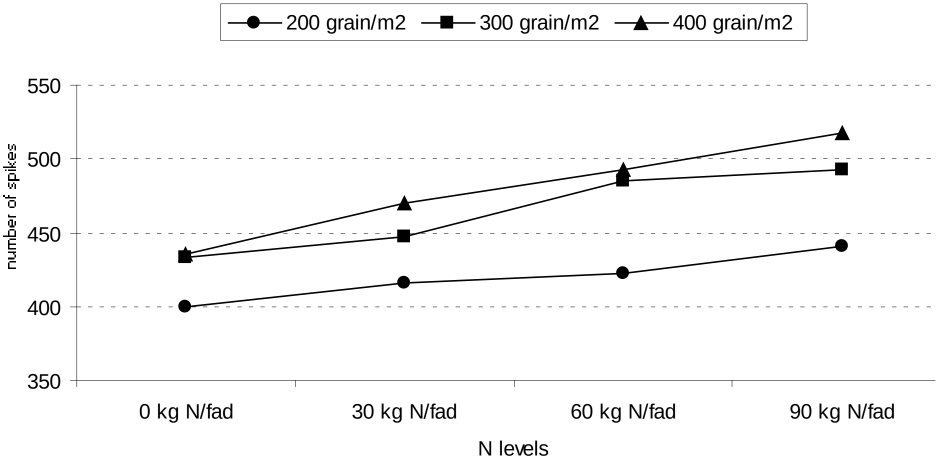


Fig (1): Effect of the interaction between nitrogen levels and planting densities on number of spikes/m^2 during 2003/2004 season.

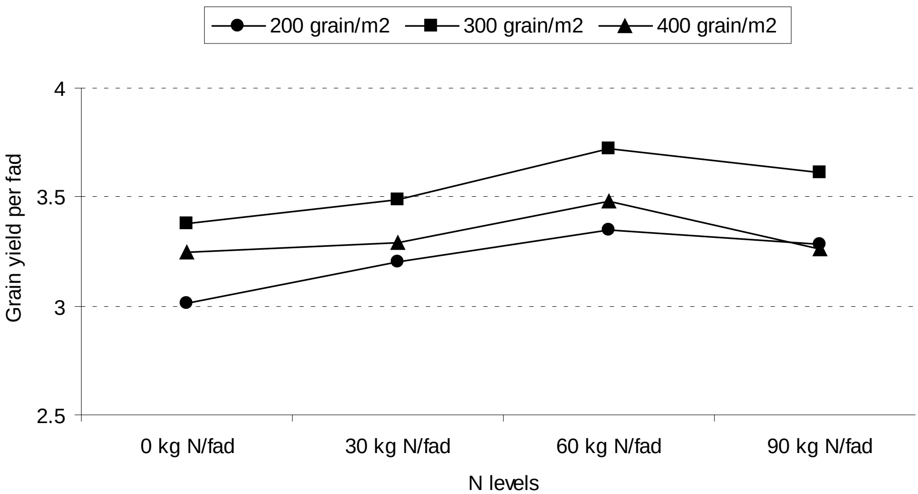
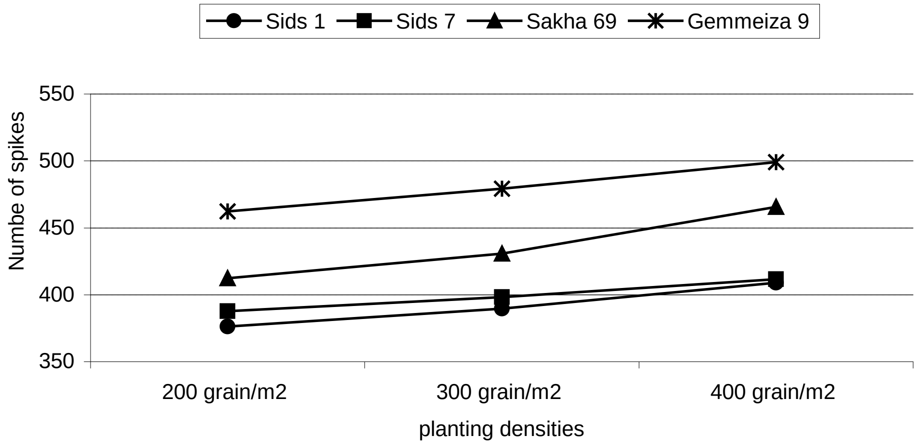


Fig (2): Effect of the interaction between nitrogen levels and planting densities on grain yield/fad during 2003/2004 season.



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number of spikes/m2 during 2004/2005 season.

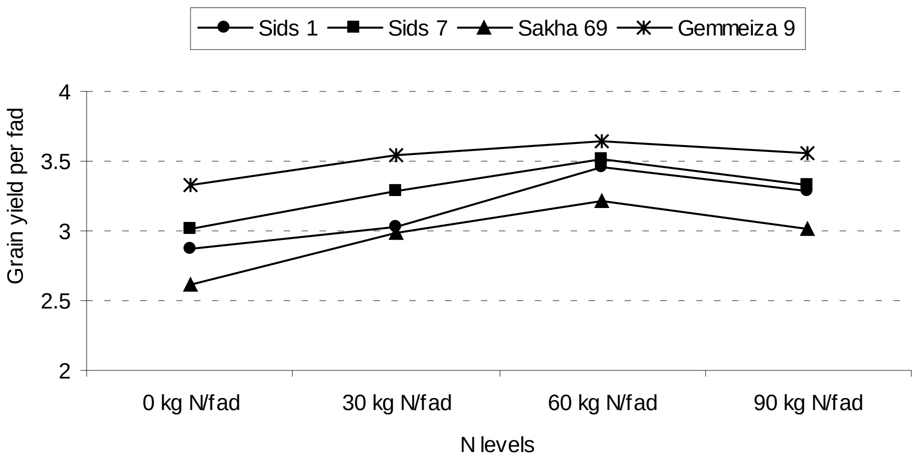

Fig (4): Effect of the interaction between nitrogen levels and varieties on grain yield/fad during 2004/2005 season.

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استجابة بعض أصناف قمح الخبز النامية تحت مستويات مختلفة من الكثافة النباتية والسماد النيتروجيني

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الملخص العربى

أقيمت تجربتان حقليتان بكلية الزراعة – جامعة المنوفية خلال موسمي الزراعة ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ بهدف دراسة تأثير مستويات السماد النيتروجيني (٠ ، ٣٠ ، ٦٠ ، ٩٠ كجم نيتروجين للفدان) ومعدلات كثافة نباتية (٢٠٠ ، ٣٠٠ ، ٤٠٠ حبة بالمتر المربع) على أربعة أصناف من قمح الخبز (سدس ١ ، سدس ٧ ، سخا ٦٩ ، جميزة ٩). وقد أسفرت نتائج الدراسة عن ما يلى:

لوحظ وجود اختلافات معنوية بين مستويات النتروجين فى كل الصفات المدروسة خلال موسمي الزراعة. حيث أدى استخدام السماد النيتروجيني بمعدل ٦٠ كجم ن للفدان إلى زيادة معنوية فى صفات عدد السنيبلات فى السنبلة ، عدد الحبوب فى السنيبلة ، عدد الحبوب بالسنبلة ، وزن ١٠٠٠ حبة ، محصول السنبلة وكذلك محصول الحبوب والمحصول البيولوجي للفدان. فى حين أعطى المعدل ٩٠ كجم نيتروجين للفدان أعلى قيم لصفات ارتفاع النبات وطول السنبلة، عدد السنابل/م^{٢} ، محصول القش للفدان ونسبة البروتين بالحبوب.

أدى زيادة الكثافة النباتية من ٢٠٠ إلى ٣٠٠ أو ٤٠٠ حبة/م^{٢} إلى زيادة معنوية فى ارتفاع النبات ، عدد السنابل/م^{٢} ، محصول كل من الحبوب ، القش والبيولوجي للفدان ولكن كان هناك انخفاضا معنويا فى عدد الأيام اللازمة لطرد ٥٠% من السنابل ، طول السنبلة ، عدد السنيبلات فى السنبلة ، عدد الحبوب فى السنيبلة ، عدد الحبوب بالسنبلة ، وزن ١٠٠٠ حبة ، محصول السنبلة ونسبة البروتين وقد تحقق ذلك خلال موسمي الزراعة.

أظهرت الأصناف اختلافات معنوية فى الصفات المدروسة حيث سجل الصنف جميزة ٩ أعلى عدد سنابل/م^{٢} ، محصول كل من الحبوب ، القش والبيولوجي للفدان علاوة على ذلك تفوق الصنف سدس ٧ على بقية الأصناف تحت الدراسة فى صفات ارتفاع النبات وطول السنبلة، عدد السنيبلات فى السنبلة ، عدد الحبوب فى السنيبلة ، عدد الحبوب بالسنبلة ، وزن ١٠٠٠ حبة ، محصول السنبلة ونسبة البروتين خلال موسمي الزراعة.

Table (2): Effect of nitrogen fertilizer on growth, yield and its components and quality of wheat plants during 2003/2004 and 2004/2005 seasons.

Characters / Treatments	Heading date (days)	Plant height (cm)	Spike length (cm)	No. of spikes /m^2	No. of spikelets/ spike	No. of kernels/ spikelet	No. of kernels /spike	1000-kernels weight (g.)	Spike yield (g.)	Grain yield /fad (ton.)	Straw yield /fad (ton.)	Biological yield/fad (ton.)	Harvest index (%)	Protein (%)
2003/2004														
0 kg N	101.80 c	115.50 c	11.17 b	418.50 d	19.09 c	2.30 c	45.26 c	44.92 c	1.89 c	2.71 c	4.08 c	6.79 c	39.91 a	10.11 c
30 kg N	104.46b	116.60bc	11.72ab	445.80 c	20.64 ab	2.61 b	50.86 b	46.78 b	2.30b	3.19 b	4.79 b	7.98 b	39.97 a	11.70 b
60 kg N	106.70 a	117.80ab	12.48 a	475.80 b	22.63 a	2.74 a	55.25 a	47.65 a	2.56 a	3.52 a	5.67 ab	9.19 a	38.30 ab	12.60 a
90 kg N	107.50 a	118.10 a	12.56 a	489.40 a	20.54 b	2.69 ab	50.98 b	46.95 a	2.32b	3.40 a	5.72 a	9.12 a	37.28 b	12.65 a
2004/2005														
0 kg N	107.80b	112.50 d	11.02 c	421.60 d	22.91 c	2.37 c	49.42 c	43.15 c	2.00 c	2.76 c	4.11 c	6.87 c	40.17 a	10.31 c
30 kg N	108.00 a	113.60 c	12.57 b	453.70 c	24.00 ab	2.54 ab	52.08 b	48.63 b	2.39b	3.24 b	4.83 b	8.07 b	40.15 a	11.57 b
60 kg N	108.70 a	114.30 b	13.10 a	476.50 b	24.19 a	2.60 a	59.95 a	51.44 a	2.64 a	3.61 a	5.81 a	9.42 a	38.32 ab	12.83 a
90 kg N	108.80 a	114.80 a	13.20 a	491.20 a	23.66 b	2.51 b	53.16 b	50.54 a	2.46b	3.49 a	5.84 a	9.33 a	37.41 b	12.85 a

Table (3): Effect of planting densities on growth, yield and its components and quality of wheat plants during 2003/2004 and 2004/2005 seasons.

Characters / Treatments	Heading date (days)	Plant height (cm)	Spike length (cm)	No. of spikes /m2	No. of spikelets /spike	No. of kernels/ spikelet	No. of kernels / spike	1000-kernels weight (g.)	Spike yield (g.)	Grain yield /fad (ton.)	Straw yield /fad (ton.)	Biological yield/fad (ton.)	Harvest index (%)	Protein (%)
2003/2004														
D1	106.20a	113.50 c	12.75 a	419.90c	20.22 a	2.60 a	51.23 a	47.30 a	2.49 a	3.21 c	4.58 b	7.79 c	41.12ab	12.08 a
D2	106.66a	115.90 b	11.52 b	464.53b	20.02 b	2.51 b	50.05 b	46.78 b	2.40 b	3.55 a	4.61 b	8.16 b	43.50 a	11.90 ab
D3	104.70b	117.50 a	11.48 b	478.72a	19.98 b	2.44 c	49.27 c	46.65 b	2.36 c	3.32 b	5.76 a	9.08 a	36.56 b	11.53 b
2004/2005														
D1	108.40a	114.70 c	12.92 a	426.50c	22.96 c	2.58 a	52.37 a	48.15 a	2.51 a	3.24 c	4.60 b	7.84 c	41.13 ab	12.19 a
D2	107.80a	116.55 b	11.56 b	459.90b	22.56 b	2.49 b	51.10 b	46.84 b	2.43 b	3.59 a	4.64 b	8.23 b	43.62 a	12.01 ab
D3	105.70b	118.32 a	11.50 b	476.24a	22.49 b	2.40 c	50.82 c	46.73 b	2.40 c	3.34 b	5.77 a	9.11 a	36.66 b	11.78 b

D1: 200 grains/m2 D2: 300 grains/m2 D3: 400 grains/m2

Table (4): Growth, yield and its components and quality of some wheat varieties during 2003/2004 and 2004/2005 seasons.

Characters / Treatments	Heading date (days)	Plant height (cm)	Spike length (cm)	No. of spikes/m 2	No. of spikelets / spike	No. of kernels/ spikelet	No. of kernels / spike	1000-kernels weight (g.)	Spike yield (g.)	Grain yield /fad (ton.)	Straw yield /fad (ton.)	Biological yield /fad (ton.)	Harvest index (%)	Protein (%)
2003/2004														
Sids 1	105.50 a	102.65 b	11.94 a	385.75 d	21.21 a	2.63 b	60.84 b	46.18 a	2.06 a	3.01 b	4.52 b	7.53 b	39.97 ab	12.01 a
Sids 7	106.30 a	106.14 a	12.37 a	394.90 c	22.26 a	2.74 a	64.93 a	47.24 a	2.12 a	3.16 b	4.70 b	7.86 b	40.20 a	12.23 a
Sakha 69	102.60 b	93.23 c	11.48 b	423.50 b	17.72 b	2.40 c	52.35 c	43.37 b	1.90 b	2.92 c	4.37 c	7.29 c	40.05 a	11.60 b
Gemmeiza 9	107.50 a	100.24 b	11.73 ab	475.33 a	19.64 ab	2.57 b	59.37 b	45.57 a	1.92 b	3.48 a	5.69 a	9.17 a	37.95 b	11.67 b
2004/2005														
Sids 1	105.70 a	104.27 b	11.97 a	391.67 d	21.29 a	2.66 b	60.82 b	46.25 a	2.05 a	3.16 b	4.49 b	7.65 b	41.31 a	12.13 a
Sids 7	106.10 a	109.51 a	12.49 a	399.23 c	22.36 a	2.76 a	65.95 a	47.61 a	2.14 a	3.29 b	4.79 b	8.08 b	40.71 a	12.27 a
Sakha 69	103.50 b	94.51 c	11.51 b	436.25 b	18.17 b	2.39 c	53.17 c	43.07 b	1.92 b	2.96 c	4.42 c	7.38 c	40.11 a	11.73 b
Gemmeiza 9	107.20 a	103.64 b	11.79 ab	481.20 a	20.01 ab	2.61 b	60.14 b	45.54 a	1.95 b	3.52 a	5.75 a	9.27 a	37.97 b	11.86 b