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RESPONSE OF SOME WHEAT VARIETIES TO NITROGEN FERTILIZATION LEVELS AND SOURCES.

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ABSTRACT

The effect of nitrogen fertilization levels (60, 75, 90 and 105kg N/fed) and sources (urea and Ammonium sulphate) on yield and its components of two wheat varieties (Giza 164 and Sakha 69) was investigated at the Agriculture Experimental and Research Center, Faculty of Agriculture, Cairo University at Giza, Egypt during 1996/97 and 1997/98 seasons .

Differences in grain and straw yields as well as their related variables due to changing N levels were significant in both seasons. Application of the highest N level (105 kg N/fed) produced 2.3 (13.4%) and 1.8 ard/fed (10.2%) more than the application of N at the recommended dose (75 kg N/fed) in the first and second seasons, respectively.

With regard to the N sources, the highest values resulted from application of N as urea, while the lowest one produced by ammonium sulphate in both seasons.

Varieties had a significant effect on plant height, number of grains/spike and grain yield/fed in both seasons and number of tillers/m^2, number of grains/spike and 1000- grain weight in one season only. As an average of both seasons, Sakha 69 outyielded Giza 164 in grain yield by 1.6 ard/fed and in straw yield by 0.6 ton/fed

The interaction of varieties x N levels had a significant effect on plant height, and 1000- grain weight in both seasons and on spike length and number of grains/spike in one season. Moreover, varieties x N levels x N sources interaction had significant effect on either grain or straw yield/fed in both seasons. As an average of both season the highest grain yield/fed (26.55 ard) was obtained by using Sakha 69 variety and 105 kg N/fed as urea.

Consequently, it could be concluded that under the conditions of this study the highest wheat production from either grain or straw can be produced with using Sakha 69 variety and application of 105 kg N/fed as urea.

INTRODUCTION

Wheat is one of the most important grain crops in the world and it is the main staple food in Egypt. Increasing wheat production under Egyptian conditions is a major concern of the Agronomists. Factors that determine wheat grain yield are numerous. Varieties and nitrogen fertilization are two of cultural practices that affect growth, yield and yield components as well as quality of wheat.

Many investigators found marked differences in either grain or straw yield of wheat cultivars (Gabr, 1988 ; Sharshar, 1989 ; El-Hefnawy *et al.* 1991 ; El-Banna, 1995 ; Al-Kasas, 1996 ; Abd El – Monem, *et al*. 1997 and Abd El-Zaher, 1997) Moreover, the response of wheat grain and straw yields to nitrogen fertilization was previously obtained by many workers (Eissa *et al*., 1990; Mosaad *et al*. 1990 ; Balyan and Malik 1991 ; El-Badry, 1995 ; Eissa, 1996 ; Abd El-Monem *et al*., 1997 ; Abd El Zaher, 1997 ; and El-Moursy, 1998.

Therefor, numerous studies have evaluate the effect of nitrogen sources on wheat production several stated that either grain and/or straw yields and their components responded differently to application of various nitrogen sources (Nour *et al.* 1989 ; Sharshar, 1989 ; Abo Soliman, *et al*. 1990 ; Abd El-Zaher, 1997 and Atia and Aly, 1998) Consequently, the present work was undertaken to study the effect of nitrogen levels and sources on growth and yield of some wheat varieties.

MATERIALS AND METHODS

Wheat (*Triticum aestivum,* L.) Giza 164 and Sakha 69 cv. were used in this study and the work was carried out at the Agricultural Experimental and Research Center, Faculty of Agriculture, Cairo University at Giza during the growing seasons of 1996/97 and 1997/98 to study the response of two wheat varieties, i.e. Giza 164 and Sakha 69 to nitrogen levels and sources.

The soil of the experimental sites were clay loam in texture and low in nitrogen, 45.1 ppm in first season and 46.2 ppm in second one (Table 1).

Table 1: Mechanical and chemical analysis of upper 50 cm of soil in 1996/97 and 1997/98 seasons.

Mechanical analysis	96/97	97/98	Chemical analysis	96/97	97/98
Clay %	36.2	36.2	Available N (ppm)*	45.1	46.2
Silt %	23.4	24.6	Available :P (ppm)*	13.1	14.9
Sand %	37.0	36.2	Available K (ppm)+	350.0	361.5
Organic mate r%	1.5	10.8	pH	7.7	7.6
Calcium carbonate %	3.2	3.6	Ec mmhos/cm 25^{o}C	2.3	2.3

*** = N according to Jackson (1985).**
**** = P according to Oisen *et al.* (1954).**
+ = K according to Pipper (1950).

Each experiment included 16 treatments, which were the combinations of two wheat varieties (Giza 164 and Sakha 69), two nitrogen sources (Urea and Ammonium sulphate) and four nitrogen levels (60, 75, 90 and 105 kg N/fed). A split- split plot design with four replications was used in both seasons. Nitrogen levels were devoted to main plots and nitrogen sources to sub- plots, while wheat varieties in sub- sub - plots. The sub - sub-plot area was 10.5 m^2.

Grains of wheat were sown at the rate of 60 kg/fed during the second week of November in both seasons. Nitrogen as the previously mentioned rates and sources were applied in two split dressings (two third before the first irrigation and the remaining third before the second one). All other cultural practices of growing wheat were followed as recommended. At harvest, plant height, number of tillers and spikes/m^2 , spike length, number of grains and weight/spike and 1000-grain weight were recorded. Grain and straw yields were determined on the whole sub-sub-plot basis.

Data were statistically analyzed according to Snedecor and Cochran (1967). Means were compared using LSD (Waller and Duncan, (1969).

RESULTS AND DISCUSSION

1- Effect of nitrogen levels:

It is observed from Table 2 that nitrogen fertilization levels had a significant effect on grain and straw yield per unit area as well as all of their contributing characters in both seasons. It is quite clear from these results that all values of grain yield and its components as well as straw yield, plant height and number of tillers/m^2 increased with increasing nitrogen fertilization levels in both seasons. The highest nitrogen level (105 kg N/fed) resulted in higher grain and straw yields/fed than lower one (60 kg N/fed) in both seasons. Moreover, increasing nitrogen fertilization levels up to 105 kg N/fed caused an obvious increase in grain yield/fed by 18.2, 13.4 and 3.2% in the first season and by 14.8, 10.2 and 2.6% in the second one over the 60, 75 and 90 kg N/fed, respectively.

These results are in agreement with those obtained by Eissa *et al.* (1990); Mosaad *et al*. (1990); Abd El- Monem (1997) and Abd El Zaher (1997) who reported that increasing N levels up to 120 kg N./fad. significantly increased each of grain number/spike, grain weight/spike, number of spikes/m^2 and plant height as well as grain and straw yields/fed Whereas, El-Moursy (1998) reported that increasing N rates from 35 to 105 kg N/fad significantly increased either grain and straw yield or their components.

Such effect of nitrogen fertilization on grain yield per unit area was a result of its effect on number of fertile spikes/m^2, number of spikelets and grains/spike, grains weight/spike and 1000- grain weight. Moreover, the positive response to nitrogen levels fertilization may be due to the assumption that nitrogen had the most profound effect on the development of the vegetative parts of plants. Consequently, the beneficial effects of increasing supply of nitrogen on the grain yield might be due to better growth of the spike, increase number of filled grains/ spike and larger size of grains Therefore, it could be concluded that these results were expected since nitrogen is one of the most important components of cytoplasm, nucleic acid and chlorophyll. Moreover, as the level of nitrogen increased rapid multiplication of cells occurs which in turn enhance the amount of metabolites necessary for building plant organs.

Table 2: Effect of N levels on grain and straw yield as well as their components in 1996/97 and 1997/98

Characters	N levels (kg/fed)					N levels (kg/fed)				
	60	75	90	105	LSD	60	75	90	105	LSD
	1996/97					1997/1998				
Plant height (cm)	95.8	103.6	110.2	120.1	2.1	101.2	112.2	116.3	118.5	1.5
No. of tillers/m^2	264.5	295.3	340.1	380.6	5.5	277.3	310.2	339.1	397.2	9.5
No. of spikes/m^2	240.2	270.5	310.2	350.1	7.8	250.1	299.2	310.2	350.2	10.2
Spike length (cm)	9.1	9.5	10.1	10.5	0.3	8.5	9.1	9.9	10.3	0.4
No. of grains/spike	50.1	60.1	63.2	70.6	1.2	51.2	61.3	66.5	72.1	1.6
Grain weight / spike (g)	2.6	3.1	3.5	3.7	0.2	2.7	3.1	3.4	3.9	0.3
1000-grain weight (g)	37.5	41.2	43.3	45.5	0.4	37.9	42.1	42.8	44.9	0.6
Straw yield/fed (ton)	6.9	7.9	9.9	10.9	0.5	7.1	8.0	10.1	10.6	0.3
Grain yield/fed(ard).	16.5	17.2	18.9	19.5	0.6	16.9	17.6	18.9	19.4	0.3

2- Effect of nitrogen sources.

Results found in Table 3 reveal that nitrogen sources had a significant effects on number of tillers/m^2 in the first season as well as plant height and straw yield in both seasons It is quite clear from these results that application of nitrogen as urea gave the highest number of tillers/m^2, tallest plants and the highest straw yield/fed, while application of ammonium sulphate produced the lowest values from these characters in both seasons.

Moreover, the differences in either grain yield/fed or all tested grain yield components i.e. number of spikes/m^2, spike length, number of grains/ spike, grain weight / spikes and 1000- grain weight due to change nitrogen fertilization sources were significant in both seasons. It is evident from these results that the highest values of the characters contributing to grain yield were obtained by application of urea as nitrogen source compared with other source (ammonium sulphate) in both seasons. The highest grain yield/fed 18.7 ard./fed in the first seasons and 18.5 ard./fed in the second one was produced by application of nitrogen as urea, while the lowest one (17.4 and 17.9 ard. in first and second seasons, respectively) was obtained by using ammonium sulphate. These results are in harmony with those obtained by Nour *et al.* 1989 and Sharsher 1989 that stated that urea gave the highest mean values of grain yield. Moreover Abo-Soliman *et al.* 1990 showed that nitrogen forms had a significant effect on the grain yield where urea was superior than ammonium sulphate.

Table 3: Effect of nitrogen sources on grain and straw yields as well as their components in 1996/97 and 1997/98.

Characters	N sources					
	Urea	Ammonium sulphate	LSD	Urea	Ammonium sulphate	LSD
	1996/97			1997/98		
Plant height (cm)	110.1	104.5	2.3	113.2	111.1	2.1
No. of tillers/m^2	323.9	316.3	3.2	331.4	330.5	NS
No. of spikes/m^2	299.8	285.7	2.5	303.7	301.0	2.5
Spike length (cm)	10.2	9.3	0.9	9.9	9.0	0.5
No. of grains/spike	61.4	60.6	0.7	63.9	61.7	1.6
Weight of grains/spike (g)	3.4	2.9	0.4	3.4	3.2	0.1
1000-grain weight (g)	43.4	40.2	2.1	42.7	41.2	1.3
Straw yield/fed (ton)	9.2	8.6	0.5	9.2	8.7	0.1
Grain yield/ fed(ard.)	18.7	17.4	1.2	18.5	17.9	0.6

A. Varietal response:

The results in Table 4 show that the difference between varieties in number of tillers/m^2 (in second season) and plant height (in both seasons). Giza 164 variety was significantly taller than Sakha 69. The differences in plant height between both varieties might be attributed to the difference in number and / or length of internodes reflecting the genetically make up. These results are in agreement with those obtained by El-Banna, 1995 and Abd El-Monem *et al.* 1997. Results also revealed insignificant effect of varieties on straw yield/fed In both seasons, Giza 164 variety produced the lower straw yield. The decrease in straw yield per unit area of this variety may have resulted from shorter plants of such variety than (Sakha 69).

Results in Table 4 indicated that number of grains/ spike in both seasons and 1000-grain weight in first season differed significantly between varieties. Moreover varieties had insignificant effect on spike length, number of spikes/m^2 and grain weight/spike in both seasons.

In general, Sakha 69 variety produced more fertile spikes/m^2; tallest spikes and heavier grains than the other variety in both seasons. Theses result might be attributed to the differences in the genetic make up of both varieties and could be postulated to a great to the environmental conditions..

It is quite clear from these results that the difference between both varieties concerning grain yield per unit area reaches the significant levels in both seasons. Sakha 69 produced higher grain yield (18.6 and 19.2 ard/fed) than Giza 164, which gave lower yield (17.5 and 17.1 are/fed) in two seasons, respectively. As an average of both seasons, it could be concluded that Sakha 69 out yielded the (Giza 164) by 1.6 ard./fed This might attributed to the increase in number of spikes/m^2, spike length, number of grains and weight/spike El-Banna (1995) and Abd El-Monem *et al.* (1997) stated that the differences among varieties were observed for grain yield and its components.

Table 4: Effect of wheat varieties on grain and straw yields as well as their components in 1996/97 and 1997/98.

Characters	Varieties					
	Sakah 69	Giza 164	LSD	Sakah 69	Giza 164	LSD
	1996/97			1997/98		
Plant height (cm)	108.1	106.5	1.5	114.9	109.2	2.3
No. of tillers/m^2	321.1	319.1	NS	341.2	320.7	9.9
No. of spikes/m^2	295.1	290.4	NS	304.2	300.5	NS
Spike length (cm)	10.0	9.5	NS	9.8	9.1	NS
No. of grains/spike	62.9	59.1	1.7	63.7	61.9	1.5
Weight of grain/spike (g)	3.3	3.0	NS	3.4	3.2	NS
1000-grain weight (g)	43.5	40.1	1.9	42.6	41.3	NS
Straw yield/fed (ton)	9.3	8.5	NS	9.1	8.8	NS
Grain yield /fed(ard.)	18.6	17.5	0.9	19.2	17.1	0.3

Effect of interactions:

The interaction between varieties and N levels had a significant effect on plant height in both seasons and 1000-grain weight in the first season as well as spike length and number of grains/spike in the second season. Sakha 69 variety with application of 105 kg N/fad. Produced the highest value for these traits Tables (5 & 6). Moreover, varieties x N sources had a significant effect on number of spikes/m^2 in the first season as well as number of tillers/m^2 and straw yield/fed in the second season. Sakha 69 plants, which were fertilized with urea as a source of nitrogen, produced highest straw yield, while Giza 164 and the same N source produced highest number of tillers/m^2 Tables (5 & 6). However N levels x N sources interaction had a significant effect on all studied characters except spike length in both seasons. The highest values were obtained by using urea and 105 kg N/fad. Tables (5 & 6). Results indicated clearly that varieties x N levels x N sources interaction had a significant effect on straw and grain yields/fed in both seasons, plant height , number of spikes/m^2, number of grains/spike and 1000-grain weight in the first season as well as number of tillers/m^2 in the second one Tables (5 & 6).

Table 5:The highest significant value for studied characters as response to the interactions of studied factors in 1996/97.

Characters	High value	Treatment		
		a - Varieties	**X**	**N levels**
Plant height (cm)	118.1	Sakha 69	X	105kg N/fed
1000 - grain weight (gm)	46.0	Sakha 69	X	105kg N/fed
		b- Varieties	**X**	**N sources**
No. of spikes / m^2	317.7	Sakha 69	X	105kg N/fed
		C- N levels	**X**	**N sources**
No. of tillers / m^2	419.5	Urea	X	105kg N/fed
Plant height (cm)	131.5	Urea	X	105kg N/fed
Straw yield/(ton/fed)	12.1	Urea	X	105kg N/fed
No. of spikes/ m^2	415.5	Urea	X	105kg N/fed
No. of grains/spike	81.6	Urea	X	105kg N/fed
Grains weight / spike (g)	4.4	Urea	X	105kg N/fed
1000 - grain weight (g)	48.1	Urea	X	105kg N/fed
Grain yield /fed (ard.)	26.4	Urea	X	105kg N/fed
		d- Varieties	**X N levels**	**X N sources**
Plant height (cm)	134.8	Sakha 69 X 105 kg N /fed	X	Urea
Straw yield (ton/fed.)	12.5	Sakha 69 X 105 kg N/fed	X	Urea
No. of spikes / m^2	421.3	Sakha 69 X 105 kg N/fed	X	Urea
No. of grains /spike	79.8	Sakha 69 X 105 kg N/fed	X	Urea
1000- grain weight (g)	50.3	Sakha 69 X 105 kg N/fed	X	Urea
Grain yield /fed (ard.)	26.4	Sakha 69 X 105 kg N/fed	X	Urea

Table 6:The highest significant value for studied characters as response to the interactions at studied factors in 1997/98.

Characters	High value	Treatment		
		a - Varieties	**X**	**N levels**
Plant height (cm)	127.2	Sakha 69	X	105 kg N/fed
Spike length (cm)	10.6	Sakha 69	X	105 kg N/fed
No. of grains/spike	79.8	Sakha 69	X	105 kg N/fed
		b- Varieties	**X**	**N Sources**
No. of tillers/m^2	336.5	Sakha 69	X	Urea
Straw yield /fed (ton)	8.6	Giza 164	X	Urea
		C- N Levels	**X**	**N Sources**
No. of tillers / m^2	446.5	Urea	X	105 kg N/fed
Plant height (cm)	132.5	Urea	X	105 kg N/fed
Straw yield/fed (ton)	12.9	Urea	X	105 kg N/fed
No. of spikes/ m^2	432.0	Urea	X	105 kg N/fed
No. of grains/spike	84.8	Urea	X	105 kg N/fed
Grains weight / spike (g)	4.7	Urea	X	105 kg N/fed
1000 - grain weight (g)	49.9	Urea	X	105 kg N/fed
Grain yield (ard/fed)	26.7	Urea	X	105 kg N/fed
		d- Varieties X N Levels X N Sources		
No.. of tillers/m^2	436.0	Sakha 69 X 105 kg N/fed X Urea		
Straw yield /fed(ton)	12.3	Sakha 69 X 105 kg N/fed X Urea		
Grain yield /fed(ard.)	26.7	Sakha 69 X 105 kg N/fed X Urea		

Finally, it could be concluded that under the conditions of this study the highest grain and straw yields of wheat could be produced by using Sakha 69 variety and application of nitrogen at the rate of 105 kg N/fed as urea.

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إستجابة بعض أصناف القمح إلى معدلات ومصادر التسميد الآزوتى

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أقيمت تجربتان حقليتان لدراسة تأثير معدلات من التسميد الآزوتى (٦٠ ،٧٥ ، ٩٠ و ١٠٥ كجم أزوت/فدان) ومصدرين من الازوت (يوريا وسلفات الأمونيوم) على محصول صنفين من القمح (جيزة ١٦٤ وسخا ٦٩) بمحطة التجارب الزراعية بكلية الزراعة ، جامعة القاهرة فى موسمى ١٩٩٧/١٩٩٦ و ١٩٩٨/١٩٩٧.

فقد أظهرت النتائج أن التغيير فى معدلات الآزوت أدى إلى وجود أختلافات معنوية سواء فى محصول القش ومكوناته أو فى محصول الحبوب ومكوناته فى موسمى الزراعة وقد أدت إضافة المعدل العالى من الآزوت ١٠٥ كجم ن/فدان إلى زيادة محصول الحبوب بحوالى ١٣,٤% و ١٠,٢% مقارنة بإضافة المعدل الموصى به (٧٥ كجم أزوت/فدان) فى موسمى الزراعة على الترتيب.

وقد أختلف مصدرى الأزوت فى تأثيرهما على محصول القش ومكوناته وكذلك محصول الحبوب فى موسمى الزراعة فقد كانت أعلى القم المتحصل عليها من معظم الصفات ناتجة عن إستخدام اليوريا بينما كانت أقل القيم ناتجة عن إستخدام سلفات الأمونيوم.

وقد أوضحت النتائج تأثيراً معنوياً للأصناف على كل من طول النبات وعدد حبوب السنبلة ومحصول الحبوب للفدان. وقد أظهرت النتائج أيضاً أن تأثير الأصناف كان معنوياً فى موسم واحد فقط على كل من عدد الأفرع/م^2 وعدد حبوب السنبلة ووزن الألف حبة ، وقد تفوق الصنف سخا ٦٩ على الصنف جيزة ١٦٤ فى محصول الحبوب والقش للفدان ومعظم مكوناتهما وكان للتفاعلات المختلفة تأثيراً معنوياً على بعض الصفات المدروسة حيث كان للتفاعل بين الأصناف ومعدلات ومصادر الأزوت تأثيراً معنوياً على كل من محصولى الحبوب والقش للفدان حيث كان أعلى محصول من الحبوب ٢٦,٥٥ أردب/فدان (كمتوسط للموسمين) ناتجاً عن إستخدام الصنف ٦٩ والأزوت بمعدل ١٠٥ كجم فى صورة يوريا.