J. Agric. Sci. Mansoura Univ., 32 (7): 5139 - 5153, 2007

EFFECT OF NITROGEN AND POTASSIUM LEVELS ON AGRONOMIC AND QUALITY TRAITS IN THREE BREAD WHEAT CULTIVARS

El Sayed, Soad, A.* and S.M. Hammad**
*** Seed Technology Dep. , Field Crops Research Institute, ARC.**
****National Wheat Research Program, Field Crops Res. Institute, ARC.**

ABSTRACT

A filed experiment was conducted to determine the effect of different nitrogen and potassium levels on the yield and its component and quality traits of three bread wheat cultivars Sakha 93, Sakha 94 and Giza 168 at Sakha Agricultural Research Station, ARC, during the two successive seasons 2004/2005 and 2005/2006. Nitrogen doses used were 0, 50, 75 and 100 kg N/fad and potassium levels were 0 and 24 kg P_2O_5/fed. The results indicated that Sakha 94 gave the highest number of kernel/spike, number of spikes/m^2 and grain yield/fed. and it was the latest in heading. Increasing nitrogen levels up to 100 kg N/fad. resulted in significant gradual increase in days to heading and days to maturity, plant height, number of spikes/m^2, number of kernels/spike, and grain yield/fad. There was no significant effect for potassium fertilization levels on the tested agronomic characters.

All fertilizing treatments resulted in increasing crude protein, total soluble protein (albumins, globulins, gliadins and glutemins), non-soluble protein, and the grain storability (aging test). Gluten quality (gliadins and glutenins) was also improved. At higher nitrogen and potassium fertilization levels, there was a negative correlation between storability, crude protein, total soluble protein, non-soluble protein, gluten quality and each of carbohydrate and oil content in grains. However, interaction of nitrogen fertilizer supply and cultivar had a significant effect on gluten quality, and most quality characters.

INTRODUCTION

Being the leading food crop all over the world, wheat (*Triticum aestivum* L.) is the most strategic winter crop in Egypt. It is used for making bread and other foodstuffs, animal feeding as well as other artficial purposes. Thus, it is a great importance to increase production per unit area. Increasing production per unit area appears to be a reasonable mean for reducing the gap between wheat production and consumption, this require yield increase by developing high-yielding cultivars and simultaneously implementing improved cultural practices.

Although nitrogen fertilizer effects on wheat production have been exclusively studied, further studies on determination of the optimum nitrogen and potassium level are still needed.

Increasing nitrogen levels resulted usually delay dates of heading and maturity, while the values of agronomic traits relating to wheat grain yield i.e., number of spikes per unit area, number of kernels per spike and the 1000-kernel weight are tended to increase, (El-Shami *et al.*, 1995 and Essa, 1996). Plant height remarkably increased with increasing nitrogen fertilization. Essa (1996) and Saleh (2001) recorded increasing in plant height, number of spikes/m^2 and number of kernels/spike was due to increasing nitrogen level. Concerning 1000 kernel weight, some workers recorded an increases in 1000 kernel weight with the increase in nitrogen level (Abdul galil *et al.*, 1997 and Chaudhary and Mehmood 1998). Other workers, (Hammad 1998 and Saleh 2000) recorded a decrease in 1000-kernel weight with increasing nitrogen level. However, El-Shami *et al.*, (1995) and Hussain *et al.*, (2006) indicated that 1000-grain weight was not affected by different nitrogen fertilizer levels.

Regarding nitrogen levels, grain yield was significantly increased at each increase of nitrogen levels up to 90 kg/fed. (Mosalem 1993 and Hammad 1998).

Potassium plays an important role in plant growth. Essa (1996) found that increasing K level significantly increased plant height, number of kernels / spike, 1000-kernel weight and number of spike / m^2.

Also, fertilization treatments resulted in increased protein content and glutenin and the content of albumin, globulin, gliadin were also improved (Guangcai Zhao, *et al.*, 2006). Although grain protein composition depends primarily on genotypes, it is significantly affected by environment factors and their interactions (Graybosch *et al.*, 1996, Huebner *et al.*, 1997 and Triboi *et al.*, 2000). Grain protein concentration and composition are also the major determinants of flour functional properties (Weegels *et al.*, 1996; Shewry and Halford, 2002). For wheat, increasing nitrogen supply usually leads to an increase in the percentage of gliadin while that of glutenin is not changed. Wheat quality was improved by increasing nitrogenous fertilizer (Guangcai Zhao *et al.*, 2006). The information on the correlation between nitrogen fertilizer levels and glotein quality (gliadein & glotenin) is useful to determine whether, there is any association that could either impede or aid materially in selecting for glotein quality.

This investigation aimed to study the effect of four nitrogen levels and two potassium levels on the agronomic, quality traits and grain storability of three high yielding wheat cultivars.

MATERIALS AND METHODS

1- Field experiments:-

The present study was carried out at the experimental farm of Sakha Agricultural Research Station, ARC during the two successive seasons 2004/2005 and 2005/2006 to study the effect of four nitrogen fertilizer levels (N1: 0, N2: 50, N3: 75 and N4: 100 kg N /fed.) and two potassium levels (K1: 0 and K2:4 kg/fed.) on the yield and its component and quality traits of three wheat cultivars (Sakha 93, Sakha 94 and Giza 168).

The experiments were sown during the last week of November in the tow seasons using spilt-spilt plot design with three replications was used. The Plot size was 4.2m^2 (1.2m x 3.5m length). The experiments included 24 treatments, which were the combinations of four nitrogen levels distributed at random in the main plots, two potassium levels assigned to the sub-plots and three cultivars allocated to the sub-sub-plots. Phosphorus fertilizer was applied in the form of mono super phosphate (15%) at rate of 15 kg P_2O_5 /fed. during land preparation. The other cultural practices were applied as recommended from each plot, the data were recorded in two growing seasons for number of days to heading, days to maturity, plant height, number of spikes/m^2, number of kernels/ spike, 1000-kernel weight and grain yield (ardab/fed.).

2- Laboratory Experiment:-

Grain properties were carried out by the Seed Technology Research. Section, Field Crop Research Institute at Sakha Agricultural Research Station.

A- Wheat grain Storability (accelerated ageing test):-

The inner chamber AA boxes and screen trays thoroughly washed with a 15 % sodium hypochlorite (Clorox) solution, placed , 40 ml of distilled water in each inner ageing chamber, inserted a dry screen tray, a minimum of 200 seeds determined on a weight are placed on the surface of the screen tray (approximately one layer deep). More than one inner chamber were used to obtain the quantity of seeds needed for larger seeds species, the lid is secured (not sealed) on each inner chamber, precisely monitor the temperature of the outer ageing chamber and maintain temperature at ±0.3 ^{0}C of desired temperature (41^{0}C) for 72 hours and planted for standard germination within one hour, the conditions for the standard germination test are those out-lined in the International Rules for Testing (ISTA, 1999).

B- Chemical properties:

Seed sample of 30 grain were taken at random from each plot and grounded to fine powder to pass through 2 mm mesh to determine the following:

- **Crude protein content**:- a known weight of the fine powdered grains (Ca 0.1 g) was digested using a micro kjeldahl apparatus. The crude protein was calculated by multiplying the total nitrogen by 5.85 (A.O.A.C 1990).
- **Protein fractions**:- Determination of protein fractions was carried out according to the method of Shoch *et al.*, (1970). In this method, the samples subjected to successive extraction processes using distilled water for the extraction of albumins, 5 % sodium chloride for the extraction of globulins, 80 % ethanol containing 0.2 % sodium acetate solution for gliadins and 0.2 % sodium hydroxide solution for glutenins.
- **Soluble protein** = (albumins + globulines + gliadins + glutenins)
- **Insoluble protein** = (crude protein – soluble protein)
- **Oil content and carbohydrate** were determined according to A.O.A.C. 1990.

Statisticial analysis:

Data recorded were analyzed according to Steel and Torrie, (1984).

The means of the treatment compared using the Least Significant Difference (LSD) at 5 % of probability as published by Waller and Duncan (1969). The statistical analyses were performed using analysis of variance technique by MSTATC computer software package.

RESULTS AND DISCUSSION

1- Agronomic traits.

Table 1 shows the data of heading and maturity date and plant height for the three wheat cultivars Sakha 93, Sakha 94 and Giza 168, as affected by nitrogen and potassium fertilizer levels and their interactions.

Table (1): Average of days to heading, days to maturity and plant height for three wheat cultivars as affected by four nitrogen levels and two potassium levels in the two season.

Treatment	Days to heading		Days to maturity		Plant height	
	04-05	05-06	04-05	05-06	04-05	05-06
Nitrogen fertilizer						
N_1	93.6 b	92.2 c	147.9	147.2 b	84.7 b	88.3 c
N_2	94.1 b	93.0 b	146.7	147.6 b	101.4 a	106.4 b
N_3	95.7 b	95.0 ab	147.7	150.2 A	105.0 a	108.1 ab
N_4	96.8 a	95.8 a	148.4	151.9 a	106.7 a	109.7 a
Potassium fertilizer						
K_1	95.3	94.2	147.7	103.5	98.2	103.5
K_2	94.8	93.8	147.7	102.8	107.0	102.8
Sig	NS	NS	NS	NS	*	NS
Cultivars						
Sakha 93	93.5 b	89.9 c	149.0 a	149.4	91.9 c	95.0 c
Sakha 94	97.1 a	101.0 a	145.9 c	149.1	107.1 a	112.7 a
Giza 168	94.5 b	91.9 b	148.1 b	149.1	99.4 b	101.7 b
Interaction						
N× K	NS	NS	NS	NS	NS	NS
N × Cv	NS	NS	NS	*	NS	NS
K × Cv	NS	NS	NS	NS	NS	NS
N × K ×Cv	NS	NS	NS	NS	NS	NS

Application of the different nitrogen levels had significant effects for days to heading in both seasons. As will as, days to maturity in the second season. Heading and maturity dates were increased with increasing nitrogen level up to 100 kg/fad where the latest date was 151.9 days, while it was 146.7 days in case of zero N/fed. The lateness obtained in maturity date could be explained by the increasing in vegetative growth with increasing nitrogen applications. Similar results were obtained by Sharshar *et al*. (1995) and Essa (1995).

Plant height was significantly affected by nitrogen levels and the response of plant height to nitrogen application was positive linear, whereas the level of 100 kg N/ fed. gave the tallest plants (109.7 cm).

Such increase in plant height may be occurred due to the stimulation of cell division and internodes elongation resulted from increasing nitrogen applications. Essa (1996) and Hussain *et al*. (2006) found the same results.

The effect of potassium levels on the three characters was not significant in both seasons except plant height in the second seasons.

The data revealed that cultivars were significantly different in both seasons except days to maturity in the second one.

Sakha 93 was the earliest cultivar in heading date and Sakha 94 was the earliest one in maturity date, while it was the latest one in heading date. It means that the grain filling period of Sakha 94 is shorter than the other ones. These differences between cultivars may be due to the genetic variation among the three cultivars, these results are in good agreement with these of Eissa (1995).

The interaction effect between cultivars and nitrogen level in Table 2 revealed that days to maturity was significantly affected by the interaction between cultivars and nitrogen level in the second seasons.

The combined data indicated that applying 100 kg N/fed. to Sakha 93 delayed maturity to 153.3 days. While, the earliest maturity date was obtained from Sakha 93 at zero N/fed.

Table (2): Effect of interaction between cultivars and nitrogen on days to maturity in 2005-2006 growing season

	Nitrogen fertilizer			
Cultivars	N_1	N_2	N_3	N_4
Sakha 93	145.8 f	147.2 ef	151.3 bc	153.3 a
Sakha 94	148.5 de	148.5 de	149.2 d	150.3 bcd
Giza 168	147.2 ef	147.2 ef	150.0 cd	152.0 ab

Yield and yield component traits:

The data of number of kernels/spike, 1000-kernel weight, number of spikes/m^2 and grain yield of three wheat cultivars as affected by four nitrogen levels and two potassium levels and their interactions in the two successive seasons are presented in Table 3.

The data showed that number of kernels per spike and number of spikes/m^2 were increased with increasing nitrogen levels up to 100 kg N/fed. in the two seasons. This increase in kernels number per spike could be attributed to the increase in number of fertile florets per spikelets and seed set per spike as encouraged by increasing nitrogen levels, these results are in harmony with those obtained by Essa (1996), Hammad (1998) and Hussain *et al.* (2006). The effect of nitrogen levels on kernel weight was insignificant in both seasons. Regarding nitrogen levels, ant and gradually increased with each increase in nitrogen levels up to 100 kg N/ fed. Hussain *et al.* (2006) found the same result.

Table 3 illustrated the data of grain yield of three wheat cultivars as affected by nitrogen and potassium levels. The data showed that grain yield was highly significant influenced by cultivars. Accordingly, Sakha 94 significantly out-yielded Sakha 93 and Giza 168. In fact, the superiority of Sakha 94 in grain yield/fed. is coming out as a result of the high records of its yield components. The data indicated that cultivars had significant effect on number of kernels per spike in the second season and insignificant effect on number of spikes/m^2 in the two seasons; Sakha 94 outnumbered Sakha 93 and Giza 168. The effect of cultivars on kernel weight was in the first seasons. El-Shami (1995) and Hussain *et al.*(2006) found the same result.

The effect of potassium fertilizer levels on grain yield and its components was not significant in both seasons (Table 3).

Table (3): Average of No. of kernels/spike, 1000-kernel weight, No. of spikes/m^2 and grain yield for three wheat cultivars as affected by four nitrogen levels and two potassium levels in the two season.

Treatment	kernels/spike		1000- kernel weight		Spikes/ m^2		Grain yield ardab/fed.	
	04/05	05/06	04/ 05	05/06	04/05	05/06	04/05	05/06
Nitrogen fertilizer								
N_1	50.1 b	48.4 b	45.4	49.7	220.0 c	208.3 b	9.6 c	13.5 d
N_2	58.0 a	53.3 a	44.9	49.9	310.8 b	353.8 a	17.7 b	23.8 c
N_3	62.9 a	54.4 a	45.8	48.8	366.9 a	355.3 a	23.2 a	26.9 b
N_4	61.1 a	55.3 a	45.5	48.0	390.0 a	371.1 a	24.8 a	29.3 a
Potassium fertilizer								
K_1	57.9	53.4	45.7	49.3	328.3	328.3	18.5	23.6
K_2	58.2	52.3	45.2	48.9	315.6	315.6	19.1	23.2
Sig	NS	NS	NS	NS	NS	NS	NS	NS
Cultivars								
Sakha 93	54.8	48.4 b	45.7	50.7 a	338.8	331.9	18.1 b	23.7 a
Sakha 94	59.5	58.8 a	45.8	49.8 b	307.3	306.8	19.9 a	24.5 a
Giza 168	59.8	51.3 b	44.7	46.9 c	319.8	327.8	18.5 ab	21.9 b
Interaction								
Cv × N	NS	NS	NS	NS	NS	NS	NS	NS
Cv × K	NS	NS	NS	NS	NS	NS	NS	NS
N× K	NS	NS	NS	NS	NS	NS	NS	NS
C×N×K	NS	NS	NS	NS	NS	NS	NS	NS

2- Quality traits: -

The effect of nitrogen fertilizer levels on wheat grain storability of the tested wheat cultivars was evaluated. Table 4 shows a significant increased in storability of wheat grains. In the first season storability reached 75% and increased up to 85.20% by increasing nitrogen fertilizer levels from zero up to 100 kg N/fed. In the second growing season, storability reached 75.90% and increased up to 86.20% as a result of increasing nitrogen fertilizer levels. Generally, when seeds are planted under stressful field conditions, accelerated aging (A.A) germination provides higher correlations with field emergence than does standard germination (ISTA 1999). On the other hand, oil percentage and carbohydrate versus increasing nitrogen fertilizer levels. In the first season oil content and carbohydrate content decreased from 1.91%, 72.19% up to 1.63% and 69.83% by increasing nitrogen fertilizer levels from zero to 100 Kg/fed. in 2004/2005 season and from 1.86%, 71.60% to 1.57 and 68.56% in 2005/2006 season by increasing nitrogen fertilizer levels from zero up to 100 kg/fed.

Table (4): Mean values of storability, oil and carbohydrate of three wheat cultivars under nitrogen and potassium levels in 2004/2005 and 2005/2006 season

Treatment	Storability(aging %)		Oil %		Carbohydrate %	
	04/ 05	05/06	04/05	05/06	04/05	05/06
Nitrogen fertilizer						
N1	75.00 c	75.90 c	1.91 a	1.86 a	72.19 a	71.60 a
N2	79.20 b	81.60 b	1.86 ab	1.81 a	71.82 ab	71.11ab
N3	82.50 b	85.10 a	1.77 b	1.68 b	70.37 bc	69.67bc
N4	85.20 a	86.20 a	1.63 c	1.57 b	69.83 c	68.56 c
Potassium fertilizer						
K1	79.30 b	80.60 b	1.85 a	1.78 a	71.73 a	70.99 a
K2	81.70 a	83.80 a	1.73 b	1.68 b	70.38 b	69.48 b
Cultivars						
Sakha 93	81.20 b	83.40 b	1.87	1.80	71.49 a	70.58 a
Sakha 94	87.30 a	87.60 a	1.73	1.68	71.97 a	71.49 a
Giza 168	73.00 c	75.60 c	1.77	1.71	69.71 b	68.65 b
Interaction						
N x K	N S	N S	N S	N S	N S	N S
N x CV	N S	N S	N S	*	N S	N S
K x CV	N S	N S	N S	N S	* *	
N x k x C V	NS	NS	NS	NS	NS	NS

Means designated by different letters in the same column are significantly different at 5 % according to Duncan's multiple range test.

Data in Table 4 also shows that potassium fertilizer supply led to increased storability of wheat grains of different cultivars. It is clear from this table that, storability increased from 79.30 % to 81.70 % by applying potassium fertilizer in the first growing season and from 80.60 % to 83.80 % in the second one. On the contrary, potassium fertilizer supply led to decreased oil and carbohydrate percentage from 1.85, 71.73 % to 1.73, and 70.38 % in 2004/2005 growing season and from 1.78, 70.99 % to 1.68, and 69.48 % in 2005/2006 growing season, respectively.

In both season 2004/2005 and 2005/2006, there were highly significant differences among cultivars in their storability. Sakha 94 had recorded the highest mean value (87.60%), while the lowest value (73.00%) was obtained from Giza 168 (Table 4). Delouche and Baskin (1973) reported that the changes in germination of high and low quality seed lots after accelerated aging followed similar trends to the germination of the same seed lots after a period of time in warehouse storage.

There were no significant differences among cultivars in oil content. Also, in both growing season, there were significant differences among cultivars in their carbohydrate contents. Sakha 94 then Sakha 93 gave the highest mean values of carbohydrate percentages (71.97 and 71.49%, respectively, while the lowest mean value of carbohydrate percentage (69.71) was obtained from Giza 168 (Table 4).

The interaction effects were not significant for grain storability, oil and carbohydrate percentage in both seasons except for nitrogen x cultivars for oil percentage and potassium x cultivars for carbohydrate percentage in the Second season (Table 4).

Data in Table 5 shows the influence of different amount of nitrogen fertilizer on crude protein, soluble protein and non-soluble protein content. Data shows that increasing nitrogen supply led to increase crude protein, total soluble protein and non-soluble protein. It is clear from this table that crude protein, total soluble protein and non-soluble protein increased from 12.7, 0.18, 12.08% up to 14.18, 0.23,13.96% by increasing nitrogen supply from zero up to 100 kg N/fed. respectively in 2004/2005 growing season and from 11.78, 0.17, 11.60 % to 13.79, 0.22, 13.57%, respectively in 2005/2006 growing season.

Table (5) Mean of three wheat cultivars under nitrogen and potassium levels values of crude protein, non-soluble protein and soluble protein % In 2004/2005 and 2005/2006 seasons.

Treatment	crude protein		non soluble protein%		soluble protein%	
	2004/2005	20052006	2004/2005	20052006	2004/2005	20052006
Nitrogen fertilizer						
N1	12.27 c	11.78 d	12.08 c	11.60 d	0.1781d	0.1740 d
N2	12.80 bc	12.37 c	12.60 c	12.17 c	0.1978 c	0.1947 c
N3	13.37 b	12.86 b	13.16 b	12.65 b	0.2077 b	0.2049 b
N4	14.18 a	13.79 a	13.96 a	13.57 a	0.2227 a	0.2209 a
Potassium fertilizer						
K1	13.11 b	12.65 b	12.43	12.02	0.1934 b	0.1896 b
K2	13.88 a	13.38 a	12.79	12.35	0.2098 a	0.2076 a
Cultivars						
Sakha 93	13.38 a	12.87 b	13.19 a	12.69 b	0.1867 c	0.1868 c
Sakha 94	13.83 a	13.22 a	13.63 a	13.02 a	0.2009 b	0.1977 b
Giza 168	12.25 b	12.00 c	12.03 b	11.79 c	0.2171 a	0.2114 a
Interaction						
N x K	N.S	N.S	N.S	N.S	N.S	*
N x CV	N.S	*	N.S	*	**	**
K x CV	**	**	**	**	**	**
N x k xCV	NS	NS	NS	NS	NS	NS

Means designated by different letters in the same column are significantly different at 5 % according to Duncan's multiple range test.

Moreover, Table 5 indicate that Potassium nutrition increase the quantity of crude protein, total soluble protein, non-soluble protein from 13.11, 12.43, 0.19 % to 13.88, 12.79, 0.21%, respectively in 2004/2005 growing season and from 12.65, 12.02, 0.19 % to 13.38, 12.35, 0.21% respectively in 2005/2006 growing season.

There were highly significant differences among cultivars on crude protein, total soluble protein and non-soluble protein percentage in both seasons (Table 5). Sakha 94 recorded the highest percentage of crude protein and non-soluble protein, while Giza 168 was recorded the highest values of total soluble protein in both seasons.

The interaction effects for nitrogen by potassium fertilizer on crude protein, non-soluble protein and soluble protein percentages were not significant except for soluble protein in the second season. Nitrogen by fertilizer interaction effect was significant on the three traits at least in one season. Meanwhile, highly significant effect was detected for potassium by cultivars interaction on the three traits (Table 5).

Generally, genotypes differ in their protein content reflect their different genetic background. In addition, fertilizers and environmental factors had effected on protein content. High levels of nitrogen fertilizers result in an increased protein content of wheat grains (Pechanek *et al.*, 1997; Wieser and Seilmeier, 1998).

Data in Table 6 shows that, different fertilizer treatments had certain effect on the content of the components of protein, but the effects were not the same. As to albumin, all the fertilizing treatments decreased the content of albumin more than that of zero nitrogen. As to globulin, all of the nitrogen fertilizer treatments increased the content of globulin more than zero nitrogen fertilizer up 75 kg N /fed., while 100 kg N /fed. had the lowest content. All nitrogen fertilizer treatments improved gluten quality (gliadin and glotenin), it true in the two growing seasons. It is clear from Table 6 that gliadin and glotenin increased from 11.32, 27.46% to 18.84, 32.92% respectively by increasing nitrogen supply from zero to 100 Kg fed. in 2004/2005 growing season, respectively and from 10.94, 26.94% to 18.11, 32.11 % in 2005/2006 growing season by increasing nitrogen supply from zero nitrogen up to 100 kg fed. Respectively. The distribution of the protein between the different solubility fractions depends on the cultivar and also the agronomical conditions (Kirkman *et al.*, 1982).

All fertilier treatments (nitrogen and potassium) resulted in increased glotenin and the content of globulin and gliadin were also improved (Guangcai Zhao, *et al.*, 2006). nitrogen nutrition increases the total quantity of protein per grain at harvest ripeness and this correlated with an increase in the quantity of gliadin and glotenin storage proteins for wheat (Pechanek *et al.*, 1997; Wiser and Seilmeier, 1998; Triboi *et al.*, 2000).

Data in Table 6 shows also that K fertilizer supply led to increase albumen and glotein quality (gliadins and glutenin). It is clear from this Table that albumins increased from 35.01% to 38.56 % in 2004/2005 growing season and from 34.93% to 39.34% in 2005/2006 growing season by adding potassium fertilizer. Moreover the results indicated that gliadin and glotenin increased from 13.19, 28.76% to 15.89, 31.53% in 2004/2005 growing season and from 12.84, 28.06% to 15.22, 30.95% in 2005/2006 growing season by potassium fertilizer supply. On the other hand, globulin was decreased by potassium fertilizer supply.

There were highly significant differences among cultivars in albumen, globulin, gliadein and glotenin percent (percent from total soluble protein) in both growing seasons. Sakha 93 recorded the highest value of globuline in both seasons. Sakha 94 recorded the highest value of glotein quality (gliadein and glotenin) in both seasons. Giza 168 recorded the highest value of albumen in both seasons.

The treatment interaction effects on albumin, globulin gluadein and glutenin percentages are presented in Table 6. The effects for nitrogen by potassium interaction were highly significant for all traits except for gluadein percentage. Nitrogen by cultivar and potassium by cultivar interaction effects were highly significant for all traits. No significant differences were detected for nitrogen by potassium by cutivar interaction on the four traits.

Table (6): Mean values of Albumen, Gglobuline, Gluadein and Glotenin of three wheat cultivars under nitrogen and potassium levels in 2004/2005 and 2005/2006 season

Treatment	Albumen %		Globuline %		Gluadein %		Glotenin %	
	2004/ 06	2005/ 06	2004/ 06	2005/ 06	2004/ 06	2005/ 06	2004/ 06	2005/ 06
Nitrogen fertilizer								
N1	42.36 a	43.22 a	19.08 a	18.90 c	11.32 d	10.94 d	27.46 d	26.94 d
N2	38.40 b	39.39 b	19.64 a	19.82 b	12.94 c	12.43 c	29.02 c	28.30 c
N3	35.44 c	34.31 c	19.99 a	20.58 a	15.05 b	14.64 b	31.19 b	30.66 b
N4	30.94 d	31.63 d	17.42 b	18.15 d	18.84 a	18.11 a	32.92 a	32.11 a
Potassium fertilizer								
K1	35.01 b	34.93 b	24.04 a	24.21 a	13.19 b	12.84 b	28.763 b	28.06 b
K2	38.56 a	39.34 a	14.02 b	14.52 b	15.89 a	15.22 a	31.532 a	30.95 a
Cultivars								
Sakha 93	35.62 b	36.56 b	19.95 a	19.99 a	14.84 b	14.41 b	29.72 b	29.08 b
Sakha 94	35.67 b	35.03 c	18.51 b	19.28 b	15.69 a	15.10 a	31.37 a	30.60 a
Giza 168	39.06 a	39.82 a	18.63 b	18.83 b	13.08 c	12.59 c	29.35 b	28.83 b
Interaction								
N x V	N.S	**	**	**	**	**	**	**
N x K	**	**	**	**	N.S	N.S	**	**
V x K	**	**	**	**	**	**	N.S	**
N x V x k	NS	NS	NS	NS	NS	NS	NS	NS

Means designated by different letters in the same column are significantly different at 5% according to Duncan's multiple range test.

The protein fractions, i.e. albumins, globulin, gliadein and glutenins were determined in wheat grains in 2004/2005, 2005/2006 seasons. Fig. 1 shows the percentage value of these fractions in each cultivar at the different fertilization levels used when applying a multivanate analysis of variance. Taking into consideration all protein fractions and all cultivars, significant differences were found between the level of nitrogen fertilizer and the proportions of the different protein fractions. All three cultivars showed increase in glotein quality (gliadein and glotenin content) with increasing amounts of nitrogen fertilizer, while a decrease in albumen content was observed with increasing amounts of nitrogen fertilizer.

Giza 168 recorded the highest values of albumen % under all level of nitrogen in the two growing seasons (Fig. 1).

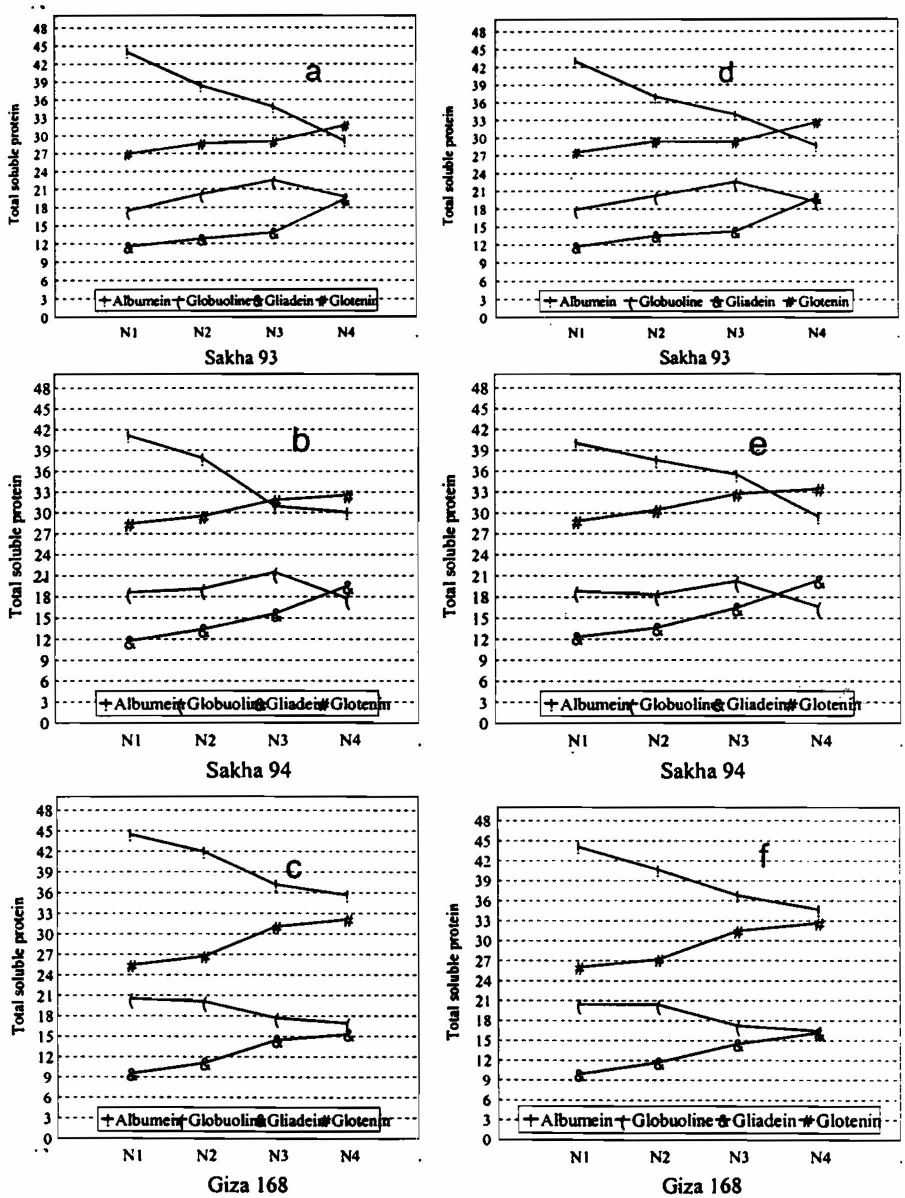

Figure (1). Effect of nitrogen fertilization levels on protein fraction of three wheat cultivars. a, b and c season 2004/2005; d, e and f season 2005/2006.

Correlation coefficients

The correlation coefficient among studied quality traits in combined data are presented in Table 7. Positive significant correlation coefficients were found between nitrogen fertilizer and each of storability (r = 0.423), crude protein (r = 0.475), total soluble protein (r = 0.674), non-soluble protein (r = 0.468); gliadein (r = 0.754); glotenin (r = 0.675). On the contrary, it was negative and significant with each of oil content (r = - 0.501); carbohydrate content (r = -0.386); albumin (r = -0.597); and gliadein 0.675). Positive significant correlation coefficients were also found between storability and each of crude protein (r = 0.624); non-soluble protein (r = 0.560); gliadein (r = 0.625) and glotenin (r = 0.543). While it was negative and significant with each of oil content (r = -0.244); albumin (r = -0.283) and globuline (r = -0.161). Oil content showed positive significant correlation with carbohydrate (r = 0.282); albumin (r = 0.218) and globulin (r = 0.203). on the contrary, it was negative significant with crude protein protein (r = - 0.357); soluble protein (r - 0.490); non-soluble protein (r = -0.191); gliadein (r = -0.439) and glotenin (r = -0.462). Carbohydrate showed negative and significant correlation with soluble (r = - 0.479); gliadien (r = -0.206) and glotenin (r = -0.270).

Table (7) Correlation coefficient between nitrogen fertilizer and studied characters of three wheat genotypes, combined over two seasons.

Variable	(x2)	(x3)	(x4)	(x5)	(x6)	(x7)	(x8)	(x9)	(x10)	(x11)
Nitrogen (x1)	0.42**	- 0.50**	-0.38**	0.47**	0.67**	0.46**	- 0.59**	-0.05	0.75**	0.67**
Storability (x2)	1.00	-0.24**	0.07	0.62**	0.14	0.56**	-0.28**	-0.16*	0.63**	0.54**
Oil (x3)		1.00	0.28**	-0.35**	-0.49**	-0.19*	0.21**	0.20*	-0.44**	-0.46**
Carbohydrate (x4)			1.00	-0.28	-0.47**	0.12	0.15	0.09	-0.21*	-0.27**
Crude protein (x5)				1.00	0.31**	0.45**	-0.29**	-0.35**	0.73**	0.684**
Soluble protein (x6)					1.00	0.23**	-0.19*	-0.34**	0.51**	0.65**
Non-soluble protein (x7)						1.00	-0.21*	-0.24**	0.55**	0.43**
Albumin (x8)							1.00	-0.56**	-0.35**	-0.39**
Globulin (x9)								1.00	-0.45**	-0.37**
Gliadein (x10)									1.00	0.776**
Glotenin (x11)										1.00

*** and ** = Significant at 0.05 and 0.01 levels, respectively.**

Positive significant correlation was found between crude protein and each of soluble protein (r = 0.311); non-soluble protein (r =0.453); gliadein (r = 0.731) and glotenin (r = 0.684) while it was negative and significant with albumin (r = -0.294) and globulin (r = -349). It is worthy to mention that soluble protein was positive and significantly correlated with each of non-soluble protein (r = 0.239); gliadein (r = 0.507) and glotenin (r = 0.646) while, it was negative with albumin (r = -0.199) and globuline (r = -0.339). Non-soluble protein showed positive and highly significant correlation with gliadein (r = 0.555); glotenin (r = 0.434). On the contrary, it was negative and significant with albumin (r = -0.206); globuline (r = -0.242). Albumin showed negative and highly significant correlation with each of globuline (r = -0.566); gliadein (r = -0.346) and glotenin (r = -0.391). globulin showed negative and highly significant with gliadein (r = -0.452) and glotenin (r = -0.368). However, the correlation coefficient between gliadein and glotenin (r = 0.776). Stenram (1988) reported that, the correlation between nitrogen fertilizater level and protein content was significant. The above mentioned results of correlative coefficients were in harmony with those obtained by El-Akhedar and El-Sayed (2006).

REFERENCES

A.O.A.C. (1990). Official Methods of Analysis of the Association of Official Analytical Chemists 15th edition (Published by Association of Official Analytical Chemists Arlington, Virginia USA).

Abdul Galil,A.A.; M.A.Gomaa; H.G.M.Geweifel and Y.E.M. Atta (1997). Response of yield and some grain quality criteria in wheat to nitrogen and phosphorus fertilization. Zagazig J. Agric. Res., 24 (4): 595-63.

Chaudhary, A.U., Mehmood, R. (1998). Determination of optimum level of fertilizer nitrogen for varieties of wheat. Pak.J.Bio.Sci., 4:351-353.

Delouch, J.C. and C.C. Baskin (1973). Accelerated Ageing Technique for predicting the Relative Storability of Seed Lots. Seed Science and Technology., 1: 427-452.

Eissa, Y.G. (1995). Response of some Egyptian wheat varieties to phosphorus and nitrogen fertilization levels under new Valley Governorate conditions. Ph.D. Thesis. Agronomy Department, Faculty of Agriculture, Minia University.

El- Akhedar A.A.A. and El-Sayed A. Soad (2006). Genetic basis for variability of seed properties and some associated traits among extra-long staple cotton genotypes in Egypt. Egypt J. Agric. Res., 84 (4) 1207-1225.

El-Shami, M.M.; M.S. Sharshar and A.H. Abdel-Latif (1995). Effect of late planting date and nitrogen fertilization on wheat. Egypt, J. Appl. Sci; 10 (9) 1995

Essa, F.A. (1996). Agronomic studies on wheat. Thesis, Ph.D. Fac. of Agric., El-Mansoura Univ.

Guangcai Zhao G., Zhang Y., Chang X., Yang G, Liu L., and Yang Y. (2006). Effect of fertilizer treatment on the content f protein types in wheat flour. Journal of the Science of Food and Agriculture 76, 49-55.

Graybosch R.A., Peterson C.J., Shelton D.R., Baenziger P.S. (1996). Genotypic and environmental modification of wheat flour protein composition in relation to end- use quality. Crop Science 36, 296-300.

Hammad, S.M. (1998). Effect of some cultural practices on wheat production. M.Sc. Thesis, Fac. of Agric., Al-Azhar Univ., Egypt.

Huebner F.R., Nelson T.C., Chung O.K., Bietz J.A. (1997). Protein distribution among hard red winter varieties as related to environment and baking quality. Cereal Chemistry 74, 123-128.

Hussain J., Ayyaz K.M. and Ahan K.E. (2006). Bread wheat varieties as influenced by different nitrogen levels. J. Zhejiang Univ. Sci. B 7: 70-78.

I.S.T.A. (1999). International Rules for Seed Testing Association. 27, 155-165. Seed Sci. & Technol., Switzerland.

Kirkman, M. A., P. Shewry and B. Mifline (1982). The effect of nitrogen nutrition on the lysine content and protein composition of barley seed. J. Sci. Food Agric. 33, 115

Mosalem, M.E. (1993). Response of two wheat cultivars to nitrogen level and seeding rate. J. Agric. Res. Tanta Univ., 19 (4): 791-805.

Pechanek U., Karger A., Groger S., Charvat B.B., Schoggl G., Lelley T. (1997). Effect of nitrogen fertilization on quality of flour protein components, dough properties, and bread making quality of wheat. Cereal Chemistry 74, 800-805.

Saleh, M.E. (2000). Effect of seeding rate and nitrogen level on the productivity of Mexipak 65 wheat cultivar. J. Agric. Sci. Mansoura Univ., 25(3): 1483-1500

Saleh, M.E. (2001). wheat productivity as affected by sources and levels of nitrogen fertilizer. Zagazig J. Agric. Res., 28 (2): 239-250.

Sharshar, M.S.; M.M. El-Shami; A.H. Abd El-Latif and N.A. El-Aidy (1995). Response of some agronomic and quality traits of wheat to nitrogen and zinc fertilization . Egypt. J. Appl. Sci; 10 (9)

Shewry P.R., Halford N.G. (2002). Cereal seed storage proteins: Structures, properties and role in grain utilization. J Exp Bot 53: 947-958.

Shoch, L.V. Doyoe, C.W., Shoup, F.K.; Bothurs, J. and Laing, D. (1970). Protein fractionation of sorghum grain. Cereal Chem. 47 (4): 472-475.

Steel, R.G.D., Torrie, J.H. (1984). Principles and procedures of statistics. Mc Graw Hill Inc., New York, USA.

Triboï E., Abad A., Michelena A., Lioveras J., Ollier J.L., Daniel C. (2000). Environmental effects on the quality of two wheat genotypes. 1. quantitative and qualitative variation of storage protein. European Journal of Agronomy 13, 47-64.

Waller, R. A. and D.B. Duncan (1969). A bay's rule for the symmetric multiple comparison problem. J. Ame. Stat. Asocy., 64: 1485-1503.

Weegels P.L., Hamer R.J., Schofield J.D. (1996). Critical review: functional properties of wheat glutenin. Journal of Cereal Science 23, 1-18.

Wieser H., Seilmeier W. (1998). The influence of nitrogen fertilization on quantities and proportions of different protein types in wheat flour. Journal of the Science of Food and Agriculture 76, 49-55.

J. Agric. Sci. Mansoura Univ., 32 (7), July, 2007

تأثير مستويات التسميد الآزوتي والبوتاسى على بعض صفات المحصول والجودة في ثلاثة أصناف من القمح

سعاد عبد الهادي السيد* و سعيد محمد حماد**
* قسم تكنولوجيا البذور- معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية
**البرنامج القومي لبحوث القمح- معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية

أقيمت تجربة لدراسة تأثير مستويان مختلفة من التسميد النتروجين والبوتاسى على المحصول ومكونات وبعض الصفات التكنولوجية لثلاث أصناف من قمح الخبز هي سخا ٩٣ ، سخا ٩٤ وجيزة ١٦٨ في محطة البحوث الزراعية بسخا مركز البحوث الزراعية خلال موسمي الزراعة ٢٠٠٤/٢٠٠٥و ٢٠٠٥/٢٠٠٦ واستخدم أربع مستويات تسميد صفر ،٥٠ ، ٧٥ و١٠٠كجم /فدان مع مستويان من التسميد البوتاسي صفر و ٢٤ كجم/فدان وتتلخص أهم النتائج في:-

تفوق الصنف سخا ٩٤ في المحصول ،عدد حبوب السنبلة و عدد سنابل /م٢-الصنف سخا ٩٣ كان أبكر الأصناف في طرد السنابل في حين كان الصنف سخا ٩٤مبكرا في النضج على الرغم من ناخرة في طرد السنابل وهذا يدل على قصر فترة امتلاء الحبوب لهذا الصنف.

زيادة التسميد النيتروجيني إلى ١٠٠كجم/فدان أدى إلى زيادة عدد أيام طرد السنابل والنضج ،طول النبات ،عدد حبوب السنبلة ،عدد السنابل /م٢ وكذلك محصول الحبوب للفدان . على العكس من ذلك لم تتأثر صفة وزن الـ ١٠٠٠ حبة بزيادة مستويات التسميد .

أوضحت الدراسة تأثيرا عالي المعنوية للتسميد البوتاسى ومستويات التسميد النتروجيني في صفات جودة حبوب القمح للأصناف الثلاثة تحت الدراسة وخاصة صفات جودة الجلوتين (الجليادين والجلوتين) ، البروتين الخام والذائب وغير الذائب والقدرة التخزينية للحبوب ، كما كانت هناك اختلافات معنوية بين الأصناف في هذه الصفات بزيادة مستويات التسميد النيتروجيني والبوتاسى تحسنت هذه الصفات بينما نقصت نسبة الزيت ومحتوى الكربوهيدرات بالحبوب بزيادة مستويات التسميد النيتروجيني والتسميد البوتاسى ، كذلك أوضحت الدراسة وجود اختلافات بين الأصناف فيما بينها في صفات الجودة ، وكان التفاعل بين مستويات التسميد النيتروجيني والأصناف معنوية في معظم صفات الجودة . وقد أوضحت النتائج وجود تلازم موجب بين مستويات التسميد النيتروجيني وكل من جوده الجلو تين ، القدرة التخزينية للحبوب ، البروتين الخام والذائب وغير الذائب بينما وجد تلازم سالب بين التسميد النيتروجيني وكل من محتوى الكربوهيدرات والزيوت في الحبوب .