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EFFECT OF N, K AND N APPLICATION TIME ON YIELD AND UPTAKE OF WHEAT PLANTS AT NORTH DELTA

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ABSTRACT

A field experiment was carried out during the two successive water seasons of 2002/2003 and 2003/ 2004. The objective of this works was to study the role of N application at tillering stage and effect of K on wheat (*Triticum aestivum L.*) yield, uptake of N, P, K and N-recovery . The obtained results could be summarized as follows:

Grain and straw yields were highly significantly increased with increasing N level up to 120 kg N/fed. (fed=4200 m^2) of the two studied wheat varieties. The highest mean values were 21.91and 30.0 ardab grain/fed, (ardab=150 kg) and 5.19 and 6.0 tons straw/fed. for Giza 168 and Sids7, respectively.

Applications of N at tillering stage in the presence of K have a high significant effect on grain and straw yields, of the two wheat varieties.

Application of N by the rates of 24, 60, 18 and 18 kg/fed. at planting, tillering, booting and milk stages dry weight of wheat plants at maturity stage recorded the highest-mean value by about 172.2 %and 198.3 % for Giza 168 and Sids7, respectively.

Applying K increased dry matter at tillering stage, booting and maturity stage for Giza 168 and Sids7.However Sids7 pronounced Giza 168.

N, P and K-uptake by wheat plants was increased for the two studied varieties by N application up to 120 kg N/fed and applying K. Uptake of N, P and K by Sids7 surpassed Giza 168

Increasing N from 75 to 120 kg/fed increased N-recovery and recorded the highest value at tillering stage > booting >maturity stage of the two wheat varieties.

Applying N at tillering stage for Sids7, recorded high N-recovery which surpassed Giza 168 by about 18.69 %.

Applying K increased nitrogen use efficiency (NUE) by about 18.21 % and 19.24 % for Giza 168 and Sids7, respectively.

Increasing N from 75 to 120 kg/fed increased the crude protein content in grains by about 12.47 % and 16.2 % and applying K increased them by 5.48 and 7.06 % for Giza 168 and Sids7, respectively.

Keywords: Wheat (*Triticum aestivum L.*), Nitrogen, potassium, tillering stage, time application, NPK Uptake, NUE, N-recovery and crude protein content%.

INTRODUCTION

Wheat (*Triticum aestivum L.*) is strategic crop because of its indispensable part of food diet. Wheat cultivation is widely scattered all over Egypt. Reducing the gap between production and consumption of wheat is a national policy in Egypt. Wheat is very sensitive to insufficient N. Application of N for wheat as one dose was usually practiced in the past. Recently, Forestar (1973) found that, the grain and straw yields of wheat increased when the N fertilizer was splited into two or three doses. Moreover, the addition of four N doses gave higher yield than 3 N doses (Rahman *et al* 2002). Also, Faizy *et al*. (1986) found that, the grain yield of wheat was higher when the nitrogen was split into 4 doses than when split into 3 or 2 doses.

Nitrogen use efficiency has been considerably improved by splitting N dressing in winter wheat (Faizy *et al*.1986 and Mengel and Kirkby 2001).

Potassium is necessary for plant growth, where it plays an integral part. Enzymes are involved in many important plant physiological processes, and over 80 plant enzymes require K for their activation. K-fertilization has a role in decreasing certain plant diseases and improving quality. Thus the intensive agriculture reduced the level of available K in the soil; nowadays insufficient soil K is usually corrected by adding K fertilizer which has a beneficial influence on the development of endosperm cells and hence on the single grain weight of cereals. Genaidy and Hegazy (2001) indicated that 24 Kg K_2O / fed as K_2SO_4 fertilizer increased the yield of wheat by 20.76 %.

Amer (2009) pointed out that N-uptake and recovery by wheat yield was increased with application of nitrogen and potassium, nitrogen use efficiency (NUE) by wheat yield was decreased with increasing application of nitrogen but improved by addition of 50kg K_2Ofed^{-1}

Therefore, the main target of this investigation is to study the effect of N level at tillering stage and K fertilization on the yield of two wheat varieties Giza 168 and Sids7 as well as N, P and K uptake by wheat plants.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Farm, Faculty of Agric., Kafr El Sheikh, Tanta Univ. (6 m altitude, 31° 07- latitude and 30° 52- longitude) during two successive seasons of 2002/2003 and 2003/2004 with two wheat varieties Giza 168 and Sids7, to study the effect of two N levels, two levels of K (with and without 50 kg/fed), timing of N application at different physiological stages (planting, tillering, booting and milk) on grain and straw yield, dry weight after tillering , booting and maturity stage, as well as N, P and K uptake by wheat plants.

The experiment was conducted in a split – split - split plot design, with four replicates. The main plots were randomly assigned to timing of doses of N, sub plot were assigned to N level (75 and 120kg/fed.), sub – sub plot to K level and the sub-sub-sub plot to wheat variety. The area of each plot was 3 X 3.5 square meter (1/400) fed. The N was applied as urea (46 % N) in four doses. The first dose was divided into two levels 15, 24, Kg N / fed and broadcasted with 22 Kg P_2O_5 / fed. with 50 Kg K_2O / fed. , as potassium sulphate (48 % K_2O) at sowing. The second dose of nitrogen was applied at the first irrigation with level: 0, 20, 30, 40, 50, 60 Kg N / fed and represented as: D_0, D_1, D_2, D_3, D_4, D_5 and D_6. The rest of N was splited equally between booting and milk stages Table (1).

Soil samples from the surface layer (0-15) and (15-30) were taken from the experimental sites before planting in two seasons and prepared for physical and chemical analysis. The soil characteristics were presented in Table 2. Also, plant samples were taken randomly at age 45 and 90 day to estimate the wheat yield and dry weight.

Soil samples were air-dried crushed and passed through a 2.0 mm sieve for the chemical analysis, according to Jackson (1967). Cation exchange capacity (CEC): as described by Gohar (1954). Available P

according to Olsen *et al* (1954). and K according to Page (1982). Mechanical analysis was determined according to Piper (1950).Protein concentration (%): was calculated from total N percent in grain yield multiplied by 6.25 according (A. O. A. C. 1980).

Data were analyzed statistically according to procedures outlined by Cochran and Cox (1960).

Table (1). Layout of the Experiment:

TREATMENTS (Kg / fed.)							
D	N Level	Different doses of N at physiological growth stages				P	K
		Planting	Tillering	Booting	Milk	P_2O_5	K_2O
D0	0	0	0	0	0	0	0
D1	75	15	0	30	30	22	0
							50
D2	75	15	20	20	20	22	0
							50
D3	75	15	30	15	15	22	0
							50
D4	75	15	40	10	10	22	0
							50
D5	75	15	50	5	5	22	0
							50
D6	75	15	60	0	0	22	0
							50
D1	120	24	0	48	48	22	0
							50
D2	120	24	20	38	38	22	0
							50
D3	120	24	30	33	33	22	0
							50
D4	120	24	40	28	28	22	0
							50
D5	120	24	50	23	23	22	0
							50
D6	120	24	60	18	18	22	0
							50

Table (2). Some chemical and physical properties of soil surface layer (0-15 , 15-30) before planting.

Year		2002/2003		2003/2004	
Soil depth cm		0-15	15-30	0-15	15-30
*Soil pH		8.0	8.1	8.1	8.13
**EC dsm^{-1}		2.3	3.6	2.0	2.5
SAR		4	7	5.2	6.8
Available ppm	N	32	17	30	18
	P	12	10	11	10
	K	195	150	201	159
O.M		2.36	2.18	2.41	2.20
Total carbonate %		3.6	3.57	3.55	3.4
CEC m.e./100g soil		45.2	43.1	47.1	44.6
Saturation percent		93	90	91	89
Particle size distribution%	Clay	57.2	58.11	56.90	56.71
	Silt	32.0	31.41	30.29	30.90
	Sand	10.8	10.48	12.81	12.39
Texture grade		clayey	clayey	clayey	clayey

*** soil pH : (1: 2.5 soil: water suspension).**

****EC dsm^{-1}: (soil paste extract)**

RESULTS AND DISCUSSION

-Grain yield:

Data in Table (3) revealed that time of N application has a high significant effect on grain yield of the studied varieties. The highest mean values were recorded at D_6 (15:60:0:0) (24:60:18:18) for both N_{75} and N_{120} These results were supported by El-Desokey *et al*. (2000) and Warraich *et al* (2002).

Table (3). Effect of N, K and timing of N application and their interactions on grain and straw wheat yield.

Treatment N dose (D)					Grain yield ardab/fed		Straw yield ton/fed	
D	Planting	Tillering	Booting	Milk	2003	2004	2003	2004
D_0	0	0	0	0	6.005	5.5	1.85	1.78
D_1	15	0	30	30	17.013	17.24	4.15	4.23
D_2	15	20	20	20	18.319	18.34	4.23	4.31
D_3	15	30	15	15	19.954	20.007	4.35	4.48
D_4	15	40	10	10	20.74	20.92	4.52	4.62
D_5	15	50	5	5	21.070	21.40	4.64	4.69
D_6	15	60	0	0	20.689	21.62	4.69	4.73
F . test					**	**	**	**
$LSD_{0.05}$					0.66	0.25	0.35	0.32
$LSD_{0.01}$					0.90	0.34	0.48	0.44
N level (N):								
N_{75}					15.709	15.71	3.58	3.67
N_{120}					19.662	20.01	4.54	4.57
F . test					**	**	**	**
K level (K):								
K_0					16.696	16.75	3.87	3.95
K_{50}					18.676	18.97	4.25	4.29
F . test					**	**	**	**
Variety (V):								
Sids 7					19.51	19.59	4.32	4.37
Giza 168					15.86	16.13	3.81	3.87
F . test					**	**	**	**
Interaction:								
D x N					**	**	**	**
D x K					**	**	**	**
N x K					*	**	**	**
D x V					**	**	**	**
N x V					**	**	*	*
K x V					**	**	**	**
D x N x K					**	**	**	**
D x N x V					**	**	**	**
D x K x V					**	**	**	**
V x K x N					**	**	**	**
D x N x K x V					**	**	**	**

Data indicated that there were high significant effects on grain yield during the two growing seasons due to the interaction between treatments used in the experiments (Table 3).These results were supported by El Kholy (2000). Data revealed that the highest mean values of grain yield was recorded by N_{120} P_{22} K_{50} (D_6) for Giza 168 and Sids 7 (21.91and 30.0, ardab/fed.), these results were supported by Koreish *et al* (2004).

-Straw yield:

Table (3) showed that straw yield of the studied wheat varieties were highly significantly increased with increasing N level up to 120 Kg/fed. The highest mean values were 5.26 and 6.0 tons/fed. for Giza 168 and Sids 7. These results were supported by El-Sherbieny *et al*. (1999) and Muhammad (2001).

Data revealed that the straw yields of the studied wheat varieties were highly significantly increased in the presence of potassium. The highest mean value was recorded with Sids 7 (6.0 tons/fed.) These results were supported by Genaidy and Hegazy (2001) and Singh and Pathak (2003).

Data showed that time of N application has a high significant effect on straw yield of the studied wheat varieties. The highest mean values were recorded at D_6 (15:60:0:0) (24:60:18:18) for both N_{75} and N_{120}. similar results were reported by El Desouqi (2000).

Data indicated that there were high significant effects on straw yield due to the interaction between the applied treatments (Table 3). Data showed that the highest mean values of straw yield was recorded at N_{120} $P_{22}K_{50}$ D_5 (15:50:5:5) (5.26 tons/fed. and 6.0 tons/fed respectively, for Giza 168 and Sids7). These results were supported by El – Banna (2000) and Wagan *et al* (2002).

-Dry weight :

- Dry weight of wheat plants at tillering stage:

Data in Table (4) indicated that the dry weight of wheat plants at tillering stage increased by 60.3 % and 59.10 % for Giza 168 and Sids 7 by increasing N level to 120 Kg / fed. Similar result was reported by El Yamany (1994).

Data showed that dry weight of the studied wheat varieties increased in the presence of potassium by about 15.93 %, 18.88 % for Giza 168 and Sids 7, these results supported by Hegab (1994).

Data of N time application revealed high effect on dry weight for the two wheat varieties. The highest relative increase was obtained under D_6 (60 kg N/feddan at tillering) for all N levels 348.2 % and 335.6 % for Giza 168 and Sids 7,. These results supported by El-Desokey *et al* (2000) and werraich *et al* (2002).

Dry weight of wheat plants at booting stage:

Table (4) indicated that the dry weight of wheat plants at booting stage increased 56.15 % and 74.10 % for Giza 168 and Sids 7 by increasing N level to 120 Kg / fed. These results were supported by Adjetey *et al* (2001).

Data revealed that dry weight of both wheat varieties Giza 168 and Sids 7 increased in the presence of potassium (50 Kg K_2O / fed.). The mean values increased by about 10.53 % and 33.64 %for Giza 168 and Sids 7, these results were supported by El Yamany (1994).

Data showed that time of N application have a high effect on the two wheat varieties, where the highest relative increase was obtained under D_6 (348.2 % and 335.6 % for Giza 168 and Sids 7). These results were supported by warraich *et al* (2002).

- Dry weight of wheat yield at maturity stage:

Data indicated that the dry weight of wheat yield was increased 22.24 % and 32.5 % for Giza 168 and Sids 7 by increasing N level to 120 Kg / fed. These results were supported by El-Sherbieny *et al* (1999) and El-Desouqi (2000).

Data in Table (4) showed that dry weight of wheat yield increased in the presence of potassium (50 Kg K_2O / fed.) where the mean value increased 9.49 % and 13.19 % for Giza 168 and Sids 7,. These results were supported by Genaidy and Hegazy (2001).

Data revealed that the time of N application have a high effect on dry weight of the two wheat yield varieties. The highest relative increases were 172.2 % and 198.3 % for Giza 168 and Sids 7 which obtained under D_6 (60 kg N/feddan at tillering) . These results were supported by Koreish *et al* (2004) and Amer (2009)

Table (4). Effect of N, K and timing of N application on the dry weight of wheat plants at different growth stages.

Treatments		Giza 168			Sids 7		
		Tillering	Booting	Maturity	Tillering	Booting	Maturity
N_{75}		0.456	1.791	5.26	0.528	2.059	5.84
N_{120}		0.731	2.797	6.43	0.842	3.586	7.74
Relative variation %		+60.03	+56.15	+22.24	+59.10	+74.10	+32.5
K_o		0.549	2.179	5.58	0.625	2.524	6.37
K_{50}		0.637	2.408	6.11	0.743	3.121	7.21
Relative variation %		+15.93	+10.53	+9.49	+18.88	+23.64	+13.19
Do		0.173	0.593	2.03	0.1995	0.632	2.41
Increase over Do	D1	127.5	198.1	125.2	131.38	192.9	159.3
	D2	177.7	243	135.7	177.7	243	171.8
	D3	224.7	275.4	155.2	225.9	339.4	179.3
	D4	266.5	309.9	165.7	271.1	368.6	188.8
	D5	314.8	334.5	171.7	316.4	416.4	193.8
	D6	348.2	357.5	172.2	335.6	441	198.3

N, P and K uptake by wheat plant:

1- Nitrogen uptake:

Data in Table (5) showed that N-uptake by grains were increased by about 22.89 % and 56.48 % for Giza 168 and Sids7, by increasing N up to 120 kg/fed. Also N-uptake by grains increased 15.32 % and 25.97 % for the two studied varieties by application of 50 kg K_2O/fed. Similar results were reported by Koch and Mengel (1977). The highest relative increment 486.41 % and 537.9 % for the two studied varieties were obtained under D6 (24:60:18:18) kg N/fed. However N-uptake by grain yield of wheat variety

Sids7 pronounced N-uptake by grain yield of wheat variety Giza 168. These results were supported by El Sherbieny *et al* (1999) and Staggenborg *et al*. (2003)

Data in Table (5) indicated that N-uptake by straw yield increased by about 41.55 % and 33.32 % for the two studied varieties by increasing N up to 120 kg/fed. Also N-uptake by straw increased by about 12.96 % and 15.5 % for the two studied varieties by application 50 kg K_2O/fed the highest relative increment was 213 % for Giza 168 under D5 (24:50:23:23) kg N/fed and 226 % for Sids7 under D6 (24:60:18:18) kg N/fed. Similar results were reported by Kanani (1996). However N-uptake by straw yield of Sids7 pronounced N-uptake by straw yield of Giza 168 by 9.44%.

Data revealed that N-uptake by wheat plants at tillering stage increased by about 90.4 % and 90.0% over control N_{75} for the two studied varieties by increasing N from 75 to 120 kg N/fed. Also N-uptake increased by about 19.36 % and 21.73 % for the two studied varieties by applying 50 kg K_2O/fed. The highest relative increments were 507.24 % and 510.5 % for the two studied varieties under D6 (24:60) kg N/fed. These results supported by Kanani (1996).

Data pointed out that N-uptake at booting stage was increased 38.5 % and 44.92 % for the two studied varieties by increasing N up to 120 kg/fed. Also N-uptake at booting stage was increased 12.76 % 17.75 % for the two studied varieties by applying 50 kg K_2O/fed. The highest relative increment 470.88 % and 510.5 % for the two studied varieties by applying 60 kg N/fed at tillering. However N-uptake by wheat variety Sids7 pronounced Giza 168 by 19.41%. Similar results were reported by Rahman *et al* (2002).

Table (5). Effect of N, K and timing of N application on N uptake (Kg/fed) of Giza 168 and Sids 7 (The mean values over two seasons).

Treatments		N uptake					
		Tillering		Booting		Maturity	
		G168	Sids7	G168	Sids7	G168	Sids7
N75		17.6	20.5	31.2	36.24	51.9	57.3
N120		33.5	38.7	50.7	61.58	57.5	86.5
+ %		+90.4	+90.0	+62.7	+69.0	64.4	89.7
Ko		23.3	26.7	38.5	44.92	55.3	62.9
K50		27.8	32.5	43.4	52.89	63.4	77.7
+ %		+19.4	+21.7	+12.7	+17.7	28.3	41.5
Do		5.38	6.19	8.55	8.34	13.2	14.1
Increment over Do	D1	216	220	267	295	569	657
	D2	281	283	322	364	577	692
	D3	348	352	365	618	653	691
	D4	406	417	407	512	682	738
	D5	463	484	442	608	699	748
	D6	507	511	471	641	698	764

- Phosphorus uptake:

Table (6) indicated that increasing N up to 120 kg N/fed increased P uptake by the studied wheat varieties at maturity stage 28.9 % and 51.95 % for the two studied varieties. Also P-uptake at maturity was increased 19.82 % and 20.0 % for the two studied varieties by applying 50 kg K_2O/fed. .The highest relative increments were 322.03 and 358.38 % for the two studied varieties by applying 50 kg N/fed. at tillering stage. While P-uptake by wheat variety Sids7 pronounced Giza 168 by 11 %. These results supported by Shams El Din (1989)

Data revealed that P-uptake by wheat plants at tillering stage increased 74.68 % and 72.38% for the two studied varieties by increased N from 75 to 120 kg N/fed. Also P-uptake at tillering stage increased 21.96 and 22.3 % for the two studied varieties by applying 50 kg K_2O/fed. The highest relative increments were 519.2 % and 487.03 % for the two studied varieties by applying 60 kg N/fed. in tillering stage. These results were supported by El-Sherbieny *et al* (1999)

Table (6) showed that P-uptake by wheat plants at booting stage was increased 66.46 % and 90.16 % for the two studied varieties by increased N from 75 to 120 kg N/fed. Also P-uptake was increased 21.03 % and 29.49 % for the two studied varieties by applying 50 kg K_2O/ fed. The highest relative increments were 483.7 and 576.13 % for the two studied varieties by applying 60 kg N/fed. in tillering stage. However P-uptake by Sids7 pronounced Giza 168 by 32.65%. These results were supported by Koreish *et al* (2004) and Amer (2009)

Table (6). Effect of N, K and timing of N application on P (Kg/fed) of Giza 168 and Sids 7 (The mean values over two seasons).

Treatments		P uptake					
		Tillering		Booting		Maturity	
		G 168	Sids7	G 168	Sids7	G 168	Sids7
N75		1.6	1.81	5.01	5.69	12.16	12.26
N120		2.8	3.12	8.34	10.82	15.67	18.63
+ %		+74.68	+72.38	+66.46	+90.16	+28.90	+51.95
Ko		1.98	2.22	6.04	7.19	12.66	14.04
K50		2.42	2.72	7.31	9.31	15.17	16.85
+ %		+21.96	+22.30	+21.03	+29.49	+19.82	+20.00
Do		0.47	0.54	1.41	1.51	3.54	3.46
Increment over Do	D1	206.38	198.15	267.38	251.65	244.63	323.12
	D2	272.34	264.81	324.11	325.17	267.79	336.99
	D3	340.42	342.60	365.25	455.6	305.68	347.68
	D4	414.89	396.30	409.92	499.3	311.86	356.06
	D5	470.21	464.81	446.1	554.30	322.03	358.38
	D6	519.15	487.03	483.7	576.13	309.03	355.78

3-Potassium uptake:

Table (7) pointed out that k-uptake by wheat yield was increased by about 35.32 % and 39.03 % for the two studied varieties, by increasing N from 75 to 120 kg/fed. Also K-uptake increased 15.68 % and 26.82 % for the

two studied varieties with applying 50 kg K_2O/fed. The highest increment was 247.39 % for Giza 168 by adding 50 kg N/fed and 234.62 % for Sids7 by applying 60 kg N/fed. at tillering stage. However K-uptake by wheat varieties. Sids7 pronounced Giza 168 by 3.23 %. These results were supported by El Yamany (1994) and El Sherbieny *et al* (1999).

Table (7) showed that k-uptake by wheat at tillering stage increased 64.5 % and 61.86 % for the two studied varieties by increasing N from 75 to 120 kg/fed. K-uptake increased by about 20.45 % 21.41 % for the two studied varieties by applying 50 kg K_2O/fed. The highest increments were 438.47 % and 469.96 % for the two studied varieties by applying 60 kg N/fed. at tillering . K-uptake by wheat plants at booting stage was increased 73.41 % and 69.15 % for the two studied varieties by increasing N from 75 to 120 kg/fed. Also K-uptake increased 30.52 % and 27.8 % for the two studied varieties by applying 50 kg K_2O/fed. However K-uptake by Sids7 pronounced Giza 168by19.64 %. These results were supported by El Beyali *et al*. (2000).

Table (7). Effect of N, K and timing of N application on K uptake (Kg/fed) of Giza 168 and Sids 7 (The mean values over two seasons).

Treatments		K uptake					
		Tillering		Booting		Maturity	
		G 168	Sids7	G 168	Sids7	G 168	Sids7
N75		16.99	19.43	28.12	34.2	54.43	55.32
N120		27.96	31.45	48.76	57.80	73.66	76.91
+ %		+64.6	+61.9	+73.4	+69.2	+35.3	+39.0
Ko		20.39	22.98	33.35	40.4	59.39	58.30
K50		24.56	27.90	43.53	51.6	68.70	73.93
+ %		+20.5	+21.4	+30.5	+27.8	+15.5	+26.8
Do		5.38	6.18	9.22	9.82	19.52	20.62
Increment over Do	D1	179.93	154.41	234.59	217.	199.9	204.4
	D2	240.33	233.82	283.84	275	209.58	211.2
	D3	296.84	292.88	317.68	372	224.89	218.6
	D4	345.72	237.06	353.1	435.	242.78	225.
	D5	406.69	401.29	381	468.0	247.39	229.8
	D6	438.47	424.59	404.89	470	244.42	234.6

- N-recovery:

Table (8) pointed out that N-recovery at tillering stage increased 91.95 % and 77.31 % for the two studied varieties by increasing N from75 to 120 kg/fed. Also N recovery by the two wheat varieties increased 27.99 % and 24.64 % for the two studied varieties by applying 50 kg K_2O/fed. However the N recovery was decreased by increasing N doses at tillering stage, where recorded highest value under D1. These results supported by Nankova (1985)

Data showed that N-recovery of wheat varieties at booting stage increased 32.98 % and 33.28 for the two studied varieties by increasing N up to 120 kg/fed. Also, N-recovery at booting stage increased 17.7 % and 26.15 % for the two studied varieties by applying 50 kg K_2O/fed. However N-recovery of

Sids7 pronounced Giza 168by 26.43 %.These results were supported by Karlen and Sadler (1990).

Table (8) indicated that N-recovery of wheat variety Giza 168 at maturity stage was decreased by (-13.28 %) with increasing N to 120 kg/fed, while N-recovery of Sids7 was increased by 12.69 % with increasing N to 120 kg/fed., N-recovery of wheat variety at maturity was increased 21.92 % and 26.92 % for the two studied varieties with applying 50 kg K_2O/fed. The highest N-recovery was recorded under D5 (50 kg N/fed) for Giza 168 and D6 (60 kg N/fed.) at tillering for Sids7, N-recovery of wheat variety Sids7 (56.9 %) pronounced Giza 168 (47.97 %) by 18.69 %. These results were supported by Blankenau *et al*. (2000).and Amer (2009).

Table (8). Effect of N, K and timing of N application on the recovery percentage of N by Giza 168 and Sids 7 at different growth stages (the values over mean two seasons).

Treatments		Giza 168			Sids 7		
		Tillering	Booting	Maturity	Tillering	Booting	Maturity
N-levels	75	26.97	35.69	51.35	33.62	45.07	53.50
	120	51.77	47.46	44.35	59.55	60.07	60.29
Relative variation %	%	+91.95	+33	-13.28	+77.1	+33.3	+12.69
K-levels	0	34.54	38.19	43.21	41.48	46.49	50.14
	50	44.21	44.95	52.68	51.70	58.65	63.64
Relative variation%	%	+27.99	+17.7	+21.9	+24.6	+26.2	+26.9
N-Doses	D1	54.83	36.47	39.11	67.5	41.78	51.68
	D2	37.34	39.05	42.82	43.35	44.69	52.69
	D3	36.86	41.66	47.79	42.89	54.57	54.92
	D4	35.94	42.83	52.60	42.33	57.07	58.70
	D5	36.16	44.48	52.69	42.05	60.24	59.69
	D6	34.76	44.92	52.62	41.40	59.12	61.22

N-use efficiency of the two wheat varieties:

Table (9) revealed that N-use efficiency (NUE) of wheat variety Giza 168 decreased about 28.23 % with increasing N from 75 to 120 kg N/fed. while NUE of wheat variety Sids7 increased by about 3.93 % with increasing N from 75 to N120 kg/fed. Also, NUE was increased by 18.21 % and 19.24 % for the two studied varieties by applying 50 kg K2O/fed. The highest mean value of NUE (23.04 kg grain/kg N) was recorded under D5 (50 kg N/fed) for wheat variety Giza 168, and (27.1kg grain/Kg) and under D6 (60 kg N/fed) at tillering for wheat variety Sids7. However, NUE of wheat variety Sids7 pronounced Giza 168 by 20.39 %. These results supported by Amer (2009).

Table (9). Nitrogen use efficiency of Giza 168 and Sids 7 as effected by N, K and timing of N application (the mean values over two seasons)

Treatments		Giza 168	Sids 7
N-levels	75	23.59	23.91
	120	16.91	24.85
Relative variation %		-28.23	+3.93
K-levels	0	18.56	22.24
	50	21.94	26.52
Relative variation %		+18.21	+19.24
N-Doses	D_1	14.69	20.93
	D_2	16.87	22.62
	D_3	21.39	23.86
	D_4	22.65	25.14
	D_5	23.04	26.0
	D_6	22.86	27.1

-The crude protein content of wheat:

Data in Table (10) pointed that the crude protein content in grains of the two wheat varieties were increased by about 12.47 % and 16.2 % by increasing N from 75 to 120 kg/fed. and was increased by 5.48 and 7.06 % by applying 50 kg K_2O/fed. These results supported by Amer (2009).

Table (10). The crude protein content (%) in grains of two wheat varieties Giza168 and Sids7 (the mean values over two seasons).

Treatments		Giza 168	Sids 7
N-levels	75	11.47	11.25
	120	12.90	13.08
Relative variation %	%	+12.47	+16.27
K-levels	0	11.86	11.75
	50	12.51	12.58
Relative variation %	%	+5.48	+7.06
N-Doses	D_0	6.99	7.49
	D_1	12.39	12.37
	D_2	12.32	12.28
	D_3	12.15	12.15
	D_4	12.1	12.13
	D_5	12.07	12.01
	D_6	12.05	12.03

Thus it can be concluded that

It is recommended to apply 120 kg N/fed. as 24, 60, 18 and 18 at planting, tillering, booting and milking stages, respectively as well as applications of 50 kg K_2O/fed. and 22 kg P_2O_5/fed. before planting. to obtain the maximum values of N-use efficienency, N-recovery, NPK-uptake, crude protein content % and yield for the studied wheat varieties Giza 168 and Sids7 under North Middle Delta conditions.

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تأثير إضافة التسميد الأزوتى والبوتاسى وميعاد الإضافة على محصول وامتصاص بعض العناصر لنبات القمح في شمال وسط الدلتا

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تم إجراء تجربة حقلية بمزرعة كلية الزراعة بكفر الشيخ خلال موسمى٢٠٠٢/٢٠٠٣،٢٠٠٣/ ٢٠٠٤حيث كان الهدف هو دراسة تأثير إضافة الأزوت في مرحلة التفريع وكذلك التسميد البوتاسى على محصول القمح وامتصاص بعض العناصر ،وقد لخصت النتائج المتحصل عليها فيما يلي:

تشير النتائج إلى أن معدلات إضافة النيتروجين ذات تأثير معنوي حتى مستوى ١٢٠ كجم نيتروجين / فدان لكل من الصنفين تحت الدراسة وكانت أعلى قيمة للمحصول (متوسط الموسمين) سجل الصنف جيزة ١٦٨ ٢١.٩١ إردب /فدان،وسدس ٧ (٣٠.٠أردب/فدان) تم الحصول عليها بإضافة ١٢٠كجم نيتروجين للفدان مقسمة كالتالي(٢٤ : ٦٠: ١٨:١٨) كجم نيتروجين للفدان أثناء مراحل (البذرة-التفريع –الحمل-النضج اللبني) وكذلك بإضافة ٥٠ كجم (بو٢ أ)، ٢٢كجم (فو٢أ٥) مع الزراعة .

توضح النتائج أن معدلات إضافة النيتروجين لها تأثير معنوي على قش القمح حتى معدل ١٢٠ كجم نيتروجين /فدان حيث سجل الصنف جيزة ١٦٨ ٥.١٩ طن/فدان،سدس٧ ٦ طن /فدان، متوسط الموسمين تم الحصول عليها بإضافة ١٢٠كجم نيتروجين/فدان (٢٤ :٦٠ :١٨ :١٨) مقسمة على أربع دفعات أثناء (الزراعة-التفريع-الحمل-النضج البني)،مع إضافة ٥٠كجم (بو٢ أ) ، ٢٢كجم (فو ٢أ٥) مع الزراعة .

تشير النتائج إلى زيادة المادة الجافة في مرحلة التفريع والحمل والنضج لكل من الصنفين جيزة١٦٨، سدس٧ بينما تفوق صنف سدس٧ على جيزة ١٦٨.

تشير النتائج إلى زيادة امتصاص النيتروجين والفوسفور والبوتاسيوم لأصناف القمح تحت الدراسة مع زيادة التسميد الآزوتي والبوتاسي ،وقد تم الحصول عليها بإضافة ١٢٠كجم نيتروجين/فدان مقسمة على أربع دفعات (٢٤ :٦٠ :١٨ :١٨) أثناء الزراعة : التفريع :الحمل: طور النضج اللبني، مع إضافة ٥٠كجم (بو٢ أ)، ٢٢ كجم (فو ٢أ٥).

»تبين زيادة النيتروجين المستعاد مع تزايد إضافة النيتروجين من٧٥ الى١٢٠ كجم نيتروجين/فدان ولوحظت أعلى القيم في مرحلة التفريع ثم مرحلة الحمل وأخيرا مرحلة النضج. وتبين تفوق الصنف سدس ٧ (١٨.٦٩%) على صنف جيزة ١٦٨

» تبين النتائج زيادة كفاءة استخدام النيتروجين مع إضافة البوتاسيوم (١٨.٢١%،١٩.٢٤%) لكل من الصنفين جيزة١٦٨، سدس٧ بالترتيب مقارنة بدون إضافة.

» تبين من النتائج زيادة محتوى الحبوب من البروتين بنسبة (١٢.٤٧%،١٦.٢%) مع تزايد إضافة النيتروجين من٧٥ الى١٢٠ كجم نيتروجين /فدان لكل من الصنفين جيزة١٦٨، سدس٧ بالترتيب.

توضح النتائج زيادة محتوى الحبوب من البروتين بنسبة (٥.٤٨%،٧.٠٦%) لكل من الصنفين جيزة١٦٨، سدس٧ بالترتيب مع إضافة ٥٠كجم بو٢أ /فدان .

للحصول على أعلى محصول مع أعلى كفاءة استخدام للنيتروجين المضاف،والنيتروجين المستعاد،والنيتروجين والفوسفور والبوتاسيوم الممتص وكذلك محتوى الحبوب من البروتين لأصناف القمح جيزة١٦٨،و سدس ٧ في منطقة شمال الدلتا يمكن التوصية بإضافة ١٢٠كجم نيتروجين/فدان بمعدلات: (٢٤:٦٠:١٨:١٨) خلال مراحل النمو: مع الزراعة-التفريع-الحمل-النضج اللبني على الترتيب علاوة على إضافة ٥٠كجم بو٢أ /فدان ، ٢٢كجم فو٢أ٥ /فدان مع الخدمة قبل الزراعة.

قام بتحكيم البحث

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