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EFFECT OF SPLITTING NITROGEN FERTILIZATION ON BREAD WHEAT PRODUCTIVITY

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ABSTRACT

Two field experiments were conducted in 2002/2003 and 2003/2004 growing seasons at Sakha Agric. Res. Sta. ARC, to study the effect of four N splitting treatments on the productivity of four promising wheat cultivars Gemmiza9 ,Gemmiza10 ,Sakha94 and Giza168 . The form of nitrogen as ammonium nitrate (33.5% N) was applied in four treatments as follows:

N_I : 3 splits compressing 20 % at sowing, 40% before the first irrigation and 40% before the second one (the recommended method).

N_{II} : 2 splits containing 25 % before the first irrigation and 75% before the second one.

N_{III} : 4 splits including 20% at sowing and 30%,30% and 20% which applied before; the first, second and third irrigations, respectively,

N_{IV} :3 splits including 25% , 50% and 25% of the N fertilizer whereas applied before; the first, second and third irrigations , respectively

The results showed that, Cultivars were significantly differed in most of the studied characters that Gemmiza9 was the latest cultivar in heading and maturity dates .It produced heavier grain weight / spike and recorded the greatest1000-grain weight and the highest grain and biological yield / fad. Gemmiza10 was the shortest cultivar, earlier in heading and maturity and recorded greater number of grains / spike and producing lower biological yield. Sakha94 was the tallest cultivar and the earliest in maturity. Giza168 cultivar recorded the lowest 1000_grain weight and grain yield / fad. The best method for splitting N fertilizer was recorded by NI treatment which also recommended by the scientific institutions .Splitting N fertilizer into three splits including 20 % of the applied fertilizer at sowing ,40% applied before the first irrigation and 40% applied before the second irrigation positively affected grain yield of wheat.

All studied characters were not significantly affected by the interaction between cultivars and methods of splitting N fertilizers. Application of N fertilizer of wheat preferably as a top dressing between tillering ,40% and stem elongation 40% is a strategy to be recommended method from the stand point both of environment and of farmer returns

INTRODUCTION

Wheat is the main cereal crop in Egypt. It is used as a stable food grain for urban and rural societies and as a major source of straw for animal feeding. On the other hand, wheat provides a major source of energy, protein and dietary fiber in human nutration.

The policy of the country aims to improve wheat production to meet the increasing demand of the local consumption which is about 12 million tons per year wherease still a gab between the national production and

consumption estimated about 40%. Reducing this gab may be possible via increasing wheat cultivated areas (horizontal expression) and/or vertical expression by enhancing the yield per unit area. Crop management i.e. different cultural practices especially nitrogen fertilization as well as amount and time of application play an important role in determining and improving wheat growth and yield. Nitrogen is one of the most important elements in the nutrition of wheat plant, an essential part of all amino acids protein and related compounds. Also, it is a constituent of chlorophyll and carboxylating coenzymes.

Many investigators found marked differences in plant height at 90 days from sowing , number of green leaves/plant , dry weight/plant, flag leaf area , number of spikes / m^2 ,number of grains / spike, grain weight / spike, 1000_grain weight ,grain yield / fad and grain protein% (Darwiche, 1994). Hifnawy (1993) evaluated three bread wheat cultivars (Sakha 69, Giza163 and Giza164) in El-Minia governorate and found that Giza164 was superior in plant height ,number of spike lets / spike, number of kernels/spike, spike length, spike kernel weight, 1000-kernel weight and grain yield/ fad., whereas Giza163 was superior in number of tillers / m^2 and crude protein % in grains. On the other hand ,Sakha69 was the earliest cultivar in heading date. Salem (1999)compared the productivity of three bread wheat cultivars i.e., Sakha 8, Sakha 69 and Sahel 1 and found that Sahel1 produced the tallest plants whereas Sakha69 produced longer spikes and Sakha 8 was superior in number of spikes/m^2, number of kernels/ spikes, 1000-kernel weight, leaf area index, grain yield/fad harvest index, water use efficiency and N use efficiency.

Method and date of N application to wheat were studied by many research workers Hussein *et al* (1984) found that splitting N fertilizer increased the response of wheat yield and plant height to N. Saunders (1985) showed that split N application demonstrated a clear yield advantage over one basal application. Abdel-Aleem (1987) studied the effect of splitting N application and found that splitting N fertilizer equally at seeding and first irrigation increased leaf area duration ,plant height and number of spikelets / spike .Application half N at seeding and the other half at second or third irrigation resulted in higher number of grains / spike , number of spikes / m2 and grain protein content . He found also that splitting N into two equal doses at the first and second irrigations produced the highest grain weight / spike and grain yield / fad. He added that the application of all N at the first irrigation increased 1000-grain weight and delayed heading and maturity dates . Abdl-Aleem *et al* (1990) reported that, splitting N in two equal doses at the first and the second irrigations produced the highest grain yield in upper Egypt. Dhuka *et al* (1991) found that splitting N application as 50% basal + 25% at 21 days + 25% at 35-40 days after sowing gave the highest grain yield.. Zewdie *et al* (1991) noticed that early application of N either all at sowing or split applied between sowing and mid - tillering resulted highest grain yield increments and also significantly increased plant height .Also Melaj *et al* (2003) found that when applied N at tillering it was increased grain yield and the number of gains/m^2 and decreased 1000-grain weight. Alcoz *et al* (1993), and Abdin *et al* (1996) reported that applying N fertilizer in splitted

doses has been demonstrated to affect the N use and uptake efficiencies in wheat. Darwiche (1994) applied in four different treatments : once at sowing ,once at tillering, in 2 equal doses at sowing and at the first irrigation and in 3equal splits at sowing ,at the second and at the third irrigations . He found that flag leaf area, spike length , number of spikelets/ spike, number of grains / spike , grain yield and protein % in grains were significantly affected by methods of N application . Almost 2 or 3 N splits positively affected of growth characters and grain yield components . The highest grain yield / fad was obtained when N was applied once at tillering stage. Geleto *et al* (1995-a) reported that, grain yield of wheat was higher with split application of N . Also Geleto *et al* (1995-b) found that split application of N was most effective for increasing grain yield and 1000_ kernel weight. Moshref and Abdel-Mottaleb (1998) found that, non splitting nitrogen treatment gave the earliest heading date and the highest K and crude proteins% in grains .They reported that the recommend treatment (3 equal splits of N at sowing , at the first and at the second irrigations) produced the highest grain yield as well as straw yield . On the other hand, 2or 3 splits of N increased 1000_kernel weight .

El-Desoky and El-Far (1999) found that wheat receiving 2 splits of N at 3 weeks from sowing and at stem elongation or 3 splits at 3 weeks from sowing , stem elongation and at heading produced the greatest straw and grain yields and highest efficiency to use N in grain production .They also added that, plant height , spike length , number of spikes / m2 ,1000 - grain weight, grain and straw yields, and grain protein % were significantly affected by splitting treatments . the highest values were recorded by applying N in two equal splits after 3 weeks from sowing and at stem elongation. El-desoky *et al* (2000) applied 100 Kg N/fad to Giza165 bread wheat cultivars and Sohag3 durum wheat either in one full dose or in 2,3 or 4 splits at 3 weeks from sowing ,stem elongation , heading or at milk ripe stages .They found that 3 splits of N after 3 weeks from sowing ,stem elongation and heading or 2 split of N at 3 weeks and at stem elongation produced the greatest grain and straw yields and the highest efficiencies to use N for grain production and to accumulate N in straw and grain. Luis L'opez-Bellido *et al* (2005) reported that single rate of 150 Kg N ha^{-1} was used and different fractions being applied at sowing ,tillering and stem elongation. They found mean wheat ranged from 14.1% when applied at sowing to 54.8% when applied as a top dressing at the beginning of stem elongation when used N fertilizer. The mean annual contribution of soil residual N and mineralization was 152 Kg N ha^{-1} , representing a considerable proportion of total wheat N uptake ,ranged from 83.2% when N fertilizer was applied in the fall to 49.4 % when it was applied at stem elongation. The present study was conducted to determine the effect of N splitting for wheat cultivars Gemmeza 9, Gemmeza 10, Sakha 94 and Giza 168.

MATERIALS AND METHODS

Tow field experiments were conducted in two successive seasons 2002/2003 and 2003/2004 at Sakha Agric. Res. Sta ., ARC , to study the effect of four nitrogen fertilizer splitting treatments on Gemmeza 9, Gemmeza 10, Sakha 94 and Giza168 breed wheat cultivars. The recommended N rate

(75 Kg N / fad)in the form of ammonium nitrate (33.5 % N) was applied in four splitting treatments as follows :

N_I : fertilizer was applied in 3 splits 20 % at sowing, 40% before the first irrigation and 40% before the second one (A recommended dose of wheat Res. Sec.).

N_{II} : fertilizer was applied in 2 splits containing 25 % as the first splits before the first irrigation and 75% as the second splits applied before the third irrigation.

N_{III} : fertilizer was applied in 4 splits 20% at sowing ,30% before the first irrigation, 30% before the second irrigation and 20% before and the third irrigation

N_{IV} : fertilizer was applied in 3 splits 25 % before the first irrigation, 50% before the second irrigation and 25% before the third irrigation

(*) **Mechanical and chemical analysis of the experimental soil in the two seasons**

year	Mechanical characters			pH	Available macronutrients		
	Clay %	Slit %	Sand %		N	P	K
2002/03	50.15	26.30	22.59	8.1	24.00	8.38	475.6
2003/04	49.95	24..91	24.91	7.9	34.00	9.70	432.5

Sowing wheat was done on 27 Nov. 2002/2003 in the first season and on 3 Dec. 2003/2004 in the second one .Wheat was irrigated five times the 1st. irrigation was followed after 3 weeks after sowing irrigation and following irrigation were scheduled at one month intervals .

The experiment was laid out in a split plot design with 3 replications .The 4 N splitting treatments were the main plots and wheat genotypes in the split plots.

The sub plot area was 4.5 m^2 containing 10 rows , 15 cm apart giving a width of 1.5 m and the rows were 3.0 m long. All subplots were harvested on the second and the sixth of June in the two seasons respectively .

The studied traits were :

1-plant height (cm) as the average of 5 guarded plants .
2-Number of days from sowing to 50% of plants reached to heading of plot.
3- number of days from sowing to 50 % maturity per sub plot.
4- number of spikes / m^2.
5- number of grains per spike.
6-Grain weight per spike (g).
7- weight of 1000 grains (g)
8- biological yield as ton / fad , on whole plot basis
9-Grain yield as ardab / fad , on whole plot basis.

The normal cultural practices of growing wheat in the region were followed. Statistical analysis of the date of the two seasons was performed according to Gomez and Gomez (1984). LSD test was used to compare the difference among means.

RESULTS AND DISCUSSION

1-Plant height :

Results in (Table 1) showed the effect of N splitting treatments on plant height of the 4 tested cultivars in 2002 /03 and 2003/04 seasons

Table (1): Plant height (cm) of wheat as affected by cultivars and N splitting in the two growing seasons 2002/2003 and 2003/2004

Var	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	106.34	118.01	114.01	120.67	114.76	101.91	110.01	107.17	115.34	108.61
Gemmiza10	94.34	105.01	103.67	105.67	102.17	95.67	89.01	99.51	93.34	95.01
Sakha 94	113.01	118.34	118.01	120.67	117.51	101.01	107.94	101.77	110.34	105.27
Giza 168	99.67	111.34	109.67	111.67	108.09	92.07	103.84	110.57	111.17	104.41
Mean(M)	103.34	113.18	111.34	114.67	110.63	97.67	102.70	104.76	106.17	103.32
	LSD	N	V	NV		LSD	N	V	NV	
	5%	5.68	3.00	_		5%	6.76	5.5	_	

The four cultivars showed significant differences in plant height in both two growing seasons. In the first season Sakha94 was the tallest cultivar and significantly surpassed Gemmiza10 . It could be concluded that Sakha94 and Gemmiza9 were taller than Giza168 and Gemmiza10 .Also Gemmiza10 was the shortest wheat cultivar.

The present results indicated the genetical differences in the tested cultivars .Results reported by Darwiche (1994),Hifnawy (1993), and Salem (1999) showed marked differences among the evaluated wheat cultivars grown in Egypt.

The effect of splitting N fertilizer on plant height was significant in both two growing seasons. The tallest plant in both seasons were produced using (N4) by applying N in three splits before the 1st , 2nd and 3rd irrigations at 25 , 50% , 25%, respectively. This treatment surpassed significantly. (N1) in the first and second seasons by 10.97 and 10.76% , respectively . The differences between (N4) , N2 and N3 treatments not reached to the level of significant. It could be concluded that the splitting N fertilizer in 3 splits applied as 25, 50 and 25% of the N fertilizer before the first three irrigations was positively enhanced wheat growth. This method is also considered as the recommended practice. Result obtained by Hussin *et al* (1984) ,Abdel-Aleem (1987), Zewdie *et al* (1991) and Darwiche (1994) showed also that plant height of wheat was markedly affected by splitting N fertilizer. The results in Table (1) showed that, plant height of wheat was not significantly affected by the interaction between cultivars and method of N application .

2- Number of days to 50% heading :

Results in Table (2) showed that, the cultivars differed significantly in heading date in both two growing seasons . Gemmeza9 was the latest cultivar in heading date compared with the 3 other cultivars with significant differences in both seasons The three other cultivars showed no any significant difference among of them in this trait .Heading was reached after

101.42 days by Gemmiza9 in the first season which was later by 2.91, 3.08 and 2.66 days compared with Gemmeza10,Sakha 94 and Giza168,respectively, Similarly , in the second season Gemmiza9 reached heading later than Gemmiza10 Sakha94 and Giza168 by 3.75 , 4.08 and 3.75 days, respectively.

Table (2): number of days to 50% heading of wheat as affected by cultivars and N splitting in the two growing seasons 2002/03 and 2003/04

var.\ nit.	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	101.01	99.67	102.67	102.34	101.42	98.34	97.67	100.01	100.01	99.01
Gemmiza10	98.01	98.01	99.67	98.34	98.51	96.01	94.34	96.01	94.67	95.26
Sakha 94	98.67	98.67	98.34	97.67	98.34	94.67	94.01	96.01	95.01	94.93
Giza 168	97.67	98.01	99.67	99.67	98.76	94.67	95.67	95.67	95.01	95.26
M	98.84	98.59	100.09	99.51	99.26	95.92	95.42	96.93	96.18	96.11
	LSD	N2	V	NV		LSD	N2	V	NV	
	5%	-	1.64	-		5%	-	1.64	-	

It could be concluded that, Gemmiza9 was the latest cultivar in heading showing different genetical make up in this trait compared with the other studied cultivars. The obtained result by Hifnawy (1993) indicated marked differences in heading date between wheat cultivars .

The results in Table (2) showed that, method of splitting N fertilizer had no significant effect on 50% heading in both two seasons. The present result is not in agreement with those obtained by Abdel-Aleem (1987), Moshref and Abdel-Mottaleb (1998) and Melaj *et al* (2003) who found that, time of applying N fertilizer and splitting N had significant effect on heading date of wheat . While, the present results were in agreement which whose obtained by Eman Sadek (1990) who found that, time of nitrogen application had no significant affection on number of days to heading.

The results in Table (2) showed also that, the interaction between cultivars and method of splitting N fertilizer did not significantly influences of heading date in both seasons indicating that both factors independently acted in affecting this trait

3- Number of days to 50% maturity:

The results in Table (3) showed that, wheat cultivars different in their maturity date in both two growing seasons .Sakha 94 was the earliest cultivar in maturity this cultivar matured earlier than the two cultivars Gemmeiza 9 and Giza 168. On the other hand, no significant differences were detected between Gemmeiza 10 and Sakha 94 in the first season. This cultivar matured earlier than the three other cultivars Gemmiza 9, Gemmiza10 and Giza168 by 2.70, 3.42 and 2.34 days in the first season respectively. ,corresponding to 6.66, 7.42, and 2.25 days in the second season compared with the other three cultivars .All differences in both seasons were significant. On the other hand, Gemmeza 9 was the latest cultivar in maturity .It matured later than Gemmeza10 , Sakha94 and Giza168 by 2.97, 3.42 and 2.33 days in the first season , respectively ,being 0.76,7.41 and 2.25 days later than the

3 respective cultivars in the second season .All differences were significant except that between Gemmeza 9 and Gemmiza10 in the second season.
The present result indicates marked differences among the evaluated cultivars due to the differences in their genetical constitution . Similar results were also reported by Hifnawy (1993).

Table (3): Number of days to 50% maturity of wheat affected by cultivars and N splitting in the growing seasons 2002/03 and 2003/04

var. \ nit.	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	152.34	150.67	152.01	152.01	151.76	146.67	147.67	148.01	149.01	147.84
Gemmiza10	150.24	149.34	148.67	148.01	149.06	145.34	148.01	146.34	149.01	147.18
Sakha 94	149.34	148.34	148.01	147.67	148.34	141.34	139.34	141.67	139.34	140.42
Giza 168	151.01	148.67	149.34	148.67	149.42	146.67	145.01	145.34	145.34	145.59
M	150.73	149.26	149.51	149.09	146.65	145.01	145.01	145.34	145.68	145.26
	LSD	N	V	NV		LSD	N	V	NV	
	5%	0.86	0.73	-		5%	-	1.64	-	

The results in Table (3) showed also that, method of splitting N significantly affected of maturity date only in the first season . Applying N fertilizer in three splits, 20% at sowing and 40% before the first irrigation (at 21 days age) and 40% before the second irrigation (51 days age) delayed maturity by 1.47 ,1.22 and 1.64 days compared with NI , NII and NIII respectively it could be concluded that, splitting N fertilizer in 3 doses as 20 , 40 , 40% applied at sowing and befor the first and the second irrigations extended the growing season of wheat by 1.22 – 1.64 days compared with the other methods. It is worth noting that, this method is recommended by the scientific institutions. The results reported by Abdel-Aleem (1987) , Moshref and Abd_El-Mottaleb (1998), and Melaj *et al* (2003) showed that N splitting affected heading and maturity dates of wheat. While, in the second season the results obtained showed that number of days to maturity was not significantly influenced by time of nitrogen application and this is agreement with the data obtained by Eman Sadek (1990).
The results in Table (3) showed also that, no significant effect was dedicated on maturity date due to the interaction between cultivar and method of splitting N fertilizer in both seasons.

4-Number of spikes / m² :

Results in Table (4) showed that the four evaluated wheat cultivars did not differ significantly in number of spikes/ m² in both seasons. The present result indicate that These cultivars are nearly similar in their tillering potentiality .The results were not in agreement with those reported by Darwiche (1994), Hifnawy (1993) and Salem (1999) who found marked differences among wheat genotypes in spikes numbers/m²

The results cleared also in this trait was not significantly affected by method of splitting N fertilizer in both seasons agreement with those obtained by Luis Lopez-Bellido *et al* (2005) The results obtained by Abdel-Aleem (1987) and El- Desoky and El-Far(1999) indicated that, number of spikes/ m² was significantly influenced by time and method of splitting N fertilizer.

Table (4) : Number of spikes / m² of wheat as affected by cultivars and N splitting ,in the two growing seasons 2002/03 and 2003/04.

var. \ nit.	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	399.33	347.62	365.21	445.59	389.42	458.73	410.32	363.03	385.01	404.27
Gemmiza10	502.72	400.42	366.33	345.41	403.72	424.61	441.11	503.81	383.92	438.36
Sakha 94	368.51	431.21	367.42	397.72	376.22	520.31	378.41	514.83	490.61	476.04
Giza 168	346.53	386.13	382.83	399.82	377.33	542.32	422.43	454.31	421.31	460.09
M	404.27	391.35	370.45	380.62	386.67	486.49	413.07	459.00	420.21	444.69
	LSD	N2	V	NV		LSD	N2	V	NV	
	5%	–	–	–		5%	–	–	–	

Also the interaction between cultivars and methods of N application did not affected significantly for this character in both seasons.

5-Nnumber of grains per spike :

The results in Table (5) showed that number of grains / spike showed significant differences among the tested cultivars in the second season. In that season Gemmeza10 cultivar produces greater number of grains compared with the other cultivars . The differences between Gemmeze10 and each of Gemmeza9 and Giza168 in this character reached the level of significant. Results reported by Darwiche (1994), Hilnaway (1993) and Salem (1999) indicated that there were significant differences among bread wheat cultivars in number of grains / spike.

Table (5); Number of grains per spikes of wheat as affected by cultivars and N splitting in the two growing seasons (2002/03 and 2003/04).

var. \ nit.	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	65.66	62.27	56.35	58.87	60.78	54.73	50.87	55.47	55.73	54.20
Gemmiza10	56.53	63.2	61.67	59.67	60.27	60.33	59.53	64.27	58.60	60.68
Sakha 94	64.27	63.67	62.07	59.73	62.43	57.73	60.00	58.60	53.86	57.55
Giza 166	60.60	60.47	60.80	52.20	58.52	60.60	60.47	55.20	51.73	57.00
M	61.77	62.4	60.22	57.62	60.5	58.35	57.72	58.38	54.98	57.36
	LSD	N2	V	NV		LSD	N2	V	NV	
	5%	–	–	–		5%	–	18.40	–	

The result cleared that methods of N splitting had no significant effect on number of grains /spike in both seasons. It seems that this character is greatly affected by the genetical make up of wheat cultivars and is not markedly influenced by environmental factors. The present result is not in agreement with those reported by Abdel-Aleem (1987) and Darwiche (1994) and Melja *et al* (2003) who found significant effect of method of splitting N fertilizer on number of grains / spike.

The effect of interaction between cultivars and method of N application was not significant on this character in both seasons (Table, 5). On the other hand, Luis-Bellido *et al* (2005) reported that methods of N splitting had no significant effect on seeds head .

6- Grain weight per spike:

Results in Table (6) showed that, grain weight / spike of the four cultivars showed significantly differed in both seasons . In 2002/03 season Gemmiza9 produced heavier grain weight / spike and exceeded Gemmiza10, Sakha94 and Giza168 by 1.39, 5.80 and 15.41% , respectively . The only significant differences were detected between Giza168 and each of Gemmiza9 and Gimmeza10.

In 2003/2004 season ,Sakha94 produced heavier grain weight / spike and was higher than Gemmiza9 Gemmiza10 and Giza168 by 6.67, 10.77 and 17.07 % respectively In this season ,significant differences were between Sakha94 and both Giza168 and Gemmiza 10 .

Table (6) : Grain weight / spike (g) of wheat as affected by cultivars and N splitting in the two growing seasons 2002/03 and 2003/04

var. \ nit.	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	3.08	2.60	2.91	3.11	2.92	2.73	2.67	2.87	2.53	2.70
Gemmiza10	2.71	2.93	2.90	3.00	2.88	2.47	2.53	2.79	2.60	2.60
Sakha 94	2.73	2.58	2.76	2.97	2.76	2.80	3.00	3.07	2.67	2.88
Giza 168	2.57	2.41	2.53	2.62	2.53	2.40	2.53	2.43	2.47	2.46
M	2.77	2.63	2.77	2.93	2.78	2.60	2.68	2.79	2.57	2.66
	LSD 5%	N2 -	V 1.20	NV -		LSD 5%	N2 -	V 1.36	NV -	

It could be concluded that, Giza168 was inferior in weight of grains/spike compared with three other cultivars . The present result is mainly due to the significant differences in the genetic constitution of the tested cultivars .Similar results were also reported by Hifnawy (1993) and Darwiche (1994).

The results showed that, N splitting treatments had no significant effected grain weight / spike in both seasons. Also, the present result did not agree with those obtained by Abdel-Aleem (1987) and Melaj *et al* (2003)which they found that, splitting N treatments significantly affected grain weight /spike.

The result showed also that, the interaction between cultivars and method of N splitting did not significantly affected in grain weight / spike.

7-Weight of 1000 grains (g):

Results in Table (7) showed that, the four cultivars varied significantly in 1000 grain weight in both seasons Gemmiza 9 recorded the greatest weight and significantly surpassed Gemmiza10 Sakha 94 and Giza168 by 8.26, 7.74 and 12.37 % in the first season, respectively. and by 10.82,18.25 and 23.64 % in the second one compared with the three respective cultivars . On the other hand ,Giza 168 recorded the lowest grain index, which was lower than Gimmiza9, Gemmiza10 and Sakha 94 by 12.37, 3.79 and 4.30 % respectively in the first season being 23.64 , 11.57 and 4.55 % lower compared with the three respective cultivars in the second one . It could be concluded that Gemmiza9 was superior in grain index and Giza168

was inferior one ,whereas Gemmiza10 and Sakha94 were in-between . The result showed marked differences among the evaluated cultivars indicating differences in their genetical make up .Similar results were also obtained by Hifnawi(1993) and Darwiche (1994) and Salem (1999). Also,the results in Table (7) showed no significant differences among the four different treatments of N splitting on grain index in both two growing seasons. However, treatment NI in which N fertilizer was applied in three splits (20,40 and 40%) applied at sowing irrigation, before the first and second irrigations produced higher 1000 grain wheat but without significant differences compared with the three other treatments. Similar results was obtained by Luis L'opez-Bellido et al (2005). The present results were not in agreement with those reported by Abdel-Aleem (1987), and El_Desoky and El-Far (1999) and Melaj *et al* (2003) who found significant effect of method of splitting N fertilizer on 1000 grain weight.

The effect of the interaction between cultivars and N splitting treatments was not significant on grain index in both two growing seasons.

Table (7) : Weight of 1000 kernels (g) of wheat as affected by cultivars and N splitting in the two growing seasons 2002/03 and 2003/04

	2002/2003					2003/2004				
var. \ nit.	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	46.41	45.41	49.01	46.34	46.79	51.21	50.41	48.61	48.54	49.69
Gemmiza10	45.94	40.67	39.34	46.94	43.22	45.61	46.01	43.54	44.21	44.84
Sakha 94	44.01	39.54	46.14	44.01	43.43	42.67	41.94	41.21	42.27	42.02
Giza 168	44.07	38.94	41.41	42.14	41.64	41.34	40.21	39.54	39.67	40.19
M	45.11	41.14	43.98	44.86	43.77	45.21	44.64	43.23	43.67	44.19
	LSD	N2	V	NV		LSD	N2	V	NV	
	5%	-	2.69	-		5%	-	1.65	-	

8- Biological yield :

The results in Table (8) showed that, the tested cultivars were significantly different in biological yield / fad. In both two growing seasons. Gemmiza 9 significantly out yielded than the other three cultivars in biological yield / fad. in both two growing seasons worthy to note that the rest cultivars Gemmiza10,Sakha94,and Giza168 did not show any significant difference in their biological yields/fad.in both seasons .In 2002/03 season, Gemmiza 9 out yield significantly than Gemmiza 10, Sakha 94, Giza 168 by 19.80, 21.69 and 25.06 % respectively .In 2003/04 the increasing in biological yield/fad. were 27.29, 25.72 and 25.20 % compared with Gemmiza10 Sakha 94 and Giza 168, respectively.

It could be concluded that Gemmiza9 was superior in biological yield compared with the other studied cultivars which were of about a similar yielding potentiality. The results indicate differences among cultivars in their productivity as confirmed by many investigations (Hifnawy, 1993 and Darwiche 1994).

Table (8): Biological yield (t/fad) of wheat as affected by cultivars and N splitting in the two growing seasons 2002/2003 and 2003/2004

var. \ nit.	2002/2003					2003/2004				
	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	12.67	14.91	16.31	17.57	15.37	11.17	12.27	13.11	12.34	12.22
Gemmiza10	11.11	13.57	12.61	14.01	12.83	8.71	9.74	10.57	9.37	9.60
Sakha 94	11.11	12.94	12.67	13.81	12.63	9.51	9.64	10.21	9.51	9.72
Giza 168	9.81	14.34	12.44	12.57	12.29	8.67	9.71	10.07	10.57	9.76
M	11.18	13.94	13.51	14.49	13.28	9.52	10.34	10.99	10.45	10.32
	LSD	N2	V	NV		LSD	N2	V	NV	
	5%	1.26	1.04	-		5%	0.85	0.51	-	

The results showed significant effect of methods of N splitting on biological yield in the two growing seasons.

The result indicated the superiority of N_{III} treatment which N fertilizer was splitted in four splits as 20% at sowing 30% ,30% and 20% at the first , second and third irrigations, respectively compared with the other studied treatments , the increasing of biological yield was 15.44% compared with NI treatment and reached to the level of significance. The results obtained by Saunders(1985),Abd-el-Aleem (1987), Abd-el-Aleem *et al* (1990), Dhuka *et al* (1991), Zewdie *et al* (1991), Darwiche (1994), Geleto *et al* (1995.b) and Moshref and Abdel-Mottaleb (1998) showed that, wheat yield was affected by time and method of N application.

The interaction between cultivars and methods of N splitting on biological yield was not significant in both two growing seasons

9-Grain yield:

Results in Table (9) showed that, the evaluated wheat cultivars were significantly differed in grain yield/fad. In the two growing seasons . In the first season (2002/03) Gemmiza 9 and Gemmiza 10 produced the similar yield which was significantly higher than that obtained by Sakha94 and Giza168 by 5.22 and 13.23 %, respectively. Also in the first season Sakha 94 significantly out yielded Giza 168 by 7.61 %. In the second season (2003/2004) season, Gemmiza 9 produced the highest grain yield/fad which was with significant differences compared with the other three cultivars. Also, significant differences were detected between the rest three cultivars.

It could be concluded that Gemmiza9 cultivar was the best cultivar in Sakha region as well as grain yield is concerned. The results reported by Hifnawy (1993) Darwiche (1994) and Salem (1999) showed marked differences in The results in Table (9) indicated that, N splitting treatments were significantly affected on grain yield/fad. In the first season only whearese, treatment NI was significantly out yielded than the three other treatments N_{II} ,N_{III} and N_{IV} by 17.62, 4.55 and 3.25 % respectively . In N_I treatment ,the N fertilizer is splitted as 20,40 and 40% of the fertilizer at sowing irrigation, before the first and second irrigations, respectively. It is worth mentioning that, this method is recommended by the scientific institution (Wheat Research Section) . In this method 20% of N is applied at

sowing to enhance seed germination and emergence ,40% of N is applied before the first irrigation which is undertaken after 21 days during start of tillering stage where the meristemic activity of plants is at its maximum ,and 40 % of the N fertilizer is applied before the second irrigation followed one month later (at 51 days age) at the end of tillering stage and start of the stem elongation where plants are great need to N.

Table (9): grain yield of wheat (ardab/fad.) as affected by cultivars and N splitting in the two growing seasons 2002/03 and 2003/04

	2002/2003					2003/2004				
var. \ nit.	N1	N2	N3	N4	M	N1	N2	N3	N4	M
Gemmiza 9	28.98	25.61	28.21	28.36	27.79	26.06	24.98	25.11	24.03	25.05
Gemmiza10	29.45	25.20	27.53	29.14	27.83	23.82	23.62	23.35	22.12	23.23
Sakha 94	27.94	24.21	26.08	27.48	26.43	25.18	23.21	25.11	23.75	24.31
Giza 168	26.60	21.00	26.23	24.42	24.56	25.04	24.64	23.75	25.04	24.62
M	28.24	24.01	27.01	27.35	26.65	25.03	24.11	24.33	23.74	24.30
	LSD	N2	V	NV		LSD	N2	V	NV	
	5%	0.35	0.26	-		5%	-	0.14	-	

In the second season (2003/2004 season) , although no significant effect was detected for N splitting ,treatment NI was the best treatment recording the greatest grain yield/fad. But the difference were no reach to the level of significance. It could be conducted that, the recommended method proved its superiority compared with the other methods . This treatment recorded the highest values of number of spikes/m2 and extended number of days to maturity and increased number of grains / spike and grain index. The results reported by Hussein *et al* (1984) Saunders (1985), Abd-el-Aleem(1987) ,Abd-el-Aleem *et al* (1990), Dhuka *et al* (1991), Geleto *at al* (1995.a) El-Desoky and El-Far(1999), Melaj *et al* (2003) and Luis L'opez-Bellido *et al* (2005) showed that splitting treatments significantly influenced on grain yield.

The results showed no significant effect of the cultivars X N splitting on grain yield in both studied seasons indicating that, each factor acted independently in affecting of grain yield.

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تأثير تجزئة سماد النيتروجين على إنتاجية قمح الخبز

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أقيمت تجربتان حقليتان فـي محطـة البحـوث الزراعيـة بـسخا خـلال الموسـمين ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/ ٢٠٠٤ لدراسة تأثير أربعة معاملات لتجزئة النيتروجين وأثر ذلك على إنتاجية أربعة أصناف جديدة من قمح الخبز وهى جميزة٩ و جميزة١٠ و سخا٩٤ وجيـزة١٦٨ وذلك باستخدام السماد الآزوتى نترات الأمونيوم(٣٣,٥ %) وطبقت المعاملات كما يلى:

١. تجزئة السماد الآزوتى الى ثلاث أجزاء (٢٠% عند الزراعة و ٤٠% قبل الريه الأولى و ٤٠% قبل الرية الثانية (وهى المعاملة الموصى بها من قبل البرنامج القومى لبحوث القمح)
٢. تجزئة السماد الآزوتى الى جزأين وتتكون من (٢٥% قبل الرية الأولـى و٧٥% قبـل الرية الثانية)
٣. تجزئة السماد الآزوتى الى أربعة أجزاء (٢٠% عند الزراعة و ٣٠% و٣٠% و ٢٠% أضيفت قبل الرية الأولى والثانية و الثالثة بالترتيب.
٤. تجزئة السماد الآزوتى الى ثلاث أجزاء ٢٥%و٥٠%و٢٥% حيث أضيفت قبل الريـة الأولى والثانية و الثالثة بالترتيب.

- أوضحت النتائج أن :الأصناف اختلفت معنويا فى معظم الصفات المدروسة فالصنف جميـزة ٩ متأخر فى طرد السنابل و النضج ، أنتج أخف وزن حبوب / سنبلة وسجل أعلـى وزن ١٠٠٠ حبة وأعلى محصول حبوب وأعلى محصول بيولوجى / فدان. الصنف جميزة ١٠ كان أقصر الأصناف وأبكر صنف فى طرد السنابل و النضج وسجل أعلى عدد حبوب / سنبلة وأنتج أقل محصول بيولوجى. الصنف سخا ٩٤ كان أطول الأصناف والأبكر فى النضج. الصنف جيـزة ١٦٨ سجل أقل وزن ١٠٠٠ حبة وأقل محصول حبوب / فدان (لموسم واحد)
- أكدت نتائج البحث أن الطريقة المثلى لتجزئة السماد النيتروجيني هى المعاملة رقـم ١ و هـى الطريقة التى يوصى بها من قبل قسم بحوث القمح حيث تتضمن تجزئة السماد النيتروجيني إلى ثلاث أجزاء هى اضافة ٢٠% عند الزراعة ،٤٠% قبل الرية الأولى ،٤٠% قبل الرية الثانيـة حيث أعطت هذه الطريقة مردودا ايجابيا على محصول حبوب القمح .
- لم يكن للتفاعل بين الأصناف وطرق تجزئة السماد النيتروجيني أى تأثيرا معنويا علـى جميـع الصفات المدروسة.
- إضافة السماد النيتروجيني كان أفضل كثيرا عند إضافته فى الفترة ما بين التفريع (٤٠% ن) ،و الاستطالة للساق (٤٠% ن) و هذه الطريقة يوصى بها إستراتيجيا كأعلى حدية عائد للفـلاح و البيئة معا حيث أن هذه الفترة من عمر نبات القمح هى فترة التفريع التى هى أساس عدد السنابل فى المتر المربع. ومن المعروف أن صفة عدد السنابل فى المتر المربع أهم مكون من مكونات المحصول الرئيسية.