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PERFORMANCE AND STABILITY OF SOME PROMISING WHEAT LINES UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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ABSTRACT

Fourty seven bread wheat promising lines were evaluated for mean performance and stability of earliness, grain yield / plant and grain protein content in F_6 and F_7 generations along with the three check cultivars, i.e., Sakha 8, Sakha 69 and Sids 1 under two sowing dates (11 Nov. and 12 Dec.) and three N-fertilization levels, i.e., 50, 75, and 100 kg N/fed . during 1996 / 97 and 1997/ 98 growing seasons . Two field experiments were carried out the first was devoted to normal sowing date and the second for late sowing. The experimental design was a split-plot design with four replications. N-levels and genotypes were randomly arranged in main and split-plots, respectively. Single and combined analysis of variance was achieved for data obtained in each season. Phenotypic stability was computed according to Eberhart and Russell (1966).

The results confirmed the existence of considerable variation among wheat genotypes and their performance, significantly affected by the changes in sowing dates and N-fertilization levels and the interaction between them for the studied traits. Delaying sowing date significantly decreased grain yield /plant in both seasons and grain protein content in first season only and caused delaying heading date. On the other hand, increasing N-levels from 50 to 75 kg N/fed. increased grain yield / plant while increasing N-levels up to 100 kg N/fed. significantly increased grain protein content. However, no significant effect was found for N-fertilization levels on heading date in both seasons except at late sowing in the 2nd season which caused significant earliness in heading under the level of 75 kg/fed. Results revealed, in general that 75 kg N/fed. was enough for obtaining high grain yield, with sowing wheat plants in the second week of November. Overall treatments, the lines No's 2,3,4 and 12 were the earliest in heading by 20 to 29.60 days than the check cvs. Moreover, the lines No's 47,46, 10 and 36 had highest grain yield/plant and surpassed the check cvs. by about 1.9 to 12.8g. Results of phenotypic stability indicated that the two intermediate heading genotypes, i.e. the line No. 13 and the check cv. Sakha 69 were the most stable for this character, while the two high yielding lines No. 36 and No. 46 were considered the most desirable and stable ones for grain yield/plant. Meanwhile all genotypes except the lines No's 8, 10, 19, 36 and the check cv. Sakha 69 were stable for grain protein content.

Key words: ***Wheat, Sowing dates, N-fertilization, Phenotypic stability.***

INTRODUCTION

Wheat is one of the most important cereal crops in terms of area and production. It is a stable food for more than one third (about 2000 million) of the worlds population. Egypt's total wheat production of grains in1997/1998 season reached about 6 million tons[1] resulted from about 2.4 million faddans, while the consumption of wheat grains is about 10 million tons. Therefore, increasing production per unit area together with the horizontal increase in cultivated area, especially in new reclaimed land, appears to be a possible solution for reducing the gap between wheat production and consumption. One of the main breeding objectives is to breed cultivars that mature early and yield more grains and protein. Also improving yield stability of wheat cultivars is an important objective. Moreover, improving the cultural practices and treatments of the available varieties or lines are necessary to step up their yield to its maximum. Planting promising varieties in a proper date with applying the optimum nitrogen fertilizer level are among the most important factors affecting the productivity of wheat plants. Siviori (1975) observed a delay of 3-days in flowering of wheat by 15 days delay in sowing date. On the other hand, Kheiralla and Sherif (1992), Ismail (1995), Khalifa *et al* (1998) and Ahmed (1999) revealed that No. of days to heading tended to decrease by delaying sowing date. Furthermore, Girothia *et al* (1987), Abd El-Shafi *et al* (1999), Ahmed (1999) and Hassan and Gaballa (1999) reported that maximum grain yield was obtained when wheat plants were sown in the optimum sowing date (first half of Nov.), while variable reduction in grain yield (varied from 13.5% to 33.26%) have been observed owing to delaying sowing date to the end of Nov. or to Dec. However, Parihar and Tripathi (1989) and Said *et al* (1999) revealed that grain protein percentage increased when plants were grown in the optimum sowing date through Nov.

Literature concerned with the response of wheat genotypes to N-fertilization showed that the grain yield increased linearly with increasing the N-level but the optimum rate for obtaining the top yield widely differed, where it was 75 kg N/fed. (Hussein *et al* 1981), 80 kg N/fed. (Abd El-Gawad *et al* 1979 and Shams El-Din and El-Habbak 1992), 100 kg N/fed. (El-Nagar 1997) and 125 kg N/fed. (El-Gareib *et al* 1998). The variation in the optimum N-rate might be due to various associate edaphic and climatic factors as well as variety. Furthermore, increasing N-levels increased number of days to heading in wheat (Dorgham 1991, Sayar *et al* 1992 and Kataria and Bassi 1997) and grain protein content (Singh 1971, Hussein *et al* 1981, Sayar *et al* 1992 and Said *et al* 1999).

The major objectives of this work were: 1- Studying performance of 47 promising bread wheat lines compared with the three commercial

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[1] Central Administration for Agricultural Economics,
General Administration for Agricultural Statistics, Egypt, 1998.

cultivars, Sakha 8, Sakha 69 and Sids1 under two sowing dates and 3 N-fertilization levels. 2- Estimating Stability parameter of genotypes for different studied traits. 3- Determining the best lines, which can be used as useful genetic sources in wheat breeding programmes.

MATERIALS AND METHODS

Two field experiments were conducted in 1996/97 and 1997/98 seasons at the Agric. Res. Stat. of Fac. of Agric., Ain Shams Univ., at Shalakan, Kalubia Governorate, Egypt to evaluate performance and stability of some promising bread wheat lines under different sowing dates and nitrogen fertilization levels. Each experiment was devoted to sowing date in every season.

The physical and chemical analyses of soil of the experimental site showed that the soil is clay in texture pH ranges from 6.81 to 7.84, EC ranges from 0.4 to 1.12 dsm^{-1} and total N ranges from 0.22 to 0.48%. The preceding crop was maize in both seasons. Monthly mean of minimum and maximum temperature degrees ($^{\circ}C$) in the experimental area during the two growing seasons are shown in Table (1).

The genetic materials used in both seasons consisted of 47 promising wheat lines derived from five bread wheat crosses following pedigree selection method in the Agron. Dept., Fac. of Agric., Ain Shams Univ. (Tolba 2000). The lines were evaluated in F_6 and F_7 in 1996/97 and 1997/98 seasons, respectively along with the three local cultivars Sids1, Sakha8 and Sakha 69.

The five crosses and their respective parents (pedigree), origin and code number of promising lines selected from each cross are presented in Table (2).

Two sowing dates,i.e, early and late were used in each season. The early date was on 11th November (normal or recommended date), while the late date was on 12th December (to represent heat stress). Three nitrogen levels were used, i.e., 50, 75 and 100 kg N/fed. Nitrogen was added in the form of ammonium nitrate (33.5% N). The amount of each rate was splited into two parts, the first part (2/3) was immediately applied before the first irrigation, while the second part (1/3) was applied before the second irrigation. The other normal cultural practices were followed as recommended for wheat production.

The experimental design was split plot design with four replicates. The three N-levels and the 50 wheat genotypes were distributed at random within the main and sub-plots, respectively. The experimental plot consisted of 2 rows, 20 cm apart and 3 m in length. Plants spaced at 10 cm within row and one plant was left per hill. During reproductive growth period, date of heading for every wheat genotype was recorded when 50% of the main stem spike of plants per plot were fully emerged from the sheath of flag leaf.

At harvest, random sample of 10 guarded plants from each plot were collected for recording data of grain yield /plant. Grain protein content was also determined for the best 10 yielding lines as well as the two check cultivars Sids1 and Sakha 69 by using micro Kjeldahal apparatus as described in the A.O.A.C. (1995).

Table 1. The average degrees of maximum and minimum temperature (°C) at Shalakan area during 1996/97 and 1997/98 growing seasons.

Season	1996/97		1997/98	
Month	Max. Temp.	Min. Temp.	Max. Temp.	Min. Temp.
Nov.	26.70	12.31	26.50	11.60
Dec.	21.30	7.95	20.40	7.70
Jan.	21.20	6.40	20.50	6.60
Feb.	20.50	5.10	21.90	9.00
Mar.	21.40	7.90	22.60	7.30
Apr.	25.70	9.90	30.00	11.30
May.	32.40	14.80	32.40	15.50

Table 2. Pedigree and origin and code No. of promising lines selected from each cross.

Cross	Pedigree and origin	Code No. of promising lines
1	MD689/B/Chere "S" (Mexico) × Giza 160 (Egypt)	1 –13
2	Bow "S"//YD "S" / ZZ "S" × Chat "S" (Mexico)	14-23
3	Giza 155 (Egypt) × MD689/B/Chere "S" (Mexico)	24-33
4	Giza 157 (Egypt) × Bow "S"//YD "S"/ZZ "S"(Mexico)	34-38
5	MD689/B/Chere "S" × KvZ//Con/Pj 62 (Mexico)	39-47

Statistical analysis for split plot design was separately carried out for each sowing date as well as combined analysis over both sowing dates in each growing season was performed according to Gomez and Gomez (1984). L.S.D was computed to compare differences among means of sowing dates, N-levels and genotypes and their interactions at 5% level. All factors used in this study were assumed as fixed factors. Phenotypic stability was analyzed for the studied traits in the best 12 wheat genotypes utilizing the method of Eberhart and Russell (1966) under 12 environments (2 sowing dates X 3 N-levels X 2 seasons.)

RESULTS AND DISCUSSION

A. Genotypes Performance

1.Heading date

Results in Table (3) reveal that heading date for 50 % of plants/plot was affected by sowing dates and genotypes in both seasons, whereas N-fertilization levels had no significant effect on this trait, except at late sowing in the 2nd season the effects of N-levels were significant. However, the significance of interaction between genotypes and sowing dates reflected the differential response of genotypes under the two sowing dates in both seasons. Unexpectedly, late sowing date caused delaying in heading dates by 6.3 days (6.61 %) in the 1st season and nearly lately by 1.6 days (1.77 %) in the 2nd season than early sowing dates (Tables 4 and 5). Genotypes were earlier in heading in the 2nd season than in the 1st season and delaying the heading dates in late sowing might be due to much low temperature degrees in Dec. (the average maximum degrees was 20.85^{0}C over the two seasons, comparing with 26.6 ^{0}C in Nov) causing delay in seedling emergence with slow growth during the early period of growth which resulted in delaying heading dates in late sowing. In this concern, Siviori (1975) observed a delay of 3-days in flowering of wheat by 15 days delay in sowing date, while Abd EL-Shafi *et al* (1999) found that days to heading was slightly affected by late planting date from 15 Nov. to 15 Dec.

As shown in Tables (4 and 5) N fertilization levels had no significant effect on number of days from sowing to heading except at late sowing date in the 2nd season where effects were significant. In this case, the most effective treatment was the N-level of 75 kg N/ fed. which caused significant earliness in heading date by 1.3

Table 3. Mean squares of combined analysis of variance over 2 sowing dates (D) and 3 N-levels (N) in 1996/97.

Source of variance	d.f		Heading date(day)	Grain yield /plant (g)	Protein percentage
			1996/97		
D	1	*(1)	11963.76**	8634.65**	21.04**
R(D)	6	(2)	74.86**	75.79**	0.16
N	2	(2)	64.51	971.20**	10.79**
DN	2	(2)	108.77	5.67	29.61**
Error	12	(4)	43.98	10.40	0.57
G	49	(11)	1954.83**	352.04**	2.37**
DG	49	(11)	185.51**	84.07**	3.34**
NG	98	(22)	9.82	29.120**	0.91
DNG	98	(22)	5.07	22.36**	1.94**
Error	882	(66)	8.57	8.27	0.69
			1997/98		
D	1	(1)	806.88**	6462.45**	1.56
R(D)	6	(2)	59.09	65.29*	0.94
N	2	(2)	4.27	349.45**	33.96**
DN	2	(2)	129.96	112.34*	3.15
Error	12	(4)	50.67	21.62	0.89
G	49	(11)	1190.4**	91.10**	2.48**
DG	49	(11)	28.12**	29.73**	2.57**
NG	98	(22)	7.39	15.22**	0.93
DNG	98	(22)	7.78	9.89*	0.99*
Error	882	(66)	9.49	7.67	0.55

*,** denote significant differences at 0.05 and 0.01 levels, respectively
Number between parenthesis are the degrees of freedom for protein percentage

days than the low level of 50 kg N / fed. Although the interaction of sowing date (D) x N-levels (N) x genotypes (G) was not significant. The low yielding lines No's 3,4 and 12 (Tables 6 and 7) appeared to be the most earliest in heading date among all genotypes and overall treatments in during both seasons as well as the line No.2 under the highest N-level at early sowing date in the 1st season and under all treatments in the 2nd season. Number of days to heading of the earliest lines, overall environments, ranged from 77.7 to 78.1 days in the 1st season and from 75 to 75.5 days in the 2nd season which reflected earliness by (24.8,29.6 days) and (20.4,24.2 days) than the check cvs., in both seasons, respectively. However, the high yielding line No. 36 was significantly later in heading than the above earliest lines, but was earlier than the other

Table 4. Response of heading date (days) of different wheat genotypes (G) to sowing dates and N-fertilization levels.

Genotype	D1*				D2				Combined			
	N1**	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Average
1	95.5	95.5	91.7	94.2	100.5	101.0	97.2	99.5	98.0	98.2	94.5	96.9
2	76.5	76.5	73.0	75.3	90.5	90.2	89.7	90.1	83.5	83.3	81.3	82.7
3	70.5	70.5	70.2	70.4	83.0	88.0	86.5	85.8	76.7	79.2	78.3	78.1
4	70.5	70.5	72.0	71.0	84.7	85.2	86.0	85.3	77.6	77.8	79.0	78.1
5	81.7	81.7	81.5	81.6	95.2	95.2	95.5	95.3	88.5	88.5	88.5	88.5
6	91.5	91.5	88.7	90.5	94.5	96.5	95.7	95.5	93.0	94.0	92.2	93.0
7	78.0	78.0	73.5	76.5	90.5	90.2	88.5	89.7	84.2	84.1	81.0	83.1
8	107.0	107.0	107.2	107.0	107.7	106.5	107.7	107.3	107.3	106.7	107.5	107.2
9	113.7	113.7	114.0	113.8	108.7	109.7	109.2	109.2	111.2	111.7	111.6	111.5
10	107.5	107.5	107.0	107.3	105.2	106.5	105.5	105.7	106.3	107.0	106.2	106.5
11	83.5	83.5	83.0	83.3	93.0	94.2	93.2	93.5	88.2	88.8	88.1	88.4
12	70.0	70.0	69.0	69.6	85.0	86.7	85.5	85.7	77.5	78.3	77.2	77.7
13	97.0	97.0	97.0	97.0	102.7	103.2	104.0	103.3	99.8	100.1	100.5	100.1
14	93.5	93.5	92.5	93.1	97.5	98.7	99.2	98.5	95.5	96.1	95.8	95.8
15	94.2	94.2	93.5	94.0	103.7	104.2	105.5	104.5	99.0	99.2	99.5	99.2
16	96.7	96.7	95.7	96.4	104.5	105.2	104.5	104.7	100.6	101.0	100.1	100.5
17	114.0	114.0	113.7	113.9	109.5	109.2	108.2	109.0	111.7	111.6	111.0	111.4
18	101.7	101.7	100.5	101.3	109.2	108.5	109.5	109.0	105.5	105.1	105.0	105.2
19	104.2	104.2	104.0	104.1	108.7	109.0	109.5	109.0	106.5	106.6	106.7	106.6
20	105.2	105.2	99.0	103.1	104.0	107.2	106.7	106.0	104.6	106.2	102.8	104.5
21	107.5	107.5	104.7	106.5	110.7	113.7	110.2	111.5	109.1	110.6	107.5	109.0
22	93.7	93.7	90.5	92.6	102.5	103.5	100.7	102.2	98.1	98.6	95.6	97.4
23	108.7	108.7	106.7	108.0	111.2	112.2	108.2	110.5	110.0	110.5	107.5	109.3
24	94.0	94.0	94.2	94.0	100.2	100.5	99.7	100.1	97.1	97.2	97.0	97.1
25	99.0	99.0	96.5	98.1	104.5	104.5	104.7	104.5	101.7	101.7	100.6	101.3
26	99.0	99.0	87.5	95.1	101.2	101.5	100.2	101.0	100.1	100.2	93.8	98.0
27	98.2	101.7	102.5	100.8	98.7	103.7	103.5	102.0	98.5	102.7	103.0	101.4
28	97.0	94.0	93.2	94.7	97.5	99.0	98.7	98.4	97.2	96.5	96.0	96.5
29	98.5	102.5	93.5	98.1	99.0	99.0	97.5	98.5	98.7	100.7	95.5	98.3
30	106.2	106.5	102.7	105.1	107.2	109.7	108.5	108.5	106.7	108.1	105.6	106.8
31	79.7	78.7	79.5	79.3	89.7	92.5	93.5	91.9	84.7	85.6	86.5	85.6
32	79.2	78.2	76.0	77.8	94.5	94.5	95.5	94.8	86.8	86.3	85.7	86.3
33	98.5	96.5	96.7	97.2	104.5	105.5	107.7	105.9	101.5	101.0	102.2	101.5
34	84.0	84.0	83.0	83.6	93.5	95.2	96.2	95.0	88.7	89.6	89.6	89.3
35	87.5	86.2	84.7	86.1	97.0	97.7	95.2	96.6	92.2	92.0	90.0	91.4
36	90.5	90.0	91.2	90.5	99.5	101.7	101.7	101.0	95.0	95.8	96.5	95.7
37	102.0	104.5	103.2	103.2	104.0	103.5	104.0	103.8	103.0	104.0	103.6	103.5
38	100.2	101.0	98.5	99.9	106.7	106.7	108.0	107.1	103.5	103.8	103.2	103.5
39	105.5	104.0	106.5	105.3	109.5	109.2	110.0	109.5	107.5	106.6	108.2	107.4
40	102.7	102.0	100.2	101.6	110.7	109.2	110.2	110.0	106.7	105.6	105.2	105.8
41	108.7	106.7	108.5	108.0	109.7	105.5	110.0	108.4	109.2	106.1	109.2	108.2
42	92.7	90.2	90.5	91.1	98.7	100.7	102.0	100.5	95.7	95.5	96.2	95.8
43	94.2	94.2	92.0	93.5	103.0	102.2	104.2	103.1	98.6	98.2	98.1	98.3
44	90.5	91.5	90.7	90.9	97.2	102.2	99.5	99.6	93.8	96.8	95.1	95.2
45	89.2	91.2	90.7	90.4	100.0	102.7	100.0	100.9	94.6	97.0	95.3	95.6
46	106.2	105.0	107.0	106.0	104.2	105.0	104.0	104.4	105.2	105.0	105.5	105.2
47	106.5	107.2	107.7	107.1	104.2	104.7	106.7	105.2	105.3	106.0	107.2	106.2
Sakha 8	109.7	109.0	109.0	109.2	105.0	107.0	107.0	106.3	107.3	108.0	108.0	107.7
Sakha 69	101.0	100.7	98.5	100.0	104.5	106.0	104.5	105.0	102.7	103.3	101.5	102.5
Sids 1	107.0	106.7	106.2	106.6	107.0	106.0	108.5	107.1	107.0	106.3	107.3	106.9
Average	95.8	95.7	94.4	95.3	101.1	102.0	101.7	101.6	98.4	98.8	98.0	98.47
L.S.D 5%												
D												0.83
N					ns				ns			ns
DN												ns
G	5.19	4.56	4.48	2.75	3.31	3.08	3.22	1.85	-	-	-	1.66
DG												2.34
NG					ns				ns			ns
DNG												ns

* D1 and D2 = 11 Nov. and 12 Dec., respectively.

** N1, N2 and N3 = 50,75 and 100 Kg N/ fed., respectively.

Table 5. Response of heading date (days) of different wheat genotypes *(G) to sowing dates* and N-fertilization levels

Genotype	D1*				D2				Combined			
	N1**	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Average
1	98.0	91.0	96.5	95.1	95.7	95.5	96.7	96.0	96.8	93.2	96.6	95.5
2	70.7	73.0	70.7	71.5	80.2	77.5	78.2	78.6	75.5	75.2	74.5	75.0
3	72.2	73.2	71.7	72.4	78.5	77.5	77.7	77.9	75.3	75.3	74.7	75.1
4	71.7	74.5	72.0	72.7	78.5	77.7	78.0	78.0	75.1	76.1	75.0	75.4
5	83.2	83.5	82.0	82.9	86.7	86.2	86.0	86.3	85.0	84.8	84.0	84.6
6	81.5	82.2	82.7	82.1	86.5	84.2	86.0	85.5	84.0	83.2	84.3	83.8
7	82.2	81.2	75.7	79.7	81.7	79.7	80.7	80.7	82.0	80.5	78.2	80.2
8	102.2	102.0	99.2	101.1	99.0	98.7	99.5	99.0	100.6	100.3	99.3	100.1
9	103.2	102.7	103.2	103.0	103.5	102.7	104.0	103.4	103.3	102.7	103.6	103.2
10	93.7	94.2	98.7	95.5	98.2	96.2	97.5	97.3	96.0	95.2	98.1	96.4
11	79.2	78.2	80.7	79.4	84.5	84.0	84.2	84.2	81.8	81.1	82.5	81.8
12	74.0	75.2	70.0	73.0	79.2	77.7	77.2	78.0	76.6	76.5	73.6	75.5
13	89.2	88.7	90.2	89.4	92.7	90.2	92.0	91.6	91.0	89.5	91.1	90.5
14	88.2	90.0	88.2	88.8	90.0	89.7	90.5	90.0	89.1	89.8	89.3	89.4
15	92.0	93.5	93.7	93.0	94.2	93.0	94.0	93.7	93.1	93.2	93.8	93.4
16	94.7	95.2	92.5	94.1	95.7	95.0	94.7	95.1	95.2	95.1	93.6	94.6
17	98.0	100.0	100.2	99.4	99.5	98.5	99.0	99.0	98.7	99.2	99.6	99.2
18	95.5	96.2	95.7	95.8	97.0	97.0	98.5	97.5	96.2	96.6	97.1	96.6
19	93.2	96.2	97.0	95.5	97.0	95.5	97.5	96.6	95.1	95.8	97.2	96.0
20	95.5	96.2	92.5	94.7	96.0	94.2	95.0	95.0	95.7	95.2	93.7	94.9
21	96.7	98.7	99.7	98.4	99.2	97.7	100.7	99.2	98.0	98.2	100.2	98.8
22	90.0	90.7	88.0	89.5	92.7	90.7	92.2	91.9	91.3	90.7	90.1	90.7
23	92.2	95.2	96.0	94.5	97.5	96.2	98.5	97.4	94.8	95.7	97.2	95.9
24	84.2	82.7	93.2	86.7	88.2	87.5	86.5	87.4	86.2	85.1	89.8	87.0
25	93.0	93.2	90.0	92.0	93.5	89.5	93.0	92.0	93.2	91.3	91.5	92.0
26	94.2	95.5	94.5	94.7	95.5	93.5	97.0	95.3	94.8	94.5	95.7	95.0
27	89.0	92.5	94.0	91.8	94.0	91.7	91.5	92.4	91.5	92.1	92.7	92.1
28	88.0	87.0	90.2	88.4	86.0	87.0	87.2	86.7	87.0	87.0	88.7	87.5
29	97.5	97.2	93.5	96.0	94.5	92.2	93.5	93.4	96.0	94.7	93.5	94.7
30	93.7	94.5	99.2	95.8	96.5	96.5	97.0	96.6	95.1	95.5	98.1	96.2
31	82.2	83.2	81.2	82.2	86.5	85.5	87.0	86.3	84.3	84.3	84.1	84.2
32	84.5	85.5	86.5	85.5	87.2	87.2	85.7	86.7	85.8	86.3	86.1	86.1
33	90.5	92.0	92.5	91.6	96.0	92.5	94.2	94.2	93.2	92.2	93.3	92.9
34	85.2	84.5	82.5	84.0	88.2	85.5	87.7	87.1	86.7	85.0	85.1	85.6
35	83.2	84.2	83.0	83.5	84.7	83.0	84.2	84.0	84.0	83.6	83.6	83.7
36	87.5	88.0	85.0	86.8	90.0	87.5	88.2	88.5	88.7	87.7	86.6	87.7
37	92.2	94.5	93.0	93.2	96.0	94.0	94.5	94.8	94.1	94.2	93.7	94.0
38	96.5	97.5	95.0	96.3	97.0	96.2	93.5	95.5	96.7	96.8	94.2	95.9
39	95.2	96.5	97.7	96.5	99.0	97.5	98.5	98.3	97.1	97.0	98.1	97.4
40	92.0	93.2	90.5	91.9	96.7	95.5	97.0	96.4	94.3	94.3	93.7	94.1
41	93.5	95.2	95.7	94.8	96.7	96.7	97.5	97.0	95.1	96.0	96.6	95.9
42	84.7	88.2	84.2	85.7	89.0	87.5	89.2	88.5	86.8	87.8	86.7	87.1
43	87.2	89.0	86.7	87.6	92.0	91.2	92.7	92.0	89.6	90.1	89.7	89.8
44	84.7	87.2	87.5	86.5	90.2	89.2	90.0	89.8	87.5	88.2	88.7	88.1
45	85.0	88.2	83.0	85.4	90.5	89.5	89.5	89.8	87.7	88.8	86.2	87.6
46	98.2	97.7	98.2	98.0	96.5	96.0	97.2	96.5	97.3	96.8	97.7	97.3
47	98.2	99.7	97.5	98.5	98.0	95.7	96.0	96.5	98.1	97.7	96.7	97.5
Sakha 8	97.7	98.5	98.2	98.1	97.5	97.2	97.7	97.5	97.6	97.8	98.0	97.8
Sakha 69	94.0	96.7	94.5	95.0	96.7	94.5	96.2	95.8	95.3	95.6	95.3	95.4
Sids 1	100.2	101.0	99.2	100.1	99.2	98.7	99.7	99.2	99.7	99.8	99.5	99.7
Average	89.8	90.7	90.0	90.2	92.4	91.1	92.0	91.8	91.1	90.9	91.0	91.03
L.S.D 5%												
D												0.89
N					ns			0.99				ns
DN												ns
G	6.62	6.34	2.75	3.19	2.16	2.35	2.48	1.38	-	-	-	1.74
DG												2.46
NG					ns			ns				ns
DNG												ns

* D1 and D2 = 11 Nov. and 12 Dec., respectively.
** N1, N2 and N3 = 50,75 and 100 Kg N/ fed, respectively.

high yielding lines No's 46,47 and 10 and the three check cvs. Sakha 8,Sakha 69 and Sids 1 by about 7 and 8 days in the 1^{st} and the 2^{nd} season, respectively. On the other hand, the low yielding line No. 9 came the most later in heading date than the other genotypes, which averaged, overall environments, 111.5 and 103.2 days in the two seasons, as well as the line No.17 in the 1^{st}, respectively. Reduction in grain yield of the late heading line may be due of densely vegetative growth expense to flowering. Other wheat genotypes behaved as intermediate in heading dates with significant differences among them.

2. Grain yield/plant

Results of analysis of variance presented in Table (3) revealed that grain yield/plant was significantly influenced by sowing dates, N-fertilization levels and wheat genotypes and the interaction between them in both seasons except for sowing date X nitrogen level interaction in first season.

Means of grain yield/plant for the genotypes sown at different dates under varying N-levels are recorded in Tables (6 and 7). The significance of interaction between genotypes and sowing dates illustrated the presence of genotypic differences in response to heat and other environmental factors associated to sowing dates. At early sowing in 11 Nov., genotypes produced the highest grain yield/plant, while at late sowing in 12 Dec. (heat stressed conditions) yield significantly reduced by 27.52 % and 31.24 % than that of early sowing in the1^{st} and 2^{nd} seasons, respectively. Several investigators as, Agarwal *et al* (1972), Kapur *et al* (1985), Kheiralla and Sherif (1992) and Abd EL-Shafi *et al* (1999) also obtained variant reduction in wheat grain yield when sowing date delayed from Nov. to first-half of Dec. However, the increases obtained in wheat yield at early sowing might be due to that environmental conditions during early sowing which seemed to be more suitable and favorable in the most growth periods and consequently plants might be more efficient in utilizing the growth factors (nutrients, water and light) which resulted in better growth with high yielding potential. On the other hand, the reduction in grain yield associated with delaying sowing date might be due to the wide changes in weather conditions between the two sowing dates especially rise in temperature during the late stage of plant growth (reproductive stage) in late sowing (Table 1) causing forced maturity of the crop which indirectly reduces yield by directly affecting on various yield contributors. Verma and Singh (1988) also reported similar views. Furthermore, Gupta *et al* (1970) concluded that yield increase of timely sown crop over late sown may be attributed to the

Table 6. Response of grain yield/plant (g) of different wheat genotypes (G) to sowing dates and N-fertilization levels

Genotype	D1*				D2				Combined			
	N1**	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Average
1	19.68	26.57	18.33	21.53	11.85	14.86	9.56	12.09	15.77	20.72	13.94	16.81
2	16.35	16.83	17.03	16.74	10.31	11.82	11.82	11.32	13.33	14.33	14.42	14.03
3	15.66	17.45	14.32	15.81	14.27	16.54	13.43	14.75	14.96	17.00	13.87	15.28
4	17.86	20.71	15.32	17.96	11.55	17.14	12.04	13.58	14.71	18.92	13.68	15.77
5	13.29	22.82	13.57	16.56	16.83	13.63	8.07	12.84	15.06	18.22	10.82	14.70
6	18.87	18.48	15.93	17.76	13.54	13.80	12.00	13.11	16.20	16.14	13.96	15.43
7	13.09	21.99	16.02	17.03	14.26	14.59	15.00	14.62	13.68	18.29	15.51	15.83
8	22.17	30.39	26.59	26.38	15.78	22.76	11.92	16.82	18.97	26.58	19.25	21.60
9	11.74	17.04	14.74	14.51	4.05	4.52	3.29	3.95	7.89	10.78	9.01	9.23
10	25.15	25.58	29.17	26.63	22.67	22.79	28.31	24.59	23.91	24.19	28.74	25.61
11	15.85	22.13	15.18	17.72	15.19	17.03	13.50	15.24	15.52	19.58	14.34	16.48
12	16.69	18.12	15.25	16.69	7.85	10.79	9.42	9.35	12.27	14.45	12.34	13.02
13	21.71	32.10	21.23	25.01	16.36	19.43	20.85	18.88	19.03	25.76	21.04	21.94
14	21.33	21.75	15.51	19.53	10.66	12.80	6.11	9.86	16.00	17.28	10.81	14.70
15	19.58	22.75	16.93	19.75	16.76	17.62	13.46	15.95	18.17	20.19	15.19	17.85
16	15.51	17.11	17.00	16.54	14.36	16.56	12.47	14.46	14.93	16.83	14.73	15.50
17	17.28	21.37	13.40	17.35	11.65	12.84	7.56	10.68	14.46	17.11	10.47	14.01
18	18.62	22.10	16.01	18.91	14.49	18.62	14.02	15.71	16.55	20.36	15.01	17.31
19	15.94	20.40	18.81	18.38	14.86	17.91	14.48	15.75	15.40	19.16	16.65	17.07
20	15.81	19.10	21.49	18.80	14.02	17.49	9.67	13.73	14.91	18.29	15.58	16.26
21	14.09	14.09	15.18	14.45	11.44	11.59	14.55	12.53	12.76	12.84	14.86	13.49
22	16.36	22.44	18.25	19.02	12.81	15.99	12.64	13.81	14.58	19.21	15.44	16.41
23	14.63	23.74	25.21	21.19	11.99	12.40	8.57	10.99	13.31	18.07	16.89	16.09
24	18.31	19.42	18.94	18.89	13.87	14.33	13.60	13.93	16.09	16.88	16.27	16.41
25	24.13	22.39	18.45	21.66	14.86	16.02	13.41	14.76	19.50	19.20	15.93	18.21
26	22.16	24.45	15.18	20.60	4.33	5.32	6.04	5.23	13.24	14.88	10.61	12.91
27	14.81	18.55	15.83	16.40	9.58	14.20	7.91	10.56	12.20	16.37	11.87	13.48
28	21.36	19.75	16.95	19.35	7.26	10.14	11.67	9.69	14.31	14.95	14.31	14.52
29	27.55	20.16	17.32	21.68	11.00	12.76	6.93	10.23	19.27	16.46	12.12	15.95
30	15.83	19.59	17.97	17.80	14.40	16.48	16.92	15.93	15.11	18.03	17.44	16.86
31	16.57	17.58	18.41	17.52	15.03	16.15	14.95	15.38	15.80	16.87	16.68	16.45
32	14.44	15.64	19.25	16.44	14.46	14.44	16.44	15.11	14.45	15.04	17.85	15.78
33	18.64	23.33	24.70	22.22	15.09	19.38	12.55	15.67	16.87	21.36	18.63	18.95
34	23.67	27.33	18.04	23.01	17.01	17.72	16.57	17.10	20.34	22.52	17.30	20.05
35	13.39	15.12	17.30	15.27	6.12	7.46	10.32	7.97	9.76	11.29	13.81	11.62
36	20.88	29.53	28.01	26.14	17.05	26.85	27.28	23.73	18.97	28.19	27.64	24.93
37	21.43	23.26	16.81	20.50	20.71	21.43	22.94	21.69	21.07	22.34	19.88	21.10
38	26.27	26.27	19.78	24.11	9.22	13.45	8.25	10.31	17.75	19.86	14.02	17.21
39	21.91	21.91	15.06	19.63	6.43	10.99	9.16	8.86	14.17	16.45	12.11	14.24
40	21.74	21.74	22.15	21.88	14.41	15.14	15.23	14.93	18.07	18.44	18.69	18.40
41	24.80	20.96	18.87	21.54	12.06	15.07	12.90	13.34	18.43	18.01	15.89	17.44
42	15.82	19.06	15.03	16.64	15.30	16.89	14.79	15.66	15.56	17.97	14.91	16.15
43	17.35	20.59	17.90	18.61	16.81	16.86	17.35	17.01	17.08	18.72	17.62	17.81
44	19.99	20.04	14.36	18.13	11.99	17.26	9.53	12.93	15.99	18.65	11.94	15.53
45	22.75	26.57	21.55	23.62	15.61	16.52	13.63	15.25	19.18	21.54	17.59	19.44
46	27.59	29.03	29.89	28.84	24.27	26.04	28.62	26.31	25.93	27.54	29.25	27.57
47	28.25	34.77	31.43	31.48	27.31	30.72	27.31	28.45	27.78	32.74	29.37	29.96
Sakha 8	17.44	18.23	19.25	18.31	14.11	17.79	11.20	14.37	15.78	18.01	15.23	16.34
sakha 69	17.54	18.87	23.92	20.11	12.52	18.41	15.67	15.53	15.03	18.64	19.80	17.82
Sids 1	20.63	27.95	20.71	23.10	15.35	23.16	17.59	18.70	17.99	25.55	19.15	20.90
Average	19.05	21.94	18.87	19.95	13.67	16.08	13.63	14.46	16.36	19.01	16.25	17.21
L.S.D. 5%												
D												0.40
N				0.69				0.88				0.49
DN												ns
G	3.95	4.64	4.03	2.43	3.62	3.78	3.80	2.16	-	-	-	1.63
DG												2.30
NG				4.22				3.37				2.82
DNG												3.98

* D1 and D2 = 11 Nov. and 12 dec., respectively.

** N1, N2 and N3 =50, 75 and 100 Kg N/ fed., respectively.

Table 7. **Response of grain yield/plant (g) of different wheat genotypes (G) to sowing dates and N-fertilization levels.**

Genotype	D1*				D2				Combined			
	N1**	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Average
1	13.65	17.80	11.73	14.39	10.60	11.27	6.86	9.57	12.13	14.53	9.29	11.98
2	9.90	12.53	10.85	11.09	6.90	10.75	10.19	9.28	8.40	11.64	10.52	10.19
3	10.50	11.98	7.66	10.05	6.77	11.81	5.80	8.13	8.64	11.89	6.73	9.09
4	9.23	11.33	9.76	10.11	7.11	10.93	9.55	9.20	8.17	11.13	9.65	9.65
5	14.18	15.99	12.02	14.06	8.66	9.00	8.02	8.56	11.42	12.49	10.02	11.31
6	12.12	12.16	10.28	11.52	10.81	10.23	6.75	9.26	11.46	11.20	8.51	10.39
7	15.27	16.05	20.58	17.30	10.33	10.60	8.02	9.65	12.80	13.32	14.30	13.47
8	16.47	19.30	17.99	17.92	8.94	10.62	9.13	9.56	12.70	14.96	13.56	13.74
9	17.98	12.29	16.79	15.69	6.99	7.86	8.33	7.73	12.48	10.07	12.56	11.70
10	19.29	19.91	22.91	20.70	11.29	13.03	10.38	11.57	15.29	16.47	16.64	16.13
11	15.55	15.35	15.71	15.54	9.57	11.73	6.77	9.36	12.56	13.54	11.24	12.45
12	12.59	16.68	17.17	15.48	11.46	11.49	8.03	10.32	12.02	14.08	12.60	12.90
13	12.91	20.97	15.41	16.43	9.03	10.65	8.89	9.52	10.97	15.81	12.15	12.98
14	12.35	13.12	20.32	15.26	10.65	9.86	7.15	9.22	11.50	11.49	13.73	12.24
15	19.55	15.74	15.56	16.95	11.38	12.40	11.43	11.74	15.46	14.07	13.49	14.34
16	14.69	18.31	14.48	15.83	9.30	9.43	8.35	9.03	11.99	13.87	11.41	12.42
17	10.29	16.80	12.84	13.31	6.48	7.18	8.19	7.28	8.38	11.99	10.51	10.29
18	12.48	13.51	13.01	13.00	12.24	12.66	11.47	12.12	12.36	13.08	12.24	12.56
19	17.51	16.46	10.85	14.94	11.45	14.46	9.76	11.89	14.48	15.46	10.30	13.41
20	17.02	13.02	18.93	16.32	9.63	10.50	10.93	10.35	13.32	11.76	14.93	13.34
21	12.05	14.34	14.22	13.54	8.08	9.15	7.73	8.32	10.06	11.74	10.98	10.93
22	11.20	14.15	12.55	12.63	11.33	11.65	10.66	11.21	11.27	12.90	11.61	11.93
23	11.00	14.01	13.34	12.78	10.67	11.95	7.43	10.02	10.83	12.98	10.38	11.40
24	9.03	13.74	11.36	11.38	7.47	9.67	8.53	8.56	8.25	11.70	9.94	9.96
25	14.24	15.79	11.15	13.73	12.03	12.29	7.30	10.54	13.14	14.04	9.23	12.14
26	12.71	16.59	17.80	15.70	9.22	9.28	7.30	8.60	10.96	12.93	12.55	12.15
27	15.45	16.08	16.40	15.98	8.70	11.08	11.28	10.35	12.07	13.58	13.84	13.16
28	16.00	16.63	14.41	15.68	12.27	12.97	6.10	10.45	14.13	14.80	10.25	13.06
29	15.56	18.59	17.02	17.06	7.12	10.99	5.30	7.80	11.34	14.79	11.16	12.43
30	12.49	17.50	17.12	15.70	7.99	12.33	10.40	10.24	10.24	14.91	13.76	12.97
31	14.30	14.57	17.58	15.48	10.13	10.52	8.58	9.74	12.22	12.54	13.08	12.61
32	11.79	16.28	15.88	14.65	10.01	11.78	9.00	10.26	10.90	14.03	12.44	12.46
33	16.79	19.69	14.78	17.09	13.40	13.75	9.25	12.13	15.10	16.72	12.02	14.61
34	15.76	17.62	16.02	16.47	12.49	13.41	10.93	12.28	14.13	15.52	13.47	14.37
35	11.96	12.03	14.11	12.70	11.05	11.14	9.27	10.49	11.51	11.58	11.69	11.59
36	14.37	19.53	17.25	17.05	13.38	13.84	10.37	12.53	13.87	16.69	13.81	14.79
37	10.44	14.16	13.34	12.65	9.58	13.43	9.75	10.92	10.01	13.79	11.54	11.78
38	18.11	20.30	14.78	17.73	10.97	11.08	7.62	9.89	14.54	15.69	11.20	13.81
39	16.05	16.75	16.03	16.28	6.17	9.59	7.64	7.80	11.11	13.17	11.83	12.04
40	12.01	12.18	16.13	13.44	9.08	9.83	11.05	9.99	10.54	11.01	13.59	11.71
41	13.86	16.84	15.15	15.28	11.70	12.90	8.59	11.06	12.78	14.87	11.87	13.17
42	11.59	11.73	9.48	10.93	4.54	7.77	8.77	7.03	8.07	9.75	9.13	8.98
43	7.79	12.85	11.87	10.84	6.83	7.18	9.65	7.89	7.31	10.01	10.76	9.36
44	11.90	12.88	11.11	11.96	8.54	8.67	11.05	9.42	10.22	10.77	11.08	10.69
45	10.14	12.03	14.34	12.17	9.30	9.73	10.30	9.78	9.72	10.88	12.32	10.97
46	15.93	19.80	20.64	18.79	13.83	16.48	15.02	15.11	14.88	18.14	17.83	16.95
47	19.04	20.84	19.15	19.68	16.40	17.18	11.98	15.19	17.72	19.01	15.56	17.43
Sakha 8	15.60	16.16	13.16	14.97	14.73	15.51	9.10	13.11	15.17	15.84	11.13	14.05
sakha 69	12.78	15.42	18.35	15.52	7.99	12.91	9.72	10.21	10.38	14.17	14.03	12.86
Sids 1	17.43	19.04	19.75	18.74	16.13	18.53	13.83	16.16	16.78	18.79	16.79	17.45
Average	13.82	15.75	14.98	14.86	10.01	11.46	9.15	10.21	11.92	13.60	12.07	12.53
L.S.D.5%												
D												0.59
N				1.12				1.15				0.72
DN												1.01
G	4.36	3.97	4.21	2.41	2.97	3.75	3.65	2.00	-	-	-	1.57
DG												2.22
NG				4.18				3.47				2.72
DNG												3.84

* D1 and D2 = 11 Nov. and 12 dec.. respectively.

** N1. N2 and N3 =50. 75 and 100 Kg N/ fed.. respectively.

better utilization of applied plant nutrients because of increase in photoperiodism.

The effects of N-fertilization levels (Tables 6 and 7) showed that grain yield/plant was significantly increased by applying 75 kg N/fed. comparing with the low level (50 kg N/fed.) and then declined with applying 100 kg N/fed. in the1st season. However, reduction in grain yield, with applying 100-kg N/fed. did not differ significantly from yield with applying 75 kg N/fed. in the 2nd season. The increments in grain yield due to applying 75 kg N/fed. over the lowest and highest N-levels were 13.94 and 14.51 % in the1st season and 12.35 and 11.25 % in the 2nd season, respectively. These results suggest that application of 75 kg N/fed. was enough to maximize the grain yield/plant for the most genotypes under the conditions of the experimental site. Overall treatments, genotypes averaged 17.21 and 12.53 in both seasons, respectively. However, the interaction between N-fertilization levels and sowing date was significant in the 1st season. Thus, the response of genotypes to N-levels was higher at early sowing rather than late sowing treatment for grain yield/plant. Also high yielding genotypes appeared to be more responsive to increase rates of N-fertilization than of the lowest yielding genotypes. Similar result was obtained by Nass *et al* (1976). Moreover, effects of sowing dates resulted in greater differences in grain yield/plant than for effect of N-fertilization in both seasons. The large magnitude of mean squares due to the interaction of sowing date with genotypes as compared with those due to the effects of interaction between N-levels and genotypes (Table 3) confirm the above result and illustrate the importance of climatic factors associated with sowing dates as temperature, rainfall, humidity .... etc. on grain yield rather than those associated with soil fertility on grain yield. It can be also inferred from the results that the reduction in yield due to delaying the sowing date did not compensated by applying extra amount of N-fertilization. In this concern, Kapur *et al* (1985) found similar finding.

However, G X D X N interaction was significant in both seasons. The data show that the line No. 47 followed by No's 13 and 8 gave the highest grain yield per plant at the normal sowing date of November at the N-level of 75 kg N/fed. in the 1st season. But in the 2nd season the line No.10 gave the highest grain yield followed by No.46 at normal sowing date and the highest N-level (100kg N/fed.).

In general results of grain yield/plant emphasize that the second week of November may be considered as the optimum period of sowing for wheat at the experimental area. Meantime, the line 47 followed by lines No's 46,10 and 36 had the highest yields across all treatments. Therefore, these lines are considered to be more suited than others or than the check cultivars for growing at both early or late sowing dates with applying 75 kg N/fed. The 4 superior lines, i.e., 47,46,10 and 36 significantly surpassed the three check cultivars by about 8.6 to 9.06 g/plant in the1st season. In the 2nd season, the three high yielding lines, 47,46 and 10 significantly surpassed the two check cultivars, Sakha 8 and Sakha 69, whereas they did not significantly differ from the check cultivar Sids 1. Meantime, the line No. 36 significantly surpassed the check cultivar Sakha 69 only. On the other hand, the line No. 9 followed by 35, 26, 12 and 27 gave the lowest grain yield/plant with difference in degrees of significance between them in the1st season, while the lines No's 3,4,24,42 and 43 had the lowest yield in the 2nd season.

3.Grain protein content

Analysis of variance for 1st season, (Table 3) indicates that grain protein content (%) was significantly affected by sowing date, N-levels and genotypes and their interactions, except N x G interaction in late sowing. In the 2nd season, sowing date effects and of sowing date x N-levels and genotypes X N-levels interactions were not significant, except N x G interaction in early sowing.

From data tabulated in Tables (8 and 9), it is noticed that during the 1st season, grain protein percentage significantly decreased with delaying the sowing date. Genotypes averaged 12.16 and 11.39 % protein in grains at early and late sowing dates, respectively indicating a 6.33 % reduction. In the 2nd season, the effects of sowing dates were not significant on the character. Overall treatments, genotypes averaged 11.78 and 12.78 % protein in grains in the two seasons, respectively. Parihar and Tripathi (1989) and Said *et al* (1999) reported that early sowing date showed tendency to increase grain protein percentage in wheat.

Results in Tables (8 and 9) show that application high successive doses of nitrogen significantly increased the protein content in grains in both seasons. The difference between the two levels (75 and 100 kg N/fed.) was not significant. Genotypes averaged 10.77, 12.23 and 12.33 % protein in grains under 50,75 and 100 kg N/fed, respectively in the1st season. vs. 11.81, 13.16 and 13.35 % protein in grains under the same respective order in the 2nd season. The data indicated that grain protein percentage was greatly affected by N-levels than sowing dates in both seasons and applying 75 kg N/fed. was enough for producing the highest protein percentage in grains for wheat genotypes used in the present study. Similar results were obtained by Singh (1971), Hussein *et al* (1981), Dorgham (1991), EL-Nagar (1997) and Said *et al* (1999)

Table 8 . Response of grain protein content of different wheat genotypes(G) to sowing dates and N-fertilization levels in 1996/97 season.

	D1*				D2				Combined			
Genotype	**N1****	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Mean**	**N1**	**N2**	**N3**	**Average**
8	10.05	11.29	10.95	**10.76**	11.97	13.07	12.16	**12.40**	11.01	12.18	11.55	**11.58**
10	12.13	13.18	13.96	**13.09**	10.61	10.72	11.09	**10.80**	11.37	11.95	12.52	**11.95**
13	9.18	12.81	13.67	**11.89**	9.06	9.79	11.39	**10.08**	9.12	11.30	12.53	**10.98**
15	9.34	13.66	13.99	**12.33**	10.59	11.44	12.53	**11.52**	9.96	12.55	13.26	**11.92**
19	12.91	12.80	11.58	**12.43**	11.02	12.14	11.77	**11.64**	11.96	12.47	11.67	**12.04**
34	11.97	12.84	13.28	**12.70**	10.39	12.31	11.13	**11.27**	11.18	12.58	12.20	**11.98**
36	12.43	12.95	13.09	**12.82**	10.74	11.29	12.38	**11.47**	11.58	12.12	12.74	**12.15**
37	11.88	13.28	13.80	**12.99**	11.14	11.92	13.28	**12.11**	11.51	12.60	13.54	**12.55**
46	10.33	11.93	12.25	**11.50**	11.79	13.21	11.52	**12.17**	11.06	12.57	11.88	**11.84**
47	10.13	12.73	12.53	**11.79**	10.66	11.29	10.81	**10.92**	10.39	12.01	11.67	**11.36**
Sakha 69	8.04	12.43	13.41	**11.29**	9.92	11.25	11.75	**10.97**	8.98	11.84	12.58	**11.13**
Sids 1	11.54	12.88	12.63	**12.35**	10.84	12.28	11.10	**11.40**	11.19	12.58	11.86	**11.88**
Average	**10.83**	**12.73**	**12.93**	**12.16**	**10.73**	**11.73**	**11.74**	**11.39**	**10.77**	**12.23**	**12.33**	**11.78**
L.S.D 5%												
D												1.35
N				1.06				0.81				1.62
DN												2.29
G	1.43	ns	ns	0.98	ns	1.63	ns	0.98	-	-		1.55
DG												2.19
NG				1.69				ns				2.67
DNG												3.78

*D1and D2 =11Nov. And 12 Dec.,respectively.

**N1,N2 and N3 = 50,75 and 100 kg N/fed., respectively.

Table 9 . Response of grain protein content of different wheat genotypes(G) to sowing dates and N-fertilization levels in 1997/98 season.

	D1*				D2				Combined			
Genotype	N1**	N2	N3	Mean	N1	N2	N3	Mean	N1	N2	N3	Average
8	12.32	13.62	12.57	12.84	12.29	13.30	13.21	12.93	12.30	13.46	12.89	12.88
10	10.06	11.85	11.40	11.10	12.84	13.72	13.89	13.48	11.45	12.78	12.65	12.29
13	10.47	13.91	14.92	13.10	12.73	12.68	12.63	12.68	11.60	13.29	13.78	12.89
15	12.52	14.66	14.51	13.90	12.39	12.59	13.75	12.91	12.45	13.63	14.13	13.40
19	12.27	13.00	13.99	13.09	11.62	12.93	13.94	12.83	11.94	12.97	13.97	12.96
34	12.57	14.51	14.92	14.00	12.20	12.95	13.89	13.01	12.38	13.73	14.40	13.50
36	10.06	14.16	14.57	12.93	10.74	12.32	13.00	12.02	10.40	13.24	13.79	12.47
37	12.30	14.26	12.48	13.01	12.78	13.00	13.85	13.21	12.54	13.63	13.16	13.11
46	11.40	13.75	13.96	13.04	11.73	12.63	12.73	12.36	11.56	13.19	13.34	12.70
47	11.98	14.01	13.48	13.15	11.22	12.72	13.82	12.59	11.60	13.37	13.65	12.87
Sakha 69	11.72	11.77	12.37	11.95	12.00	12.84	11.79	12.21	11.86	12.30	12.08	12.08
Sids 1	11.96	12.32	13.20	12.49	11.40	12.50	11.70	11.87	11.68	12.41	12.45	12.18
Average	11.63	13.48	13.53	12.88	11.99	12.84	13.18	12.67	11.81	13.16	13.35	12.78
L.S.D 5%												
D												ns
N				1.45				0.81				0.53
DN												ns
G	1.00	1.79	1.05	0.83	ns	ns	1.27	0.92	-	-	-	0.61
DG												0.86
NG				1.44				ns				ns
DNG												1.48

*D1and D2 =11Nov. And 12 Dec.,respectively.

**N1,N2 and N3 = 50,75 and 100 kg N/fed., respectively.

Moreover, the data show that the line No.15 had the highest protein content in grains at the normal sowing date under the highest N-level (100 kg N/fed.) in the 1st season. While for the 2nd season, the line No.13 gave the highest value in the 2nd season under the same treatments. Over all treatments the lines No's 15,19,34 and 37 had the highest values for grain protein percentage under different treatments in the two seasons. Further, the high-yielding genotypes had less grain protein content except the line No. 36 in the 1st season.

B-Phenotypic Stability

Pooled analysis of variance in Table (10) reveals that difference among the twelve-wheat genotypes was highly significant for the studied traits over 12 studied environments. Also variability among environments (linear) was large enough for a proper estimation of b_i values. Pfahler and Linskens (1979) pointed out that variability among environments is an important factor and in large part determines the usefulness of (b_i) values. The highly significant mean square due to environment + (genotype x environment) interaction revealed that genotypes interacted considerably with the changes in the environmental conditions. These results are in agreement with the findings of Chaubey and Sastry (1981), Ismail (1995) and Menon *et al* (1996) they reported that the response to environments was genetically controlled and showing the differential response of wheat genotypes to different agro-climates. The mean squares of genotype x environment interaction (linear portion of interaction) were highly significant and explained the large part of interaction, indicating that the studied characters were highly influenced by the changes in the environmental conditions. Similar trend was also reported in wheat by Chaudhary and Paroda (1980), Sharma *et al* (1987), Ismail (1995), Menon *et al* (1996) and EL-Nagar (1997) who found that the regression analyses were significant. However, the magnitude of the variance due to genotypes and that due to environments was much larger as compared with that due to (GξE) interaction. On the other hand, mean squares due to deviation from regression (non-linear portion of interaction) were significant showing differential of genotypes response to environmental conditions for the three characters. In this respect, Ebrehart and Russell (1969) mentioned that the most important stability parameter appeared to be the deviation mean squares, where all types of gene action are to be involved in this parameter and considered varieties with the lowest deviation being the most stable. In addition, Joppa *et al* (1971) pointed out that, the magnitude of S^2d_i was an excellent indicator of specific genotype x environment interaction. Moreover, the magnitude of predictable (linear) portion of interaction was

Table 10. Mean squares of stability analysis of variance for 3 characters studied in 12 wheat genotypes

Source of variance	d.f	Heading date (day)	Grain yield/ plant (g)	Protein percentage
Genotype(G)	11	232.40**	267.18**	1.54**
Environment (E)+ (GxE)	132	29.48**	15.80**	0.02
Environment(Linear)	1	2556.37**	3042.00**	124.68**
GxE (Linear)	11	8.00**	24.99**	1.81**
Pooled deviation	120	4.88**	6.11**	0.63**
Genotype				
8	10	2.98*	9.58**	0.94**
10	10	7.37**	9.34**	1.51**
13	10	1.12	4.91*	0.52
15	10	8.36**	5.06*	0.39
19	10	0.71	4.04	0.58*
34	10	14.36**	4.57*	0.36
36	10	6.88**	6.18**	0.91**
37	10	2.67*	8.94**	0.37
46	10	5.00**	5.42*	0.50
47	10	6.20**	4.11	0.21
Sakha 69	10	1.13	6.24**	0.97**
Sids 1	10	1.79	4.90*	0.27
Pooled error		432 (144)	2.46	0.31

*,** denote significant differences at 0.05and 0.01 levels of probability, respectively.
* Number between parenthesis are the degrees of freedom for protein percentage.

larger than for nonpredictable (non-linear) portion for all traits. Similar finding was obtained by Sharma *et al* (1987) for grain yield. Furthermore, Chaudhary and Paroda (1980) reported that both the linear and non linear components of interaction were found to be almost equally important for the stability of protein content in wheat.

The three parameters of stability, i.e., mean (x). regression coefficient (b_i) and deviation from regression (S^2d_i) estimated for different characters are given in Table (11) and shown in graphical figures (1) and will be discussed as follows:

1. Heading date

Table (11) and Fig. (1) give means of genotypes and stability parameters for heading date. Heading dates of genotypes ranged from 87.47 days for the line No. 34 to 103.66 days for the line No. 8. These two lines had intermediate values for grain yield/plant. However, genotypes averaged 98.47 days over all environments. The high yielding genotypes (lines No's 47,46,10 and 36 and the check cv. Sids 1, (Tables 6 and 7) were found to be late in heading, except the line No. 36 was medium which was earlier with about 7 days than the general mean. Heading date of the line No. 37 and the

Table 11. Stability parameters for heading date, grain yield and protein percentage of 12 wheat genotypes over 12 environments.

Genotype	Heading date(day)			Grain yield/plant (g)			Protein prcentage		
	X	b_i	$S^2 d_i$	X	b_i	$S^2 d_i$	X	b_i	$S^2 d_i$
8	103.66	0.79	1.62**	17.66	1.30	7.11**	12.23	0.52	0.63**
10	101.50	1.10	6.01**	20.87	1.17	6.88**	12.11	0.74	1.20**
13	95.35	1.26	-0.24	17.46	1.32*	2.45**	11.93	1.86**	0.20
15	96.23	0.94	6.99**	16.09	0.58**	2.59**	12.66	1.53*	0.07
19	101.35	1.32*	0.64**	15.23	.55**	1.58**	12.49	0.60	0.27*
34	87.47	0.74	12.99**	17.21	0.84	2.10**	12.74	1.21	0.05
36	91.75	1.20	5.52**	19.80	1.27	3.72**	12.31	1.07	0.59**
37	98.79	1.09	1.31**	16.43	0.93	6.48**	12.82	0.74	0.05
46	101.29	0.83	3.63**	22.25	1.16	2.95**	12.26	0.82	0.19
47	101.87	0.93	4.84**	23.69	1.43**	1.65**	12.11	1.25	-0.09
Sakha 69	99.00	0.94	-0.23	15.34	0.77	3.78**	11.60	1.08	0.66**
Sids 1	103.31	0.83	0.43*	19.17	0.64*	2.44**	12.60	0.54	-0.03
Average	98.47			18.43			12.32		
L.S.D 5%	0.93			1.25			0.45		

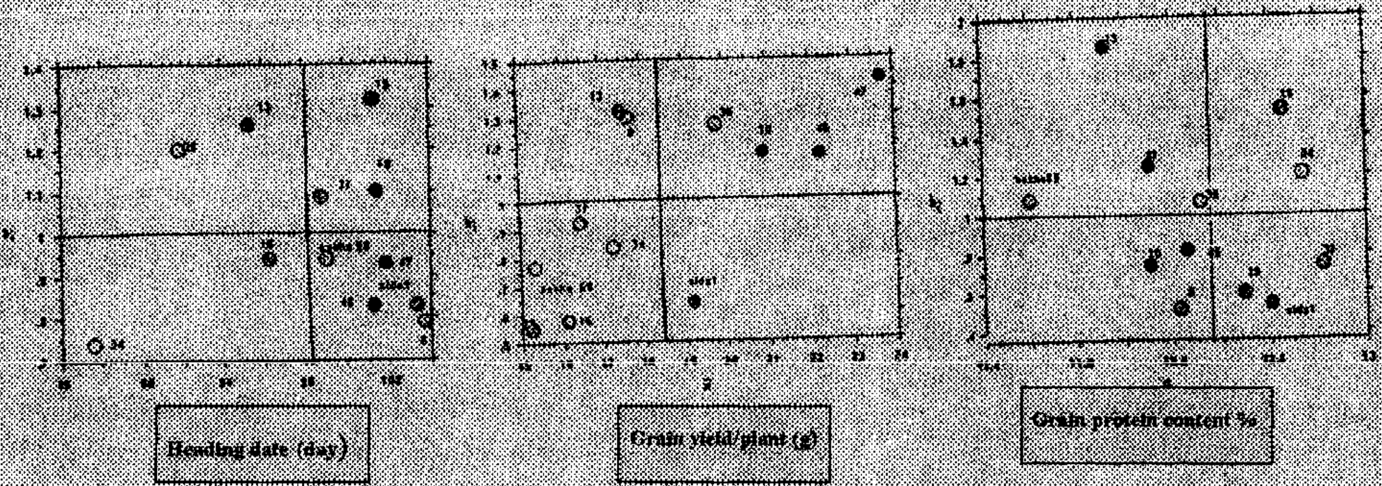

Fig.1. Graphical illustration of stability parameter (bi) and the mean performance of individual genotypes ($\overline{x}$) for heading date, grain yield/plant and grain protein content.

check cv. Sakha 69 were very close to the general mean. The first stability parameter (b_i) was non-significant for all genotypes, except the relatively late heading line No. 19 had b_i value significantly higher than unity considering to be more responsive to better environments. While, the second stability parameter (S^2d_i) was non-significant only for the line No. 13 and the check cv. Sakha 69 showing that these two intermediate heading genotypes were the most stable for this character. In this respect, Hassan (1997) found that Sakha 69 cv. was unstable for days to 50 % heading under specific environments. Conversely the earliest line No. 34 in the present study was considered unstable, it had the highest S^2d_i value (S^2d_i = 12.99) among all genotypes. Furthermore, the lines No's 8,19,37 and check cv. Sids1 having the least S^2d_i values are being more stable than the lines No's 10,15,36,46 and 47 which had slightly higher S^2d_i values. Generally the above results indicated that the majority of genotypes appeared to be less stable for heading date. Although, Chaubey and Sastry (1981) mentioned that of most wheat cultivars were stable for days to flowering, Ismail (1995) reported that heading date was a less stable character, indicating stability results depend on genotypes set use.

2. Grain yield /plant

Results in Table (11) and Fig. (1) showed considerable variation among genotypes for mean yield and for estimated regression parameters (b_i and S^2d_i). Grain yield/plant for the 12 wheat genotypes ranged from 15.23 to 23.69 g with an overall mean of 18.43 g. The line No. 47 had the highest grain yield followed by lines No's 46,10,36 and the check cv. Sids1, with significant differences among them. These 5 genotypes yielded above the grand mean and considered as high yielding group. The other genotypes, yielded below the grand mean and classified as medium (means of yield more than 16 to less than 18 g) and low (means of yield less than 16 g) yielding groups.

Values of regression coefficients (b_i) ranged from 0.55 to 1.43 with different degrees of significance, indicating differential responses of genotypes to the studied environments. On the other hand, values of deviation from regression (S^2d_i) were highly significant for all genotypes. The high yielding lines, i.e., lines No. 36 and No. 46 had b_i values closely to unity and least S^2di values thus, they could be considered the most desirable and stable ones. Also, the two high yielding genotypes, i.e., line No. 47 and the check cv. Sids1 are being stable on the basis of its low S^2d_i values with $b_i > 1$ vs $b_i < 1$, respectively showing that line No. 47 would be more responsive and yielded relatively better in more favourable growing conditions, while the check cv. Sids1 is relatively better under less favourable environments but not as good under favourable environments. Results of yield performance (Tables 6 and 7) emphasize this conclusion, where the line No. 47 had the highest yield under normal sowing date with applying 75 kg N/fed., in the two growing seasons which proved to be useful material under this conditions, or considering suitable for growing under good conditions whereas the check cv. Sids1 maintained its yield relatively more than yields of other genotypes as environment became yet poorer, i.e., under late sowing with applying 50 kg N/fed. Ghanem *et al* (1996) illustrated that Sids 1 was unstable for yield when tested in four agroclimatic zones across Egypt. However, the remainder high yielding line No. 10 having b_i value did not differ significantly from unity with high S^2d_i value, therefore, it was considered as unstable genotype. Regarding medium yielding genotypes, however, two of them, i.e., line No. 8 and No. 37 were found to be unstable, where they had b_i values very close to unity and high S^2d_i values revealing thereby specific instability for this trait, as pointed out by Eberhart and Russell (1966) and Joppa *et al* (1971). Whereas two others, i.e., lines No. 13 and No. 15 were stable which had least S^2d_i values with $b_i > 1$ vs $b_i < 1$ for the two lines, respectively, revealing that line No. 13 is more responsive to favorable environments while the line No. 15 is lesser which is expected to be equal or exceed the average performance only under unfavorable environment. The remainder medium yielding line No. 34 considered also as stable genotype and having general stability. On the other hand, the two low yielding genotypes, i.e., the line No. 19 and the check cv. Sakha 69 were stable (small deviation mean square), but line No. 19 is relatively better adapted to unfavorable environments ($b<1$) while the check cv. Sakha 69 have general adaptability over all environments studied. Ismail (1995) and EL-Nagar (1997) found that Sakha 69 cv. was unstable for grain yield. Also, Nanda *et al* (1983) indicated that lower yielding variety may be most stable. Further, Kaltsikes (1971) pointed out that stability of yield performance can be incorporated without impairing yielding ability in wheat and triticale.

The previous results indicated that there is no clear trend can be drawn between yielding ability and stability of wheat genotypes, although certain lines (36 and 46) combined high mean performance with unit linear response and low deviation from linearity, revealing the possibility of developing stable and high yielding varieties through wheat breeding programs. In this respect, Abd EL-Hakeem (1983) mentioned the successfulness of wheat breeding efforts in introducing G. 157 and Sakha 78 as stable and high yielding varieties.

3.Grain protein content

Means and stability parameters of wheat genotypes for grain protein content are given in Table (11) and Fig. (1). Mean values ranged from 11.60% for the check cv. Sakha 69 to 12.82% for line No. 37 with an average of 12.32%. Estimates of stability parameters showed that b_i values did not differ significantly from unity for all genotypes exhibiting general stability across different environments, except b_i values for the lines No. 13 and 15 that were significantly greater than unity indicating the higher responsive of these lines under good environments. On the other hand, S^2d_i values did not differ significantly from zero for all genotypes except for the lines No's 8,10,19,36 and the check cv. Sakha 69 considering these genotypes being less stable than the other genotypes. The above results did not show clear association between the mean performance and stability of genotypes for grain protein percentage. EL-Nagar (1997) indicated that wheat cultivars had high values for grain protein content were unstable. Further, Chaudhary and Paroda (1980) found that the stability of this trait of a population was the specific property of the genotype itself and did not relate to either the homogeneity or the heterogeneity of the population. They also indicated that widely adapted genotypes showed high stability for protein content over environments.

REFERENCES

Abd EL-Gawad, A.M, F.I. Gab-Alla and A. Roshdy (1979). Comparative studies of Giza 155 and Mexibac cultivars of wheat. Effect of different irrigation systems and levels of nitrogen fertilization on the yield and its components. Annals of Agric. Sci., Moshtohor. 12: 23-34.

Abd EL-Hakeem, A.M. (1983). Estimating the stability parameters for comparing agronomic wheat varieties and their implication in breeding programs. M. Sc. Thesis, Ain Shams. Univ., Egypt.

Abd EL-Shafi, A.M., A.M. Abd EL-Ghani, M.B. Tawfelis, M.G. Mosaad and M.K.H. Moshref (1999). Screening of wheat germplasm for heat tolerance in Upper Egypt. Egypt. J. Plant Breed.3: 77-87.

Agarwal, S.K., M.K. Moolani and H.P. Tripathi (1972). Effect of sowing dates, levels of nitrogen and rate of seeding on dwarf wheat (*Triticum aestivum*, L.). Indian J. Agric. Sci. 42 (1): 47-52.

Ahmed, M. (1999). Inheritance of earliness and grain yield and its components under different planting dates in wheat. M.Sc. Thesis. Fac. of Agric., Assiut Univ., Egypt.

A.O.A.C. (1995). Official Methods of Analysis, 16th Ed. Association of Official Analysis Chemists. Washington, DC, U.S.A.

Chaubey, J.S. and E.V.D. Sastry (1981). Stability analyses of yield and yield components in some Indian and Mexican varieties of wheat. Ind. J. Agric. Sci. 51 (9): 611-614.

Chaudhary, B.S. and R.S. Paroda (1980). Phenotypic stability for protein content in relation to homogeneous and heterogeneous populations in wheat. Ind. J. Genet. and Plant Breed. 40. (1) : 172-131.

Dorgham, Elham.A. (1991). Effect of water stress, irradiation and nitrogen fertilization on grain filling, yield and quality of certain wheat cultivars. Ph.D. Thesis. Fac. Agric., Ain Shams Univ., Egypt.

Eberhart, S.A. and W.A. Russell (1966). Stability paramcters for comparing varieties. Crop Sci. 6:36-40.

Eberhart, S.A. and W.A. Russell (1969). Yield and stability for 10 line diallel of single cross and double cross maize hybrids. Crop Sci. 9:357-361.

EL-Ghareib, E.A., A.M. Azab and G.A. EL-Shaarawy (1998). Effect of nitrogen fertilizer and seeding rate on yield components of some new wheat cultivars. Al-Azhar. J. Agric. Res. 27:31 - 40.

EL-Nagar, G.R. (1997). Evaluation of yield and quality of some local and introduced wheat cultivars under variable nitrogen fertilizer levels. Assiut J. of Agric. Sci. 28 (2) 118-134.

Ghanem, E.H., A.M. Abd EL-Shafi, N.S. Hanna, S.K. Mahomoud, S.R.S. Sabry, M.M. Abd EL-Halim, H.M.M. Zaid, A.M. Moussa, S.A. Abd EL-Majead and S. Sherif (1996). Grain yield and stability of the new bread wheat (*Triticum aestivum,* L.) cultivar Sids I in different agroclimatic zones of Egypt. Bull. Fac. Agric. Unvi. Cairo, 47:565-575.

Girothia, O.P., M.L. Nema and A.K. Sharma (1987). Response of wheat cultivars to sowing time and fertility levels. Ind. J.Agron.32 (1): 34-36.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research. 2nd ed. John Wiley & Sons, New York.

Gupta, V.K., A.C. Vig and R. Singh (1970). Influence of spacing, time of sowing and nitrogen fertilization on the yield of wheat. Ind. J. Agron. 15: 251-253.

Hassan, E.E. (1997). Partitioning of variance and phenotypic stability for yield and its attributes in bread wheat. Zagazig J. Agric. Res. 24. (3): 421-433.

Hassan, A.A. and A.B. Gaballah (1999). The response of wheat cultivars to sowing and foliar nutrition in newly reclaimed sandy. Zagazig J. Agric. Res. Vol.26 No. (6): 1521-1533.

Hussein, M.A., A. Kandil, S. Shokr and M.M. Abd EL-Alim (1981). Effect of nitrogen fertilizer on yield and yield components of Giza 157 and Sakha 8 wheat cultivars (*Triticum aestivum,* L.). Annals of Agric. Sci., Moshtohor. 15: 13-22.

Ismail, A.A. (1995). The performance and stability of some wheat genotypes under different environments. Assiut. J. Agric. Sci.26(4): 15-37.

Joppa, L.R., K.L. Lebsock and R.H. Busch (1971). Yield stability of selected spring wheat cultivars (*Triticum aestivum*). in the uniform regional nurseries 1959-1968. Crop Sci, 11:238-241.

Kaltsikes, P.J. (1971). Stability of yield performance in Triticale and common and durum wheats. Crop Sci. 11:573-575.

Kapur, M.L., D.S. Ranan, K.N. Sharma, A.L. Bhandari and J.S. Sodhi (1985). Nitrogen uptake pattern in four dwarf wheat (*Triticum aestivum,* L.) varieties as influenced by nitrogen and sowing dates. Ind. J. Agron. 30(3): 318-321.

Kataria, N. and K. Bassi (1997). Effect of organic mulch and nitrogen in early sown wheat (*Triticum aestivum*) under rainfed conditions. Ind. J. Agron.42 (1): 94-97.

Khalifa, M.A., A.A. Ismail, G.R. EL-Nagar and I.A. Amen (1998). Response of some genotypes of bread and durum wheats to differences in sowing dates. Assiut J. of Agric. Sci. 29 (5): 31-46.

Kheiralla, K.A. and T.H. Sherif (1992). Inheritance of earliness and yield in wheat under heat stress. Assiut J. Agric. Sci. 23 (1): 105-126.

Menon, U., S.N. Sharma and U. Menon (1996). Stability analysis for grain yields and associated traits in bread wheat. Ann. of Agric. Res. 17(1): 33-37.

Nanda, G.S., P.S. Virk and K.S. Gill (1983). Stability for plant height, ear length, peduncle length and spikelets per spike in breed wheat. Ind. J. Genet. and Plant Breeding 43 (2): 221-225.

Nass, H.G., J.A. Macleod and M. Suzuki (1976). Effects of nitrogen application on yield, plant characters, and N levels in grain of six spring wheat cultivars. Crop Sci.16: 877-879.

Parihar, S.S and R.S. Tripathi (1989). Response of wheat to nitrogen, irrigation and sowing dates. Ind. J. Agron. 34(2): 192-196

Pfahler, P.L. and H.F. Linskens (1979). Yield stability and population diversity in oats (*Avena* sp.). Theoret. App. Genet. 54: 1-5

Said, E.M., E.M. Gabr and A.A. Sarhan (1999). Response of some wheat varieties to planting dates and nitrogen fertilization. J. Agric. Sci. Mansoura Univ., 24(6): 2711-2720.

Sayar, R., A. Gharbi and H. Ghorbel (1992). Grain yield and quality of five genotypes of durum wheat as influenced by nitrogen fertilization. Rachis 11(1/2): 55-59.

Shams EL-Din, G.M. and K.E. EL-Habbak (1992). Response of some wheat varieties to nitrogen fertilizer rates. Annals Agric. Sci., Ain Shams Univ., Cairo, Egypt. 37 (1): 61-68.

Sharma, R.C., E.L. Smith and R.W. McNew (1987). Stability of harvest index and grain yield in winter wheat. Crop Sci. 27: 104-108.

Singh, S.P. (1971). Comparative performance of nitrogen fertilizers at varying levels on the yield and quality of tall wheat. Ind. J. Agron. 16: 37-39.

Siviori, Z. (1975). Planting time and vegetative period of wheat. (C.F. Field Crop Abst., 28 :2959).

Tolba, Afaf, M. (2000). Evaluation of different bread wheat lines in the F_6 and F_7 generations for grain yield and its attributes. J. Agric. Sci. Mansoura Univ. 25(10): 6061- 6073.

Verma, R.S. and M. Singh (1988). Studies on grain development pattern and yield of wheat varieties under different sowing dates. Ind. J. Agron. 33 (2): 193-195.

دراسات على سلوك و ثبات بعض سلالات القمح المبشرة تحت ظروف بيئية مختلفة

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قيمت ٤٧ سلالة مبشرة من قمح الخبز من حيث السلوك والثبات المظهري بالنسبة لتاريخ طرد السنابل ومحصول الحبوب / نبات ومحتوى الحبوب من البروتين في الجيلين السادس والسابع مع ثلاثة من أصناف المقارنة هي سخا ٨ ، سخا ٦٩ وسدس ١ وذلك تحت ميعادين من الزراعة هما ١١ نوفمبر و١٢ ديسمبر وثلاثة مستويات من التسميد النيتروجيني هي ٥٠ ، ٧٥ ، ١٠٠ كجم نيتروجين / فدان خلال الموسمين الزراعيين ٩٦ / ١٩٩٧ ، ٩٧ / ١٩٩٨م. أقيمت تجربتين حقليتين بمزرعة كلية الزراعة جامعة عين شمس بشلقان محافظة القليوبية خلال كل موسم. اختصت الأولى لميعاد الزراعة المناسب والثانية للميعاد المتأخر ، وكان التصميم التجريبي المستخدم القطع المنشقة مرة واحدة في أربع مكررات حيث وزعت معدلات التسميد بالقطع الرئيسية والتراكيب الوراثية بالقطع المنشقة . حللت إحصائياً بيانات كل ميعاد زراعة علي حدة ، كما حللت بيانات الميعادين معاً لكل موسم وتم تقدير الثبات المظهري بطريقة Eberhart and Russell (1966) .

وتتلخص أهم نتائج الدراسة فيما يلي :

١– أدي التأخير في ميعاد الزراعة إلي تأخير ميعاد طرد السنابل ونقص محصول الحبوب / نبات في كلا الموسمين ، كما نقص محتوي الحبوب من البروتين في الموسم الثاني فقط . ومن ناحية أخري لم تؤثر الزيادة في التسميد النيتروجيني معنوياً علي ميعاد طرد السنابل في كلا الموسمين فيما عدا حدوث تبكير لطرد السنابل تحت المستوي ٧٥ كجم نيتروجين / فدان عند ميعاد الزراعة المتأخر في الموسم الثاني ، في حين أدت زيادة التسميد النيتروجيني من ٥٠ إلي ٧٥ كجم نيتروجين / فدان إلي زيادة محصول الحبوب / نبات والزيادة حتى ١٠٠ كجم نيتروجين / فدان إلي زيادة محتوى الحبوب من البروتين في كلا الموسمين ، وتوضح نتائج الدراسة بصفة عامة أن التسميد بمعدل ٧٥ كجم نيتروجين / فدان كافياً للحصول علي أعلي محصول مع الزراعة في الأسبوع الثاني من شهر نوفمبر بمنطقة التجربة .

٢– تميزت السلالات المنخفضة المحصول أرقام ٢ ، ٣ ، ٤ ، ١٢ بالتبكير في طرد السنابل بحوالي (٢٤,٨ ، ٢٩,٦) ، (٢٠,٤ ، ٢٤,٢) يوماً عن أصناف المقارنة في الموسمين علي الترتيب . كما كانت السلالة رقم ٣٦ عالية المحصول مبكرة في طرد السنابل عن السلالات الأخرى عالية المحصول وأصناف المقارنة بحوالي ٧ ، ٨ أيام في الموسمين علي الترتيب . كما تفوقت السلالات أرقام ٤٧ ، ٤٦ ، ١٠ ، ٣٦ علي أصناف المقارنة في محصول الحبوب / نبات في مبعادى الزراعة وفي

الموسمين . وكانت السلالات أرقام ١٥ ، ١٩ ، ٣٤ ، ٣٧ الأعلى في المحتوي البروتيني تحت الظروف المختلفة في الموسمين .

٣- أظهرت السلالة رقم ١٣ وصنف المقارنة سخا ٦٩ *ثباتاً مظهرياً بالنسبة لميعاد طرد السنابل ، أما* السلالتين ٣٦ ، ٤٦ (عالية المحصول) فكانتا الأفضل ثباتاً بالنسبة لمحصول الحبوب / نبات . كما أظهرت السلالات أرقام ١٣ ، ١٥ ، ٣٤ ، ٣٧ ، ٤٦ ، ٤٧ وصنف المقارنة سدس ١ ثباتاً لمحتوي الحبوب من البروتين .

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