RESPONSE OF SIX BREAD WHEAT GENOTYPES TO DIFFERENT SOWING DATES

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Abstract

Six bread wheat (*Triticum aestivum* L.) genotypes were selected from previous screening trails at Sakha Agric. Res. Station based on yield potentiality and adaptability for different sowing dates. These genotypes were evaluated in field experiment under six sowing dates, planted at two-week intervals, started from October 26 in two consecutive seasons 2004/05 and 2005/06. Results indicated that sowing wheat in the last ten days of November recorded the highest number of days to heading, number of kernels spike^{-1} and grain and straw yields in both seasons. Meanwhile, the early or late sowing date declined the records of these characters in the two seasons. The earliest sowing date, October 26 recorded the highest number of days to maturity and heaviest 1000-kernel weight, while, delaying sowing time reduced these characters. Giza 168 was the earliest genotype in days to heading in both seasons and Line 3 was the latest one. Sakha 94 was the earliest genotype in maturity. The highest grain yield was obtained from Sakha 94 and Line 1 in the first and second season, respectively. The late genotypes in heading date were more suitable to early planting, so, Line 3 might be more adapted to early sowing. Meanwhile, Sakha 94 was more adapted to late sowing than the other genotypes. Phenotypic stability of the six genotypes across 6-sowing dates and 2-years with respect to grain yield was estimated. The regression coefficients (b_i) of all genotypes were not significantly different from unity. Therefore, stability of genotypes in this case is predicted on the basis of the other two parameters, i.e., stander deviation from regression (S^2_d) and average yield over all environments. Line 1, Giza 168 and Sakha 94 gave the highest yield over the grand mean with the regression coefficients; 1.10, 0.99 and 0.97, respectively, and they were not significantly different from regression coefficient. Line 1 is expected to give good yield under favorable environmental conditions, where it had the highest average of grain yield and regression coefficient (b_i > 1.0). Giza 168 and Sakha 94 had above average grain yield, their regression coefficients were close to unity (b_i = 0.99 & 0.97) with non-significant standard deviation, indicating wide adaptation and stability for grain yield across the tested environments.

Keywords: Wheat, Sowing dates, Agronomic characters, Stability parameters, Regression coefficient.

INTRODUCTION

Plant breeders aim to develop new wheat cultivars that consistently have high yield under variety of environments. The adaptability of a cultivar is usually tested by the degree of its interaction with different environments. A cultivar or genotype is considered to be more adapted or stable if it has a high mean yield with low degree of fluctuation in yielding ability over different climatic conditions.

The wheat crop sown at different dates witnesses vast differences with respect to abiotic factors such as temperature, light and humidity. The genotypes interact differently with abiotic factors, especially, temperature and light in accordance with their photothermal responses, and several morphological and productivity traits are also affected (Kumar *et al.*, 1995). Therefore, there is a need to develop cultivars could effectively facing vagarious of the environment. The progress of breeding efforts in this direction will depend on amount of variability present in the breeding materials.

The timing of initiation of vegetative and reproductive organs depend upon temperature and photoperiod, but the survival and subsequent size of such organs depend upon the supply of assimilate. The choice of sowing date is, therefore, vital to ensure both sufficient grain setting initiation and sufficient assimilate, that will initially support and subsequently fill the grains (Satorre and Slafer, 1999)

Tawfelis (2006) found significant variation in yield and its components among wheat genotypes under normal and late planting. He reported also that delaying sowing date reduced number of kernels spike^{-1}, 1000-kernel weight and grain yield. Moreover, Mahgoub et al. (2006) found gradual decreases in grain yield accompanied with delaying sowing dates, and the proper sowing date is during the last ten days of Nov. Also, in case of late sowing, growing Sakha 94 is recommended.

The performance of a genotype mainly depends on environmental interaction. Estimation of phenotypic stability, which involves regression analysis, has proved to be valuable technique to assess the response of various genotypes under changing environmental conditions. Evaluation of genotype x environmental interactions gives an idea about the buffering capacity of the population under study. The low magnitude of genotype environmental interactions indicates consistent performance of a population over variable environments. In other words, it shows high buffering ability of the population (Singh and Narayan, 2000). Various statistical methods have been proposed to determine the stability of new cultivars. The most commonly used method is the joint regression analysis for yield stability (Finlay and Wilkinson, 1963 and Eberhart and Russell, 1966). The regression coefficient (b_i) and the average deviation from regression line (S^2_d) are two mathematical indices for the assessment of stability (Eberhart and Russell, 1966). A genotype with a high b_i and S^2_d reacts readily to change in the environment and possesses considerable variability, whereas, cultivars with a $b_i < 1.0$ and S^2_d near to 0.0 react weakly to changes in growing conditions and considered to be stable in yield (Shindin and Lokteva, 2000). Finlay and Wilkinson (1963) regarded those genotypes with a b_i near 1.0 and high mean yield as being well adapted to all environments.

The genotype x environment interaction was studied by different researchers (Ashraf *et al.*, 2001; Amin *et al.*,2005; Amin, 2006 and Tarakanovas and Ruzgas, 2006). The present investigation was conducted to achieve the following objectives:

1- Evaluation of some agronomic characters of wheat genotypes under different sowing dates.

2- Observation of phenotypic stability, with respect to grain yield, of six bread wheat genotypes across 6 sowing dates and 2 years.

3- Selection of genotypes with high grain yield and yield stability.

MATERIALS AND METHODS

The field experiments were conducted during 2004/05 and 2005/06 wheat growing seasons at the Experimental Farm of Sakha Agricultural Research Station, Kafer El-Sheikh governorate, Egypt. Six bread wheat genotypes were evaluated under six sowing dates. Name and pedigree of these genotypes are shown in Table 1. These genotypes include two new bread wheat cultivars and four promising lines. Those genotypes were selected based on their yield potentiality and adaptability for different sowing dates from previous screening trails at the same station.

Table 1. Name and pedigree of the six bread wheat genotypes.

Genotype	Pedigree
Line 1	Attila / Sids 1 CRGZ9684-8GZ-3GZ-0FU-2S-0S
Line 2	Kaus / Atila CMSS93Y00066S-5AP-2AP-3AP-0AP-OSH
Line 3	Shi # 4414 / Crow "S" // Giza 163 S.12601-10S-4S-2S-0S
Line 4	Mayon"s" // Crow"s" / vee"s ICW 90-0382-5AP-OTS-OBR-2AP-OL-OAP-OSD
Sakha 94	Opata / Rayon // Kauz CMBW 90Y3180 -0TOPM-3Y-010M-10M- 010Y-6M-0S
GIZA 168	Mrl / Buc // Seri CM 93046-8M-0Y-0M-2Y-0B- OGZ

The genotypes were planted at 2-week intervals started on 26 Oct., i.e. Oct. 26, Nov. 9, Nov 23, Dec. 7, Dec. 21 and Jan. 4 in both seasons. A randomized complete block design with three replications was used for each date. Each plot consisted of 12 rows x 20 cm apart x 3.5m length ($8.4m^2$). The recommended package of cultural practices of the region was followed. The average of minimum and maximum temperatures from Nov. to May at Sakha Agric. Res. Station during the two seasons are presented in Table 2.

Table 2. Ten days average, of minimum and maximum temperatures form Nov. to May compared with long-term (LT) average at Sakha Agric. Res. Station during two seasons.

Month	Day	Maximum Temp.(c)			Minimum Temp.(c)		
		LT•	2004-05	2005-06	LT•	2004-05	2005-06
Nov	1-10	26.86	30.00	24.25	13.03	17.00	10.25
	11-20	25.61	25.85	23.20	11.94	13.70	10.75
	21-30	24.14	20.85	25.15	10.92	10.05	10.60
Dec	1-10	21.81	22.15	23.45	10.09	9.70	9.80
	11-20	19.85	19.35	21.10	8.27	8.05	7.35
	21-31	19.84	21.05	17.59	6.35	6.64	4.32
Jan	1-10	19.17	18.80	21.70	7.21	7.50	8.50
	11-20	18.66	19.25	17.95	6.34	4.95	2.80
	21-31	18.72	20.27	18.55	5.99	6.05	4.64
Feb	1-10	18.63	17.15	19.35	6.63	5.00	9.05
	11-20	18.87	21.12	19.15	7.18	6.30	4.95
	21-28	20.42	22.06	24.13	6.93	8.44	7.94
Mar	1-10	21.76	24.35	21.80	8.73	10.65	7.00
	11-20	21.07	20.45	22.55	7.69	4.80	5.80
	21-31	22.88	24.05	25.41	9.00	7.51	8.32
Apr	1-10	23.26	23.10	24.70	9.58	8.60	8.30
	11-20	26.74	28.55	28.05	11.50	12.05	9.85
	21-30	26.30	27.35	28.35	11.92	11.40	10.35
May	1-10	28.39	28.30	27.4	13.16	10.9	10.5
	11-20	30.15	32.40	28.3	14.68	13.75	10.4
	21-31	30.18	30.64	32.5	16.20	15.23	15.3

•LT= average ten years

In both seasons, measurements were made on days to heading (DH), days to maturity (DM) number of spikes m^{-2} (Sm^{-2}), number of kernels $spike^{-1}$ (KS^{-1}), 1000-kernel weight (KW), grain yield (GY) and straw yield (SY). Grain yield was eastimated from the ten central rows of each plot and converted to ardab $feddan^{-1}$ (one ardab = 150 kg of wheat grain and one feddan = 4200 m^2). Straw yield was measured using the same way as grain yield but, it was converted to ton $feddan^{-1}$.

The collected data in the two seasons were statistically analyzed according to analysis of variance (ANOVA) for one factor and combined over sowing dates following Gomez and Gomez (1984). The means of treatments were compared using the Least Significant Difference (LSD) method at 5% of probability. Statistical analysis was performed using "MSTATC" microcomputer program (MSTATC, 1990).

Stability analysis of grain yield (ardab feddan^{-1}) of the tested genotypes was done for the 12 environmental conditions (6-sowing dates and 2-years). Stability was defined as a function of slope and deviation from the regression of cultivar yield on an environmental index. Yield stability was analyzed similar to that suggested by Eberhart and Russell (1966). They proposed to use two statistics, depending on genotypes x environment interaction, (1) regression coefficient (b_i) and (2) the deviation from regression (S^2d) to estimate stability.

RESULTS AND DISCUSSION

Analysis of variance

The combined analysis of variance over the two years showed significant or highly significant differences between years and interactions of years by sowing dates for all studied characters (Table 3). Therefore, the results are discussed in separate year.

Table 3. Mean square values of the studied agronomic characters of wheat genotypes grown under six sowing dates (SD) during 2004/05and 2005/06 seasons.

		MS						
SOV	df	DH	DM	S M^{-2}	KS^{-1}	KW	GY	SY
Year (Y)	1	16.7**	55.0*	236281**	909.7**	65.5*	102.8**	5.2**
Sowing date (S)	5	748.1**	2577.0**	127633.9**	276.2**	639.3**	311.3**	18.2**
YS	5	84.1**	115.0**	17607.09**	565.8**	91.6**	59.1**	7.5**
Rep(YS)	24	2.1**	14.3	4171.9	42.5	23.7**	4.2*	0.9**
Genotypes (G)	5	558.9**	57.5**	8442.1**	59.3	47.1**	13.1**	4.4**
YG	5	31.4**	7.3	2465.3	59.3	20.1	3.1	0.6
SG	25	51.1**	21.7*	4038.2	37.3	11.4	4.3*	0.4
YSG	25	16.0**	16.9	3446.2	21.0	10.8	5.3**	0.5
Error	120	0.8	12.2	2677.8	30.6	11.2	2.4	0.4
CV%		0.94	2.41	13.31	9.94	7.23	6.41	9.51

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

Sowing date

Effect of sowing dates was highly significant for all studied characters (Table 3 and 4). The observed variation in the agronomic characters, of the genotypes between planting dates can be considered as combination effect of planting date and weather conditions. The sowing date, Nov. 23, recorded the highest number of days to heading, number of kernels spike^{-1} and grain and straw yields in both seasons. Meanwhile, the early or late sowing dates had gradually decline these characters in both seasons. The earliest sowing date, Oct. 26, recorded the highest number of days to maturity and heaviest 1000-kerneel weight, while delaying sowing dates gradually reduced these characters in the two seasons. This result could be attributed to grain–filling process that harmfully affected by high temperatures and kernels reaching to maturity stage before complete filling.

Table 4. Mean values for studied characters of six sowing dates in 2004/2005 and 2005/2006seasons.

Trait	Years	Sowing date						LSD	CV%
		Oct. 26	Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4	0.05	
DH	2004/05	88.9	95.6	98.6	94.8	89.5	89.9	0.7	0.8
	2005/06	84.7	96.0	99.4	96.9	94.5	89.0	1.2	1.1
Dm	2004/05	155.2	152.1	151.0	144.7	134.9	133.5	1.9	0.7
	2005/06	149.5	151.3	151.9	141.4	139.6	131.7	3.3	3.6
Sm^{-2}	2004/05	366.0	373.6	402.9	464.1	487.4	436.5	67.3	12.4
	2005/06	232.4	326.2	328.5	407.2	436.5	402.9	49.2	14.4
KS^{-1}	2004/05	54.4	61.2	62.5	54.9	48.9	52.6	9.1	10.7
	2005/06	51.6	52.8	58.1	54.5	56.0	48.8	3.9	8.9
KW	2004/05	53.5	49.0	45.2	44.6	45.8	36.4	4.4	9.7
	2005/06	50.2	49.6	47.6	46.5	44.7	42.4	1.1	3.5
GY	2004/05	23.1	24.6	27.8	25.6	24.3	18.5	1.1	5.2
	2005/06	20.6	27.2	30.2	25.7	25.1	23.4	1.4	7.3
SY	2004/05	7.1	7.5	7.7	6.7	6.1	5.4	0.6	8.5
	2005/06	5.8	7.1	7.7	6.5	5.8	5.8	0.7	10.5

Regarding number of spikes m^{-2}, early sowing decreased this trait and late sowing increased it up to Dec. 21 in the two seasons. Timing of initiation of vegetative and reproductive organs depends upon temperature and photoperiod, but the survival and subsequent size of such organs is dependent upon the supply of assimilates. The choice of sowing date is, therefore, vital to ensure both sufficient grain sitting initiated and sufficient assimilates (Satorre and Slafer, 1999). Tawfelis (2006) and Menshawy (2007 a & b) reported that late sowing reduced number of days to maturity, 1000-kernel weight, grain yield and straw yield. These results indicate that proper sowing date could be during the last ten days of Nov. Similar results were recorded by Mahgob et al. (2006).

The mean performance of genotypes

Highly significant genotype differences were recorded for all characters (Tables 3 and 5). These variations among genotypes might partially reflect, their different genetic backgrounds. The data in Table 5 illustrate the results of yield and agronomic characters of the tested six wheat genotypes. Giza 168 was the earliest genotype in days to heading in both seasons, while Line 3 was the latest one. For days to maturity, Sakha 94 was the earliest genotype, while Line 3 had the reverse trend in the two seasons. It was noticed that Sakha 94 was later in days to heading than Giza 168, while, it was earlier in days to maturity. Therefore, Sakha 94 had short grain filling period.

Table 5. Mean values for studied characters of six wheat genotypes as affected by sowing dates in 2004/2005 and 2005/2006seasons.

Trait	Years	Genotype						LSD	Inter-
		L 1	L 2	L 3	L 4	Sak 94	G 168	0.05	action
DH	2004/05	88.7	96.1	98.3	93.6	94.7	85.7	0.8	**
	2005/06	90.7	94.6	98.0	94.7	93.6	89.0	0.6	**
Dm	2004/05	144.6	144.8	146.8	146.0	143.6	145.6	1.2	*
	2005/06	143.0	145.5	145.7	145.0	141.8	144.4	-	-
Sm^{-2}	2004/05	428.2	419.5	399.2	407.2	434.4	441.9	-	-
	2005/06	350.8	373.5	354.0	322.8	361.2	371.4	-	-
KS^{-1}	2004/05	54.9	55.3	54.1	55.6	58.4	56.0	-	-
	2005/06	53.9	50.6	53.5	54.7	55.0	54.1	-	-
KW	2004/05	45.4	47.9	47.3	45.3	45.0	43.6	-	-
	05/06	48.6	46.9	47.2	46.9	46.3	45.3	1.0	-
GY	2004/05	24.4	23.3	23.4	23.5	24.8	24.6	0.8	**
	2005/06	26.2	25.6	24.7	24.5	25.4	25.8	1.4	-
SY	2004/05	7.0	6.8	7.1	6.7	6.5	6.5	0.4	-
	2005/06	6.8	6.4	7.2	6.0	6.2	6.1	0.4	-

Number of spikes m^{-2} and number of kernels $spike^{-1}$ were not affected by genotypes and the interaction between sowing dates and genotypes in the two seasons (Table 5). The insignificant variation among genotypes might reflect their high capacity for these traits.

Data presented in Table 5 illustrate significant differences among genotypes for 1000-kernel weight in the second season. Line 1 recorded the heaviest kernel weight (48.6 g), while, Giza 168 was vice versa (45.3g). There were significant differences among genotypes in grain and straw yields in both seasons (Table 5). The highest grain yield was obtained from Sakha 94 (24.8 ardab $fadan^{-1}$) in the first season and from Line 1 (26.2 ardab $feddan^{-1}$) in the second season. The genotypes; Line 1 , Sakha 94 and Giza 168 gave almost the same grain and straw yields in the two seasons. Line 3 recorded the highest straw yield in both seasons. Generally, all genotypes showed slight differences in grain and straw yields. This result might be attributed to that these genotypes include two new bread wheat cultivars and four promising lines selected based on their high yielding potential and adaptability for sowing dates from previous screening trails at the same farm.

Genotype–Sowing date interaction

Regarding the interaction effects, only the significant effects will be discussed. The interaction between genotypes and sowing dates had highly significant effects on days to heading in both seasons, days to maturity and grain yield in the first season, while it had no effect on the other traits (Table 5). Data in Table 6 indicated that the earliest heading genotype was Giza 168 in both seasons. On the other hand, the latest was Line 3 up to Dec. 7 and Line 4 in the last two sowing dates. Therefore, the significant interaction between planting dates and genotypes in days to heading may be, mainly, due to the different response of these two lines. The relative changes in days to heading among planting dates were small for Line 3 and Sakha 94 up to Dec. 7 compared with the other genotypes. This result indicates that these genotypes might be sensitive to photoperiod response.

Table 6. Interaction between six wheat genotypes and sowing dates and their effect on days to heading in 2004/2005 and 2005/2006 seasons.

	Sowing dates (2004 / 05)					
Genotype	Oct. 26	Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4
Line1	80.7	91.3	95.0	91.0	86.7	87.3
Line2	97.0	101.3	100.3	96.3	91.0	90.7
Line3	100.7	104.3	102.0	99.0	92.3	91.7
Line4	83.0	94.0	101.0	97.7	93.3	92.7
Sakha 94	99.3	98.7	98.3	94.3	88.3	89.0
Giza 168	72.7	83.7	94.7	90.3	85.3	87.7
$LSD_{0.05}$			1.9			
	Sowing dates (2005 / 06)					
Genotype	Oct. 26	Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4
Line1	81.0	92.7	96.3	95.0	92.3	86.7
Line2	87.0	97.3	101.3	98.0	94.7	89.0
Line3	93.3	102.0	105.0	99.7	96.7	91.0
Line4	82.7	96.7	99.7	99.3	97.7	92.3
Sakha 94	85.7	97.3	101.0	96.0	93.7	88.0
Giza 168	78.7	89.7	93.3	93.3	92.0	86.7
$LSD_{0.05}$			1.5			

The interaction between genotypes and sowing date had highly significant effect on days to maturity in the first season (Table 5 and 7). Sakha 94 was the earliest maturing genotype under all sowing dates except that of the first one. This cultivar was late in days to heading so that it had short grain filling period. These results indicate that the earliest heading genotype might not be always the earliest in maturity. The latest genotype in days to maturity was L3 under the first and second dates of sowing and L4 under the other sowing dates. This study suggested that evaluation of earliness in maturity on the basis of heading date may be misleading. Similar results were obtained by Van Sanford (1985) and Menshawy (2007 a).

Table 7. Interaction between six wheat genotypes and sowing dates and their effect on days to maturity in 2004/2005 season.

		Sowing dates				
Genotype	Oct. 26	Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4
Line1	154.0	152.0	149.3	143.3	135.3	133.7
Line2	155.3	152.3	150.7	143.7	133.7	133.0
Line3	160.0	153.3	152.7	145.7	135.0	134.0
Line4	153.0	152.7	153.0	147.0	136.3	134.0
Sakha 94	156.3	148.7	148.0	143.3	133.0	132.3
Giza 168	152.7	153.7	152.3	145.0	136.0	134.0
$LSD_{0.05}$			3.1			

Data in Table 8 illustrate the effects of sowing dates and genotype interaction on grain yield in the first season. Line 3 recorded the highest grain yield under first and second sowing dates (early sowing), while it was the lowest under the other sowing dates (optimum and late sowing). Moreover, Sakha 94 gave the highest yield under optimum and late sowing. These results indicate that, late genotype can be more suitable for early planting and so did Line 3. These results are in agreement with those of Kumar et al. (1995) they reported that the photothermal non responsive genotypes were always late in heading which occurred in time irrespective of sowing dates. Such genotypes could tolerate high temperature and are suitable for early sowing. Meanwhile, Sakha 94 is more adapted to late sowing than other genotypes. Mahgoub et al. (2006) reported that, in case of late sowing, growing Sakha 94 is recommended.

Table 8. Interaction between six wheat genotypes and sowing dates and their effect on grain yield in 2004/2005 season

	Sowing dates					
Genotype	Oct. 26	Nov. 9	Nov. 23	Dec. 7	Dec. 21	Jan. 4
Line 1	23.9	24.7	28.0	25.8	25.3	18.8
Line 2	22.0	23.2	27.8	24.4	23.2	19.3
Line 3	24.2	26.3	25.3	24.0	22.3	18.1
Line 4	22.6	25.3	27.5	26.1	23.5	15.9
Sakha 94	22.3	23.2	29.3	27.1	26.0	20.6
Giza 168	23.9	24.7	28.9	26.1	25.7	18.2
$LSD_{0.05}$			2.3			

Line 1 gave grain yield similar to that of Giza 168 with insignificant differences from Sakha 94 in average over sowing date in the two years and in the interaction in the first season. This promising line had good yield potentiality and agronomic characters. So, it is recommended to be reevaluated on the national level.

Stability analysis

The analysis of variance revealed that genotypes (G), environments (E) and the G x E interaction mean squares had significant effect on grain yield of the six bread wheat genotypes across 12 environments, i.e. 6 sowing dates in 2-years (Table 9). Singh and Narayanan (2000) reported that, if G x E interaction is found to be significant, the stability analysis can be carried out.

Table 9. Mean squares of combined analysis of variance for grain yield

Source of variation	df	Mean squares
Environments (E.)	11	177.77**
Rep / E	24	4.232*
Genotypes (G)	5	13.12**
ExG	55	4.70**
Error	120	2.5

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

The joint regression analysis of variance showed highly significant differences among genotypes and environments (Table 10). This is indicating the presence of genetic and environmental variability among the studied genotypes. The G x E interaction was, further, partitioned into linear and non-linear (pooled deviation) components. Mean square of the environmental linear effect was highly significant. This means that a large portion of this interaction between genotype and environment was obtained by the linear regression on the environmental means. The magnitude of non-linear components was considerably smaller than that of linear one.

Table 10. Summary of the joint regression analysis of variance for grain yield

Source of variation	df	Mean squares
Genotypes (G)	5	4.37**
Environnent+ (G.xE)	66	11.18**
Environnent (linear)	1	651.8**
GxE. (linear)	5	0.75
Pooled deviation	60	1.37
Pooled Error	144	0.93

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

Eberhart and Russel (1966) define the desired variety as that of a high mean performance, unit regression coefficient (b_i=1) and deviation from regression as small as possible (S^2d=0). In the present study, the regression coefficients of all genotypes were not significantly different from unity. Therefore, the stability performance of the tested genotypes in this case can be predicted on the basis of the other two parameters, i.e., deviation from regression and average yield over all environments (Amin et al., 2005).

Table 11. Stability parameters for grain yield of the six bread wheat genotypes over 12 environments

Genotype	Mean	b_i ±SE	B	S^2d
Line 1	25.33	1.10±0.10	0.10	0.234
Line 2	24.45	0.96±0.10	-0.04	0.083
Line 3	24.01	0.89±0.12	-0.11	0.683
Line 4	23.99	1.10±0.12	0.10	0.512
Sakha 94	25.08	0.97±0.12	-0.03	0.635
Giza 168	25.19	0.99±0.12	-0.01	0.518
Mean	24.67			

The simultaneous consideration of the three stability parameters for the individual genotype revealed that Line 1, Giza 168 and Sakha 94 gave the highest yield of 25.33, 25.19 and 25.08 ardab fadan^{-1} over the grand mean yield with the regression coefficients 1.10, 0.99 and 0.97, respectively, and not significantly different from regression (Table 11). Due to greater value of regression coefficient (b_i > 1.0), Line 1 is expected to give good yield under favorable environmental conditions. The genotypes, Giza 168 and Sakha 94 had above average grain yield, their regression coefficients are close to one (b_i = 0.99 & 0.97). The non-significant standard deviation revealed wide adaptability and stability for grain yield across the tested environments. Similar results were also reported by Sial et al. (1999), Shindin and Lokteva (2000) and Amin (2006). Generally, all genotypes showed slight differences among them in grain yield. This result might be obtained because these genotypes were selected based on their high yield potentiality and adaptability for sowing dates from previous screening trails at the same location.

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إستجابة ستة تراكيب وراثية من قمح الخبز لمواعيد زراعة مختلفة

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أجريت هذه الدراسة على ستة تراكيب وراثية من قمح الخبز اختيرت على أساس كفائتها المحصوليه وتأقلمها مع مواعيد الزراعة من تجارب أولية سابقة بمحطة البحوث الزراعية بسخا. أقيمت تجربة حقلية تحت ستة مواعيد زراعة زرعت على فترات متتاليه كل أسبوعين ابتداء من ١٠/٢٦ وحتى ١/٤ فى موسمين متتاليين ٢٠٠٤/٢٠٠٥ ، ٢٠٠٥/٢٠٠٦. كانت الصفات المدروسة هى عدد الأيام حتى طرد السنابل ، عدد الأيام حتى النضج ، عدد السنابل م$^{-2}$ ، عدد حبوب السنبلة ، وزن الـ ١٠٠٠ حبه و محصول كلاً من الحبوب والقش . أوضحت النتائج أن الزراعة في العشرة أيام الأخيرة من نوفمبر سجلت أعلى عدد أيام حتى طرد السنابل ، عدد حبوب السنبلة ومحصولي الحبوب والقش فى الموسمين ، بينما أدت الزراعة المبكرة أو المتأخرة عن ذلك إلي نقص قيم هذه الصفات في كلا الموسمين .سجل ميعاد الزراعة المبكر (١٠/٢٦) أعلى عدد أيام حتى النضج وأثقل حبوب، فى حين أدي التأخير في ميعاد الزراعة بعد ذلك إلى تقليل قيم هذه الصفات . كان الصنف جيزة ١٦٨ أبكر التراكيب الوراثية فى تاريخ الطرد بينما كانت السلالة ٣ أخرها فى كلا الموسمين. وكان الصنف سخا ٩٤ أبكر التراكيب الوراثية فى عدد الأيام حتى النضج فى الموسمين كما كان أعلى محصول حبوب فى الصنف سخا ٩٤ والسلالة ١ فى الموسم الأول والثانى على التوالى. كما اوضحت النتائج ان التراكيب الوراثية المتأخرة فى طرد السنابل قد تكون أكثر مناسبة للزراعة المبكرة وبناءاً على ذلك فإن السلالة ٣ ربما تكون الأكثر أقلمة للزراعة المبكرة فى حين كان الصنف سخا ٩٤ الأكثر ملائمة للزراعة المتأخرة فى كلا الموسمين. وقد أختبر أيضاً الثبات المظهري للستة تراكيب وراثية مقابل ستة مواعيد زراعة فى سنتين بالنسبة لمحصول الحبوب . كان معامل الانحدار لكل التراكيب الوراثية غير معنوى عن الواحد الصحيح . ولذلك فأن الإداء الثابت للتراكيب الوراثية فى هذه الحالة يتوقع الحصول عليه من خلال الانحراف المعيارى عن الانحدار (S^2d) ومتوسط محصول الحبوب لكل البيئات. و قد أعطت السلالة ١ وجيزة ١٦٨ وسخا ٩٤ أعلى محصول جبوب عن المتوسط العام مع معامل انحدار ١,١٠ ، ٠,٩٩ ، ٠,٩٧ على التوالى مع عدم معنوية الانحراف عن معامل الانحدار . السلالة ١ يتوقع أن تعطى محصول عالى تحت ظروف الزراعة المناسبة حيث أعطت أعلى متوسط محصول حبوب ومعامل انحدار أكبر من الواحد (b_i >1.0) . جيزة ١٦٨ وسخا ٩٤ كان لهما متوسط حبوب أعلى من المتوسط العام ، ومعامل انحدار قريب من الواحد الصحيح (٠,٩٩ ، ٠,٩٧) مع عدم معنوية الانحراف المعيارى (S^2d) لمعامل الانحدار. ولذلك ربما يظهر هذين الصنفين أقلمه واسعة وثبات لمحصول الحبوب مقابل بيئات الاختبار المختلفة.