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Response to Selection for Earliness and Grain Yield in Wheat (*Triticum aestivum* L.) Under Normal and Water Stress Conditions.*

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Abstract:

This study was carried out during the period from 2004/05 to 2006/07 growing seasons, at Faculty of Agriculture, Sohag University, Egypt to estimate observed and expected response to selection and other genetic parameters and calculate drought susceptibility index. Results revealed highly significant differences between F_3 and F_4 families under normal and drought conditions for days to heading, spike length, no. of spikes/plant, no. of kernels/spike, 100-kernel weight and grain yield/plant.

Observed direct response to selection for days to heading was negative and highly significant compared with bulk and the check cultivar in F_4 with values of -5.58 and - 13.88 % and -6.13 and -13.88 % under normal and drought conditions, respectively. The expected response to selection was 3.15 and 3.68% under normal and drought conditions, respectively. Observed direct response to selection for grain yield/plant was positive and highly significant compared with bulk, better parent and the check in F_4 with values of 28.19, 18.59 and 26.09 % and 27.49, 16.67 and 21.20 % under normal and water stress conditions, respectively. On the other hand, the expected response to selection was 11.98 and 9.06% under normal and drought conditions, respectively.

Phenotypic and genotypic coefficients of variation under normal conditions for days to heading of the early families were 4.75 and 4.26% in F_3 and 5.17 and 4.84% in F_4 generation, respectively. While under drought stress conditions those values were 4.26 and 4.05% in F_3 and 4.84 and 4.78% in F_4 generation, respectively. Phenotypic coefficient of variation for grain yield of the highest yielding families under favourable conditions was 14.57 and 13.40 % in F_3 and F_4 generations, respectively, while, it was 13.32 and 12.43 % in the same generations, respectively under water stress conditions.

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Likewise the genotypic coefficient of variability under normal conditions was 12.48 and 11.96 % in F_3 and F_4 generations, respectively. Meanwhile, it was 10.82 and 10.89 % under drought stress conditions in the two generations, respectively.

High broad sense heritability values for days to heading of the early families was obtained under normal and drought stress in F_3 and F_4 generations. While narrow sense heritability was 34.34 and 39.40 % in F_4 generation under normal and drought stress, respectively. The broad sense heritability for grain yield/plant of the highest yielding families was high under normal and water stress in F_3 and F_4 generation, while, the narrow sense heritability was 53.34 and 43.43 % in F_4 generation under the two studied conditions, respectively. These results showed that the pedigree method of selection was effective to produce new lines tolerant to drought stress with high grain yield.

Drought susceptibility index showed that the nine families, i.e., no. 19, 22, 24, 25, 33, 35, 37, 38 and 39 produced relatively high grain yield under drought stress environments due to high yield potential, rather than having low susceptibility to stress environments. These genotypes could be used as source of drought tolerance/or factors contributing to general adaptation.

Introduction:

Wheat is considered the most important cereal crop in terms of area and production. In Egypt, wheat production is far below to meet the local consumption of the growing population of the country which resulted in increasing wheat imports. The total wheat production in 2008 season was 8 million metric tons obtained from 3 million feddans and the annual consumption of wheat was about 14 million metric tons so the imported wheat was about 6 million tons (F.A.O. Statistic Year Book, 2009). Increasing wheat production vertically and horizontally became an important target to reduce the amount of wheat imports, save hard currency and provide enough quantity to meet the increase in internal demands. These targets could be realized through expanding wheat cultivated area in the new reclaimed areas as well as rainfed area with using drought tolerant wheat cultivars. Such cultivars could help increasing land use efficiency.

In Egypt, earliness has several advantages, for instance, early cultivars are highly needed to fit in new crop intensive rotation as planting cotton after wheat and planting wheat after harvesting short duration vegetable crops, ect. Also, early cultivars are also prefered to escape drought, heat, diseases, pests and other stress injuries that occure at the end of growing season (Menshawy, 2007).

The efficiency of a breeding program for drought tolerance depends largely on the efficiency of selection criteria and the selection method used to achieve genetic improvement through selection. In addition to the complexity of drought itself (Passioura, 1996, 2007), plant response to drought is complex and different mechanisms are adopted by plants when they encounter drought (Levitt 1980, Jones et al. 1981, Jones 2004). The most important mechanism is drought escape by rapid development which allows plants to finish their cycle before severe drought stress occur, so the selection for earliness is very beneficial to drought tolerance. Nasr and Ghoshe (1977) found 92 % heritability estimate for heading date in segregated wheat population grown under rainfed conditions in semi-arid region of the Middle East in Iran. Broad and narrow sense heritabilities for heading date were 0.87 and 0.85 (Calzolari *et al.*, 1980). The broad sense heritabilities for heading date ranged from 82.4 to 90.8 % in seven crosses (Das and Razzaque, 1983)

The increase in wheat grain yield is considered the final goal for breeding programs under drought conditions to face the growing population requirements (Tammam et al., 2004a and b), thereby it has been advocated to develop genotypes, which consistently show superior yields. In the breeding programs the first step is to identify, the superior tolerant genotypes to be used. Heritability estimates of developmental traits in spring wheat were intermediate to high (Mou and Kronstad, 1994 and Menshawy, 2007). Heritability of days to heading and grain yield has been studied under drought conditions by many investigators. Broad sense heritability for days to heading and grain yield were high (Calzolari *et al.*, 1980, Kheiralla *et al.*, 1993, Wiersma *et al.*, 2001 and Shamroukh, 2006) On the other hand, narrow sense heritability values were moderate for days to heading and grain yield/plant (Attia, 2003 and Shamroukh, 2006). Information about association of earliness and grain yield and its components can help breeders for increasing the selection efficiency (Menshawy, 2007).

The objective of this study was to estimate the selection response for earliness and grain yield under normal and drought stress conditions.

Material and methods

The present study was carried out during the period from 2004 /2005 to 2006/2007 growing seasons, at Faculty of Agriculture, Sohag University, Egypt, to estimate the response to selection (i. e. pedigree selection) under normal and water stress conditions, in early generations of a bread wheat (*Triticum aestivum* L. em. Thel) population originated from the cross between Sids 4 and Tokwie. The genetic parameters were estimated in F3 and F4 generations. The pedigree and origin of the two parents and the check (Sahel 1) is presented in table 10

Table (1): The pedigree and origin of the parents and the check (Sahel 1) used in this study.

Parental name	Pedigree	Origin
Sids 4 (P1)	May'S'/Mon'S'//CMH74A.592/ 3/Giza 157*2	Egypt
Tokwie (P2)	------	South Africa
Sahel 1	NS 732/PIMA//Veery'S'	ICARDA

In the 2004 / 05 season, 1000 plants of F_2 generation were grown in four non-replicated plots. Each plot consisted of 12 rows 3 m long, 20 cm apart and grain spaced 10 cm within row (average 30 individual plant/row). Also, the parents and the local check (Sahel 1, drought tolerant) were grown alongside each a row. The cultural practices were carried out as recommended for wheat production. Data were collected on 600 harvested plants. Data were recorded on number of days to heading, No of spikes/plant, 100 kernels weight and grain yield/plant for each individual plant. The 60 highest yielding plants and 60 earliest plants were selected. An equal number of grains from each plant (600 plants) were bulked to give F_3 random bulk sample.

In the 2005/06 season, two field experiments were conducted each in a randomised complete block design of four replications. The first experiment did not receive any irrigation after jointing stage (drought stress "D"), while the other one was grown in supplemental water applied regularly as recommended (Normal "N"). Each selected plant from the F2 generation was planted in the two experiments. Each experiment comprised 120 F_3 families (60 high yielding and 60 early families). At the end of the season, the 15 earliest and 16 high yielding families were identified from both experiments after the statistical analysis. The best plant from each of these families was saved (31 plants; 15 for earliness and 16 high yielding).

In 2006/07 season (F_4 generation), two field experiments were conducted as in the previous season. The selected plants from the F_3 generation (31 plants) were evaluated under stressed and normal irrigated conditions; along with the two parents, bulk sample and the check cultivar Sahel 1. Days to 50% heading, spike length, no. of spike/plant, no. of kernel/spike, 100-kernel weight and grain yield/plant ere recorded.

The analysis of variance for randomized complete block design was carried out according to Snedecor and Cochran (1980).

1- The observed and expected response to selection were calculated using the following formula :

Observed response: the difference between the mean of the selected families and the mean of bulk population, best parent and check cultivar.

Expected response = i H_n σ p

where σ p = is the phenotypic standard division, H = narrow sense heritability and i = selection intensity.

The degrees of freedom and expected mean squares are present in Table (2).

Table (2): the analysis of variance and expected means of squares:

Source of variance	D.F	M . S	E . M . S
Replication	r – 1	M_3	$\sigma^2 e + g\,\sigma^2 r$
Genotypes	g – 1	M_2	$\sigma^2 e + r\,\sigma^2 g$
Error	(r –1) (g –1)	M_1	$\sigma^2 e$

2 – The genotypic variance $\sigma^2 g = M_2 - M_1/r$

3 – The phenotypic variance $\sigma^2 p = \sigma^2 g + \sigma^2 e$

4 – The genotypic (G.C.V%) and phenotypic (P.C.V%) coefficient of variability were calculated as $\sigma g / \bar{x}$ and $\sigma p / \bar{x}$ respectively .

5 – Heritability in the broad sense (H) was estimated as the ratio of genotypic ($\sigma^2 g$) to the phenotypic ($\sigma^2 g + \sigma^2 e$) variance according to Walker (1960).

6 – Heritability in the narrow sense was estimated using the correlation and offspring regression according to Smith and Kinman (1965) as follow:-

Parent – offspring generation rxy h = b/2rxy

F_2 , F_3 3 /4 2 / 3 b F_3 , F_2

F_3 , F_4 7 / 8 4 / 7 b F_4 , F_3

7 - The genetic parameters were estimated as outlined by Mather and Jinks (1977) and Falconer (1989).

8 – Comparisons among means were calculated by using revised L.S.D where, L.S.D = least significant difference, and was calculated as:

R L S $D_\alpha = (t^-)_\alpha * \sqrt{(2MSE / r)}$ (El Rawi and Khalafalla 1980)

Where t^- is the t value from "minimum-average-risk t-table" at F-value of treatments, treatment df and experimental error df.

9 - The significance of observed direct and correlated response to selection was measured as deviation percentage of families mean from the bulk or the better parent or the check using L. S. D. where, L.S.D = least significant differences between the bulk or the better parent or the check values and mean of the selected families, and was calculated as:

$L.S.D = \sqrt{(MSE / r + MS_E/fr)} * t_\alpha$

Where f: number of families r: number of replicates

Drought susceptibility Index (S): was calculated according to the method of Fischer and Maurer (1978).

Results and discussion

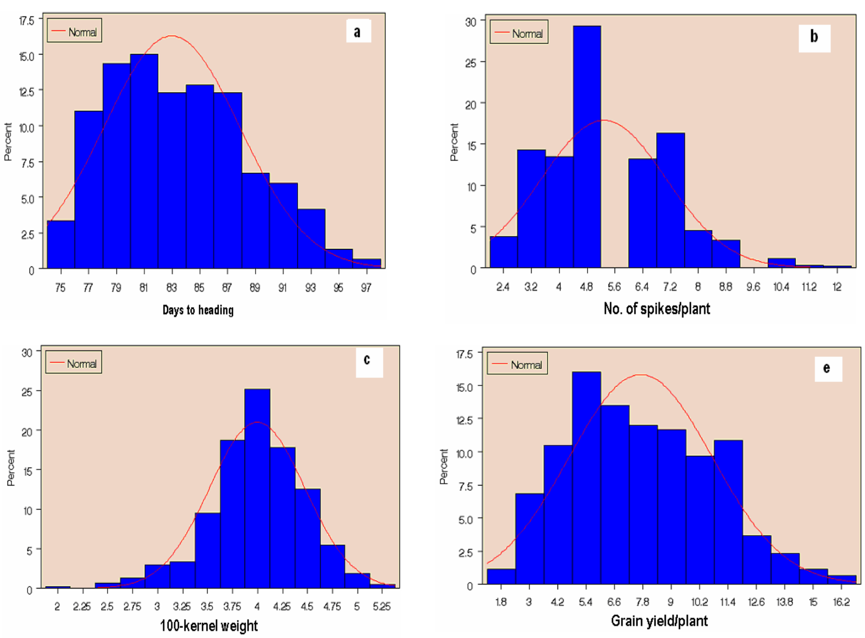
I- Evaluation of the base population (F_2 –generation).

The results in Table (3) indicated that number of days to 50 % heading ranged from 74.00 to 97.00 with an average of 82.98

days and variation coefficient was 5.91 in F_2 generation under normal conditions (see histogram a). The average number of spikes/plant was 5.28 with a range from 2.00 to 11.00 and variation coefficient was 33.84 in F_2 under normal conditions, as shown histogram (b). The average 100-kernel weight ranged from 2.00 to 5.26 with an average of 3.99 and coefficient of variation was 11.89 in F_2 (histogram c). The average grain yield/plant ranged from 1.36 to 16.62 with an average of 7.70 and coefficient of variation was 39.29 in F_2 generation (see histogram d).

Table (3): Range, mean and coefficient of variation in F_2 plants for days to heading, no. of spikes/plant, 100-kernel weight and grain yield/plant under normal conditions.

Trait	Range	Means±S.E	C.V. %
1–Days to heading	74.00 – 97.00	82.98±0.20	5.91
2–No. of spikes / plant	2.00 – 11.00	5.28±0.07	33.84
3-100 kernel weight (gm)	2.00 – 5.26	3.99±0.02	11.89
4–Grain yield / plant (gm)	1.36 – 16.62	7.70±0.12	39.29



Histograms (a, b, c and d) shows the normal distribution of days to heading , no. of spikes/plant, 100 kernel weight and grain yield/plant as traits on the F_2 plants under normal conditions

Selection for earliness.

1-Response to direct selection for early heading under normal and water stress conditions.

The analysis of variance for all studied traits (Table 4) showed highly significant differences among F_3 and F_4 families under normal and water stress conditions.

Data presented in Table (5) showed that number of days to 50 % heading in the F_4 generation ranged from 68.50 to 82.50 with an average of 71.05 days and from 68.00 to 73.00 with an average of 70.46 days under normal and water stress conditions**,** respectively. The four families, i.e., no. 35, 37, 56 and 89 from earliness selection were significantly earlier than the earlier parent in days to heading under normal and water stress conditions. Meanwhile, all selected families were significantly earlier than check (Sahel 1) under the two conditions. These results refer to that the pedigree selection was more effective in isolating early genotypes in heading date. These results were in agreement with those obtained by Knott, 1979, Pawar *et al*., 1986 and Tammam *et al*., 2004a.

The observed response to selection for earliness (Table 6) compared with bulk, better parent and check were (-5.58, -0.98 and - 13.88 %) and (-6.13, -1.19 and - 13.88 %) in F_4 families under normal and drought conditions, respectively. On the other hand, the expected response to selection was 2.24 and 2.59 days under normal and drought conditions, respectively. These results are in line with those reported by Kheiralla *et al.,* 1993, Tammam *et al*., 2004a and Shamroukh, 2006.

Values of phenotypic (P.C.V.%) and genotypic (G.C.V.%) coefficients of variation in F_3 and F_4 generations under normal conditions (Table 7) cleared that PCV and GCV were 4.75 and 4.26% in F_3 and 5.17 and 4.84% in F_4 generation, respectively. Under drought stress condition those values were 4.55 and 4.05% in F_3 and 5.26 and 4.78% in F_4 generation, respectively. Many investigators obtained PCV values ranged from 3.82 to 6.15% and GCV values ranged from 3.61 to 5.81% (Amin *et al*, 1992, Kheiralla *et al*., 1993, Tammam, 1995 and Tammam *et al*., 2004a).

The broad sense heritability for days to heading (Table 7) was 80.33 and 79.52 % in F_3 generation under normal and water stress, respectively, while, it was 87.57 and 82.59 % in F_4 generation under normal and water stress, respectively. Narrow sense heritability was 34.34 and 39.40 % in F_4 generation under normal and drought stress, respectively. These results are in line with those reached by Wiersma *et al.,* 2001, Tammam *et al*., 2004a and Shamroukh, 2006.

II-2-Effects of selection for earliness under normal and water stress conditions on correlated traits.

Data in Table (5) presented the range and average of F_4 generation under normal and water stress conditions for the studied traits. The average spike length ranged from 11.03 to 15.93 with an average of 13.23 cm and from 9.28 to 14.23 with an average of 11.70 cm under the two environments, respectively. However, the eight families, i.e., no. 3, 12, 35, 52, 56, 75, 100 and 105 in F_4 were significantly longer than the check under drought conditions.

The range of no. of spikes/plant varied from 4.50 to 10.60 with an average of 6.96 spikes/plant and from 4.40 to 9.00 with an average of 6.15 spikes/plant in F_4 generation under the two environments, respectively. The two families, i.e., no. 37 and 56 of the earliness selection surpassed the check in no. of spikes/plant under normal and water stress conditions.

Mean 100-kernel weight ranged from 4.14 to 5.72 with an average of 5.21 and from 3.74 to 5.22 with an average of 4.65 gm under the two conditions, respectively. The six families, i.e., no. 12, 35, 37, 52, 53 and 56 were significantly higher than the better parent under drought condition. While, all selected families surpassed the check except no. 57 and 75 under water stress conditions.

The average no. of kernels/spike ranged from 34.01 to 64.12 with an average of 49.99 and from 27.96 to 54.11 with an average of 43.14 under the two environments, respectively. The two families, i.e., no. 56 and 105 were significantly higher than the better parent under normal condition. While, they surpassed the check under drought conditions.

The average grain yield/plant ranged from 13.82 to 22.02 with an average of 16.65 g/plant and from 9.47 to 15.59 with an average of 12.67 g/plant under the two environments, respectively. The three families in the early families, i.e., no. 35, 37 and 56 were significantly out-yielded the better parent and the check under normal and water stress conditions.

II-4- Drought susceptibility index (DSI).

The values of drought susceptibility index for families selected for earliness (Table 8) ranged from 0.72 to 1.50 and from 0.66 to 1.31 in F_3 and F_4 generations, respectively. Data indicated that six families in F_3 and seven families in F_4 gave low values of drought susceptibility index (DSI < 1), but the five families, i.e., no 3, 35, 52, 85 and 103 produced the low values of susceptibility index in F_3 and F_4 generation, (0.73 and 0.72), (0.98 and 0.91), (0.72 and 0.67), (0.73 and 0.66), (0.72 and 0.72), respectively. Superior genotypes for drought tolerance of the selected families gave the low values of drought susceptibility index and the highest grain yield under drought. These families were no. 35 in F_3 and F_4 generations and no. 37 in F_4 generation.

III-Selection for grain yield.

III-1-Response to direct selection for grain yield under normal and water stress conditions.

The analysis of variance in Table (4) revealed highly significant differences among F_3 and F_4 families for all studied traits under normal and water stress conditions.

The results in Table (9) showed that the range of F_4 generation varied from 19.21 to 26.55 with an average of 21.54 g/plant under normal condition and was from 14.28 to 19.37 with an average of 16.22 g/plant under drought condition. All selected families under normal condition significantly exceeded the better parent except (no. 1, 24 and 35), also all selected families under drought stress significantly outyielded the high yielding parent except (no.1, 13, 28, 42 and 56). Meanwhile, all selected families under normal condition and all selected families under drought stress except (no. 1 and 42) significantly exceeded the check.

The observed response to selection for high yielding families (Table 10) compared with bulk, better parent and check were (28.19, 18.59 and 26.09 %) and (27.49, 16.67 and 21.20 %) in F_4 families under normal and drought conditions, respectively. On the other hand, the expected responses to selection were 2.58 and 1.47 gm under normal and drought conditions, respectively. These results are in agreement with many studies, Kheiralla, 1993, Tammam, 1995 and Tammam *et al.*, 2004a.

The phenotypic coefficient of variation for grain yield/plant under favourable conditions (Table 7) was 14.57 and 13.40 % in F_3 and F_4 generations, respectively. While, it was 13.32 and 12.43 % in the same generations, respectively under water stress conditions. Likewise the genotypic coefficient of variability under normal condition was 12.48 and 11.96 % in F_3 and F_4 generations, respectively. Meanwhile, it was 10.82 and 10.89 % under drought stress conditions in the two generations, respectively.

The broad sense heritability for grain yield/plant (Table 7) was 73.36 and 65.96 % in F_3 generation under normal and water stress, respectively as well as 79.66 and 76.76 % in F_4 generation under normal and drought stress conditions, respectively. While, the narrow sense heritability was 53.34 and 43.43 % in F_4 generation under the two studied conditions, respectively. These results are in agreement with those obtained by Tammam, 1995, Wiersma *et al.*, 2001 and Tammam *et al.*, 2004a.

III-3-Effects of selection for grain yield under normal and water stress conditions on correlated traits.

The range of days to heading in F_4 under normal condition (Table 9) varied from 68.50 to 85.25 with an average of 77.72 days and was from 68.00 to 84.50 with an average of 77.02 under water stress conditions. The two families, i.e., no. 35 and 56 of high yielding families were significantly earlier than the earlier parent under normal and drought conditions. Meanwhile, all selected families under normal condition except (no. 1, 19 and 39) and all selected families under water stress condition except (no. 1, 19, 39 and 43) were significantly earlier than the check.

The average spike length in F_4 generation (Table 9) ranged from 12.38 to 16.95 with an average of 14.07 cm and from 11.40 to 14.75 with an average of 12.82 cm under the two environments, respectively. One family, i.e., no. 19 under normal conditions was significantly longer than the better parent. While, all selected families except (no. 45) under normal conditions and all selected families except (no. 13, 25 and 45) under drought condition were significantly longer than the check.

The range of no. of spikes/plant in F_4 (Table 9) varied from 6.00 to 11.40 with an average of 8.92 spikes/plant and from 5.00 to 10.55 with an average of 8.04 spikes/plant under the two environments, respectively. The two families, i.e., no. 6 and 25 under normal conditions and three families, i.e., no. 6, 25 and 45 under drought condition were significantly higher than the better parent. While, the nine families, i.e., no. 6, 13, 19, 25, 39, 42, 43, 45 and 56 under normal and drought stress conditions surpassed the check.

Mean 100-kernel weight in F_4 (Table 9) ranged from 4.95 to 5.98 with an average of 5.45 and from 4.41 to 5.35 with an average of 4.88 gm under the two conditions, respectively. Moreover, the nine families, i.e., no. 6, 22, 24, 25, 28, 33, 35, 39 and 45 under water stress conditions were significantly higher than the better parent. Meanwhile, all selected families under water stress condition surpassed the check.

The average no. of kernels/spike in F_4 (Table 9) ranged from 40.56 to 63.38 with an average of 48.60 and from 32.29 to 54.11 with an average of 40.78 under the two conditions, respectively. One family, i.e., no. 56 surpassed the better parent and the check under normal conditions and one family, i.e., no. 56 significantly exceeded the check under water stress conditions.

These results showed that the selection for high yield under water stress condition was more effective in improving grain yield/plant in the dry land through earliness and some major yield components. These results are in agreement with those obtained by Kheiralla, 1993, Tammam, 1995, Tammam *et al.*, 2004a and Shamroukh, 2006.

III-4- Drought susceptibility index (DSI).

The values of drought susceptibility index for the highest yielding families (Table 8) ranged from 0.69 to 1.34 and from 0.60 to 1.53 in F_3 and F_4 generations, respectively. Seven families in F_3 generation and nine families in F_4 gave low values of drought susceptibility index (DSI < 1), but the seven families, i.e., no 19, 22, 24, 25, 33, 35 and 38 have tolerance for drought stress in both generations. Meanwhile, the four families, i.e., no. 24, 25, 33 and 38 and the six families, i.e., no. 19, 22, 24, 25, 33 and 38 were superior for drought tolerance and had high grain yield under drought in F_3 and F_4 generations, respectively. Moreover, superior families for drought tolerance of the selected families gave the low value of drought susceptibility index and high grain yield under drought. These families were no. 24, 25, 33 and 38 in two generations.

A significant and negative correlation (Table 11) was established between the mean grain yield under normal and DSI (r=-0.56*) and between the mean grain yield under water stress and DSI (r=-0.48*). This would indicate that about 50% of variation in drought susceptibility in this set of genotypes could be ascribed to variation in yield potential, as defined by DSI, need not be have a high yield since DSI provides a measure of tolerance based on minimization of yield loss under stress, rather than no stress yield as pointed by Bruckner and Frohberg (1987). These results are in accordance with those reported by Bidinger *et al.*, 1987, Kheiralla, 1994 and Shamroukh, 2006.

Finally it could be concluded that drought susceptibility index indicated that drought tolerance could be due to high yield potential and / or low susceptibility to stress (DSI < 1). The nine families, i.e., no. 19, 22, 24, 25, 33, 35, 37, 38 and 39 produced relatively high grain yield under drought stress and low drought susceptibility index (tolerance for drought). These genotypes could be used as source of drought tolerance or factors contributing to general

Table (11): Mean days to heading, grain yield/plant under normal and water stress conditions and drought susceptibility index and correlations between them of the highest yielding families in F_4 generation.

Selected families	DSI	DHn	DHs	GYn	GYs
1	0.98	83.50	82.75	19.21	14.51
6	1.53	79.00	78.25	26.32	16.28
13	1.22	75.75	75.00	21.44	14.91
19	0.67	82.50	81.25	20.69	17.23
22	0.60	76.00	75.75	20.51	17.43
24	0.62	77.25	76.50	19.35	16.37
25	0.76	78.25	77.25	21.50	17.39
28	1.15	76.00	75.00	21.24	15.11
33	0.68	75.75	75.25	21.32	17.70
35	0.88	68.50	68.00	19.44	15.18
38	0.73	78.75	78.00	21.31	17.45
39	0.99	85.25	84.50	20.18	15.17
42	1.32	78.75	78.25	21.30	14.28
43	1.12	80.75	80.25	22.21	16.01
45	1.08	78.00	77.25	26.55	19.37
56	1.26	69.50	69.00	22.02	15.09
r		-0.05	-0.05	0.56*	-0.48*
r			1.00**	0.005	0.06
r				0.003	0.05
r					0.46

adaptation and can be used in breeding programs to produce lines or cultivars having high grain yield ability and high tolerance for drought stress. These results are in agreement with those obtained by Kheiralla, 1993, Farshadfar *et al.,* 2001 and Tammam *et al.*, 2004b.

References

Amin, M.R., N.C.D. Barma and M. A. Razzaque. 1992. Variability, heritability, genetic advance and correlation study in some quantitative characters in durum wheat. Rachis, 11(1/2): 30-32.

Attia, I.A. 2003. Selection for drought tolerance in wheat. Ph.D. Thesis, El-Minia Univ., Egypt.

Bidinger, F.R., V. Mahalakshmi and G.D.P Rao. 1987. Assessment of drought resistance in pearl millet [*Pennisetum american* L.]. II-Estimation. Aust. J. Agric. Res., 38: 49-59.

Bruckner, P.L and R.C. Frohberg. 1987. Stress tolerance and adaptation in spring wheat .Crop Sci., 27:31-36.

Calzolari, A.M., O.O. Poldoro and H.C. Conta. 1980. Inheritance of the characters days to heading and number of spikelets in the ear in wheat (*Triticum aestivum* L.) crosses. Expere. Regional Agropecria Pergamina, no. 160, pp. 11.

Das, A. and C.A. Razzaque. 1983. Inheritance of heading in some crosses of wheat. Indian. J. Agric. Sci., 53: 177 - 179.

El-Rawi, K. and A.M. Khalafalla. 1980. Design and analysis of agricultural experiments, El Mousel Univ., Iraq, 19.

F.O.A. 2009. Food and Agriculture Organization of United Nations, Vial delle terme di caraclla, 00100. Rome, Italy.

Falconer, D.S. 1989. Introduction to quantitative genetics. 2rd ed John wiley and Sons, New York.

Fischer, R. A. and R. Maurer. 1978. Drought resistance in spring wheat cultivars. I. Grain yield response. Aust. J. Agric. Res., 29: 897 - 912.

Jones, M.M., N.C. Turner and C.B. Osmond, 1981. Mechanisms of drought resistance. In: Paleg LG, Aspinall D, eds. The physiology and biochemistry of drought resistance in plants. Academic Press, 15–35.

Jones, H. 2004. What is water use efficiency? In: Bacon MA, ed. Water use efficiency in plant biology. Oxford: Blackwell, 27–41.

Kheiralla, K.A. 1993. Selection response for grain yield and its components in a segregating population of spring wheat. Assiut. J. of Agric. Sci. 24: 87-98.

Kheiralla, K.A. and M.M. El-Defrawy. 1994. Inheritance selection for early heading in wheat under water stress and non-stress conditions. Assiut J. of Agric. Sci., 23(5):1-17.

Kheiralla, K.A., E.E, Mahdy, and R.A. Dawood. 1993. Selection for early heading and correlated response in grain yield and its components of spring wheat. Assiut J. of Agric. Sci., 24(4):95-106.

Knott, D. R. 1979. Selection for yield in wheat breeding. Euphytica, 28:37-40.

Levitt, J. 1980. Stress terminology. In: Turner NC, Kramer PJ, eds. Adaptation of plants to water and high temperature stress. New York: Wiley, 473–439.

Mather, K. and J. L. Jinks. 1977. Introduction to biometrical genetics. Chapman and Hall, Londan.

Menshawy, A.M.M. 2004. Genetical studies on spring wheat. Ph.D. Thesis, Zagazig Univ. Egypt.

Menshawy, A.M.M. 2007. Evaluation of some early bread wheat genotypes under different sowing dates: 2. Agronomic characters. Egypt J. Plant Breed., 11(1): 41-55.

Mou, B. and W.W.E. Kronstad, 1994. Duration and rate of grain filling in selection winter wheat population. Crop Sci., 34: 833-837.

Nasr, H.G. and D. Ghoshe, 1977.Variation and covariance in segregating wheat populations grown under rain fed and irrigated conditions in semi-arid region of Middle East. Iran J. Agric. Res., 5:1-13.

Passioura JB. 1996. Drought and drought tolerance. Plant Growth Regulation, 20: 79–83.

Passioura JB. 2007. The drought environment: physical, biological and agricul -tural perspectives. Journal of Experimental Botany, 58: 113–117.

Pawar, I.S., R.S. Paroda and S. Singh. 1986. Acomprarison of pedigree selection, single seed descent and bulk method in two wheat (*Triticum Aestivum* L.em Thel) crosses. Crop Improv., 13:34-37.

Shamroukh, M. 2006. Breeding for drought tolerance in bread wheat under new land condition in Upper Egypt. Ph.D. Thesis, Minia Univ. Egypt.

Smith, J.D. and M.L. Kinman. 1965. The use of parent-offspring regression as estimation of heritability. Crop Sci., 5(6): 595-596.

Snedecor, G.W. and W.G. Cochran. 1980. Statistical methods.7th ed.Lowa State Unv. Press., Ames., Lowa, U.S.A.

Tammam, A.M. 1995. Response to selection for agronomic traits in wheat. Ph.D. Thesis, Fac. Agric. Assiut Univ. Egypt.

Tammam, A.M., M.S.F. El-Ashmoony, A.A. El-Sherbeny and I.A. Amin. 2004a. Selection responses for drought tolerance in two bread wheat crosses. Egypt. J. Agric. Res., 82 (3):1213-1226.

Tammam, A.M., M.S.F. El-Ashmoony, A.A. El-Sherbeny and I.A. Amin. 2004b. Breeding for drought tolerance and the association of grain yield and other traits of bread wheat. Egypt. J. Agric. Res., 82 (3):1227-1241.

Walker, T.T. 1960. The use of a selection index technique in the analysis of progeny row data. Emp.Cott.Gr.Rev., 37: 81-107.

Wiersma, J.J., R.H. Busch, G.G. Fulcher and G.A. Hareland. 2001. Recurrent selection for kernel weight in spring wheat. Crop Sci., 41: 999-1005.

"الاستجابة للإنتخاب للتبكير و محصول الحبوب فى القمح (*ترتيكم استيفم ل.*) تحت ظروف الري العادي والاجهاد المائي "

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أجرى هذا البحث بكلية الزراعة – جامعة سوهاج – مصر خلال الثلاث مواسم الشتوية من ٢٠٠٤ / ٢٠٠٥ إلى ٢٠٠٦ / ٢٠٠٧ م لتقدير الاستجابة الفعلية و المتوقعة للإنتخاب تحت الظروف العادية وظروف الجفاف و تقدير المكونات الوراثية الاخري وحساب معامل الحساسية للجفاف لصفة محصول الحبوب. أظهر تحليل التباين وجود اختلافات معنوية بين عائلات الجيل الثالث و الرابع تحت الظروف العادية وظروف الجفاف لعدد الأيام حتى طرد السنابل ، طول السنبلة ، عدد السنابل بالنبات، عدد الحبوب بالسنبلة ، وزن ١٠٠ حبة ، محصول الحبوب للنبات.

الاستجابة الفعلية لعدد الأيام حتى طرد السنابل للإنتخاب لعائلات التبكير كان سالب و عالي المعنوية مقارنة بالعشيرة المجمعة و صنف المقارنة (ساحل ١) فى الجيل الرابع حيث كانت –٥,٥٨ و –١٣,٨٨% تحت الظروف العادية وكانت –٦,١٣ و –١٣,٨٨% تحت ظروف الجفاف. ومن ناحية أخرى كانت الاستجابة المتوقعة ٣,١٥ و ٣,٦٨% تحت الظروف العادية وظروف الجفاف على التوالى. الاستجابة الفعلية لمحصول الحبوب للنبات للإنتخاب لعائلات المحصول العالي كان موجب و عالي المعنوية مقارنة بالعشيرة المجمعة والاب الافضل و صنف المقارنة فى الجيل الرابع حيث كانت ٢٨,١٩ و ١٨,٥٩ و ٢٦,٠٩% تحت الظروف العادية على التوالى وكانت ٢٧,٤٩ و ١٦,٦٧ و ٢١,٢٠% تحت ظروف الجفاف على التوالى. ومن ناحية أخرى كانت الاستجابة المتوقعة ١١,٩٨ و ٩,٠٦ % تحت الظروف العادية وظروف الجفاف على التوالى.

معامل الاختلاف المظهري و الوراثي تحت الظروف العادية لعدد الأيام حتى طرد السنابل كان ٤,٧٥ و ٤,٢٦% في الجيل الثالث وكان ٥,١٧ و ٤,٨٤% في الجيل الرابع بينما تحت ظروف الجفاف كان ٤,٢٦ و ٤,٠٥% في الجيل الثالث وكان ٤,٨٤ و ٤,٧٤% فى الجيل الرابع. معامل الاختلاف المظهري تحت الظروف العادية لمحصول الحبوب للنبات كان ١٤,٥٧ و ١٣,٤٠% في الجيل الثالث و الرابع على التوالى بينما تحت ظروف الجفاف كان ١٣,٣٢ و ١٢,٤٣% في نفس الاجيال على التوالى . كذلك معامل الاختلاف الوراثي تحت الظروف العادية لمحصول الحبوب للنبات كان ١٣,٤٨ و ١١,٩٦% في الجيل الثالث و الرابع على التوالى بينما تحت ظروف الجفاف كان ١٠,٨٢ و ١٠,٨٩% في نفس الاجيال

على التوالى.

أرتفاع قيم درجة التوريث المقدرة بالمعنى العريض لعدد الأيـــام حتـــى طرد السنابل للإنتخاب للتبكير تحت الظروف العادية وظروف الجفاف فـــي الجيل الثالث و الرابع. بينما درجة التوريث بالمعنى الضيق كانت ٣٤,٣٤ و ٣٩,٤٠% في الجيل الرابع تحت الظروف العادية وظروف الجفـــاف علـــى التوالى. كذلك أرتفاع قيم درجة التوريث المقدرة بالمعنى العريض لمحصول الحبوب للنبات للإنتخاب للمحصول العالي تحت الظروف العادية وظـــروف الجفاف في نفس الاجيال. بينما درجة التوريـــث بـــالمعنى الـــضيق كانـــت ٥٣,٣٤ و ٤٣,٤٣% في الجيل الرابع تحت الظـــروف العاديـــة وظـــروف الجفاف على التوالى.

والنتائج المتحصل عليها من الدراسة تشير إلى أنه يمكن الحصول علـــي سلالات تتحمل الجفاف ذات محصول حبوب عالي باستخام طريقة تـــسجيل النسب.

أظهرت نتائج معامل الحساسية المنخفض للجفاف الى أن تسعة تراكيـــب وراثية رقـــم ١٩ ، ٢٢، ٢٤ ، ٢٥ ، ٣٣ ، ٣٥ ، ٣٧ ، ٣٧ ، ٣٩ أعطـــت معدل عالى من محصول الحبوب تحت ظروف الجفـــاف بجانـــب معامـــل الحساسية المنخفض للجفاف (التحمل للجفاف) . هذه التراكيـــب الوراثيـــة يمكن أن تستخدم كمصدر لتحمل الجفاف وألاقلمة العامة .