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# PERFORMANCE AND STABILITY OF SOME DURUM WHEAT GENOTYPES UNDER DIFFERENT SOWING DATES IN UPPER EGYPT

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## ABSTRACT

**The present investigation was carried out at Shandaweel, Agricultural research station, Agricultural research center, Egypt, during the three seasons of 2004/05 2005/06 and 2006/07. The objectives were to evaluate some durum wheat genotypes under three sowing dates, effect of late sowing dates (heat stress) on grain yield, yield components, genotype × environment interaction and stability parameters. Eight of durum wheat genotypes were used in this study. These genotypes were sown under three sowing dates, the recommended date of 20th Nov., 5th Dec. and 20th Dec. A randomized complete block design was used with three replications. Data of days to heading, yield and yield components were collected from each plot and were subjected to analysis of variance according to Gomez and Gomez, (1984). Stability statistics and heat susceptibility index were estimated according to Eberhart and Russell (1966) and Fischer and Maurer (1978).**

**Results showed that sowing dates were highly significant for all studied characters. Combined data showed that number of days to heading decreased by delay the sowing dates. Genotype No. 4**

(Bani-sawef 1) was the earliest, while the genotype No. 3 was the latest . The reduction in the number of days to heading ranged from 7.09 to 11.06%. Data indicated that the recommended sowing dates produce the highest number of spikes/m$^2$ compared with late date, 1000-kernel weight and number of kernels/spike. The highest values were obtained by the genotype No. 1(378.78 spikes/m$^2$), genotype No. 3 (56.46 gm) and genotypes No. 1 and 8 (43.17 and 43.95 kernels/spike) in the three characters respectively. On the other hand, the reduction in the number of spikes/m$^2$, 1000-kernel weight and number of kernels/spike result exposed heat stress ranged from -3.56 to 14.15, -1.01 to 9.81 and -3.37 to 16.78 in the three characters respectively. Genotypes number 1, 2 and 5 gave the highest values of grain yield (18.71, 18.08 and 18.34 Ard./fed.), respectively. While reduction in grain yield resulted from late sowing dates (heat stress) ranged from 22.70 to 32.03 %.

The data of stability analysis indicated highly significant differences between genotypes and environments and their interactions for all studied traits. For days to heading, stability parameters showed that three genotypes (2, 6 and 8) had stability, while genotype No. 2 was adapted to unfavorable environments, for days to heading. For number of spikes/m$^2$, data of stability parameters indicated that four genotypes (1, 4, 6 and 8)were stable, but genotype No. 6 (Bani-sawef 4) was adapted to unfavorable conditions (heat stress). For 1000-kernel weight, stability parameters showed that all genotypes were stable except genotypes No. 4 and 7, while genotypes 6 (Bani-sawef 4) and 8 (Sohag 3) were stable under unfavorable conditions. For number of kernels/spike, data showed that six genotypes were stable for nine environments (1, 2, 4, 6, 7 and 8), but genotypes No. 4, 6 and 8 were adapted to unfavorable conditions (heat stress). For grain yield, stability parameters ($b_i$ and $S^2d_i$) and mean performance ($\bar{X}$) showed that genotypes No. 1 and 8 (Sohag 3) were stable, on the other hand, Sohag 3 was stable under late sowing dates (tolerance to heat stress).

Data of heat susceptibility index for grain yield under normal and very late sowing dates indicated that five genotypes (No. 2, 3, 6, 7 and 8) were tolerant to heat stress (late sowing dates) and produce high grain yield under heat stress.

## INTRODUCTION

Wheat is considered as the most spread grains on earth and has the biggest production which is about 30 % of total grain production in the world. Wheat occupies about 22 % of the cultivated area (29 %) of the area of cereal crops in the world equals 500 million feddan distributed on different areas of the world. Wheat is considered as one of the most important cereal crops not only in Egypt but also in the world. The cultivated area in Egypt reached 2.92 million feddan in 2007/2008 season and produced about 7.977 million tones with average 18.21 Ardab/fed., equal. to 2.73 ton (refer to the ministry of agriculture and land reclamation- economic affairs sector).

Wheat crop is often affected by different types of stresses at various times during its growth stages, a biotic stresses including heat, cold and drought may be the major limiting factors. During the grain filling period of wheat in north Africa and west Asia, wheat crop is often affected by high temperature which severely limits grain yield in these regions. Spring wheat is successfully grown under various environments.

Heat stress (from 33 to 43 C°) during grain filling periods had significant effects on plant height, 1000 grain weight, and grain yield, except for number of days to heading. Delayed planting adversely affected yield and yield components of wheat genotypes. All genotypes significantly produced higher grain yields under normal date of sowing than under late date of sowing, (Sial *et al.* 2005).

Evaluation of wheat genotypes under different environmental conditions is very important, in the breeding program, to identify and select the high yielding and tolerant genotypes under harsh conditions. Many studies reported significant differences among wheat cultivars in their response to environmental conditions and hence, their grain yields (Salem et. al, 1990; Ismail, 1995; Hamada et. al, 2002 and Said, 2003). Stable genotype is, in general, the one has consistent performance across environments and is affected by the presence of significant G x E interactions. So, assessment parameters in the presence of significant G x E interactions is inevitable and important to determine the superiority of individual genotypes across the range of environments. The objectives of this study were to: Identify the best durum wheat genotypes under different sowing dates, effective late sowing dates (heat stress) on grain yield and yield components, and genotypes × environment interaction and genetic stability.

## MATERIALS AND METHODS

The present investigation was conducted at Shandaweel Agricultural Research Station, Agricultural Research Center, Egypt. During 2004 / 2005 to 2006 / 2007 growing seasons. Eight durum wheat genotypes were planted; three released from the advanced lines of Wheat in the National Program of wheat research Line # 1 (AJAIA//JAV-10/AUK), 2 (BOOMER-24/AJAIA-9//ACO89), 3 (DIPPER-2/BUSHEN-1), and five durum wheat varieties Bani sweef 1, Bani sweef 3, Bani saweef 4, Bani saweef 5 and Sohag 3. The eight genotypes were grown on three successive seasons. Sowing dates were (20$^{th}$ November, 5$^{th}$ and 20$^{th}$ December). The experimental design was complete randomized blocks(RCBD), with three replications for each planting date. The plot size was 3.5 m long with 2.4 m width (3.5 × 2.4 = 8.4 m$^2$ = 1/500 from fed.). Each plot included 12 rows, 20 cm between rows and 5 cm within row. Genotypes were sown by experimental seed sown. The recommended practices of wheat production were adopted all over the growing seasons.

Data were recorded on: days to heading; number of days elapsed from sowing until the upper most spikes appeared beyond the auricles of the flag leaf sheath (50% heading), number of spikes/m$^2$ (No. S/m2); average number of spikes/m$^2$. 1000-kernel weight (gm): the weight of 1000-kernel from the bulk of the plot in gm, number of kernels/spike: as an average of kernels/spike from random sample which concluded 5 spikes and grain yield /plot (kg): The weight of grains from the ten middle rows (plot area 7 $m^2$) = 1/600/feddan.

Environment: monthly mean temperature differ from season to other season, (Table 1). The mean daily maximum and minimum temperature from the date of sowing to booting stage, booting stage to heading date and heading date to maturity of favorable and late sown crop (heat stress). The differences in the maximum temperature at Sohag between late and favorable sowing dates were 0.1 C, 1.87 C and 2.06 C in the period, sowing to booting, booting to heading and heading to maturity, respectively. The temperature in Table 1 indicate that the degree cent great missing during grain filling period under late sowing date.

**Table 1: Mean maximum and minimum air temperature (C) during growth stage in favorable and late sowing date at Sohag:**

| Months | 2004 / 2005 | | 2005 / 2006 | | 2006 / 2007 | |
|---|---|---|---|---|---|---|
| | Max | Min | Max | min | Max | Min |
| November | 27.90 | 11.50 | 25.90 | 10.00 | 24.03 | 10.69 |
| December | 22.10 | 6.60 | 23.40 | 9.00 | 21.34 | 6.88 |
| January | 20.20 | 5.40 | 21.50 | 6.80 | 19.33 | 5.16 |
| February | 23.30 | 7.60 | 23.50 | 8.90 | 27.48 | 8.52 |
| March | 25.60 | 9.40 | 26.60 | 11.00 | 27.68 | 11.29 |
| April | 36.80 | 16.20 | 30.10 | 14.60 | 34.67 | 21.63 |
| Sowing dates | sowing to booting | | first booting to heading | | heading date to maturity | |
| | Max | Min | Max | Min | Max | Min |
| Recommended | 22.31 | 7.38 | 24.76 | 8.34 | 27.48 | 11.30 |
| Late | 22.41 | 7.08 | 26.63 | 10.56 | 29.54 | 13.36 |

**Statistical analysis:** Data was subjected to the standard analysis of variance and the combined analysis of variance over nine environment was performed according to Gomez and Gomez, 1984. and stability parameters were estimated by the method described by Eberhart and Russell (1966). Heat susceptibility Index (HSI) was calculated according to the method of Fischer and Maurer (1978), using the following formula:

Heat susceptibility index (HSI) = $(\bar{Y}\ no - \bar{Y}\ h) / (\bar{Y}\ no.\ H)$

Heat density (H) = $1 - (\bar{x}h / \bar{x}no)$

$\bar{x}$h = Average of genotypes yield under heat stress.

$\bar{x}$no = Average of genotypes yield under normal conditions.

$\bar{Y}$ no = yield potential of genotype under normal conditions.

$\bar{Y}$ h = yield of genotype under heat stress.

## RESULTS AND DISCUSSION

### Effect of sowing dates:-

Results showed that sowing dates, genotypes and their interaction were highly significant for all studied traits, (Table 2). Same results were obtained by Abdel-Rahman *et al* . (1979), Tammam and Tawfiles (2004) and Amin (2006).

**Table 2: Mean squares of the combined analysis of variance for days to heading, number of spikes/m$^2$, 1000-kernel weight, number of kernels/spike and grain yield, over three seasons.**

| S.O.V. | D.F | Mean squares | | | | |
|---|---|---|---|---|---|---|
| | | days to heading | Number of spikes / m$^2$ | 1000 kernel weight | Number of kernel / spike | Grain yield |
| Season(S) | 2 | 1243.70** | 91093.63** | 46.91** | 2306.97** | 27.70** |
| Dates(D) | 2 | 2392.84** | 43109.26** | 251.38** | 777.20** | 1015.25** |
| S D | 4 | 37.241** | 13588.39** | 125.06** | 59.34** | 93.65** |
| Error (a) | 18 | 12.61 | 159.72 | 5.07 | 6.71 | 0.49 |
| Genotypes(G) | 7 | 269.17** | 7262.93** | 154.63** | 100.21** | 16.06** |
| S G | 14 | 26.20** | 4015.30** | 30.41** | 105.20** | 7.49** |
| D G | 14 | 6.72** | 1863.47** | 42.11** | 68.54** | 4.45** |
| S D G | 28 | 2.72** | 4210.57** | 26.61** | 83.48** | 4.22** |
| Error (b) | 126 | 0.49 | 295.85 | 5.80 | 11.23 | 0.49 |

Combined over all average for number of days to heading, (Table 3) showed that days to heading decreased by delaying sowing dates. Genotype No. 4 (Bani-sawef 1) was the earliest while genotype No. 3 was the latest for days to heading. Reduction of number of days to heading (Table 3 cont.) ranged from 7.09 to 11.06%, (Tammam and Taw files 2004). Data indicated that the recommended sowing dates produced the highest values of number of spikes/m$^2$, 1000-kernel weight and number of kernels/spike compared with late date, (Tables 4, 5 and 6). The highest values were obtained by genotype No. 1(378.78 spikes/m$^2$), genotype No. 3 (56.46 gm) and genotype No. 1 and 8 (43.17 and 43.95 kernels/spike) in the three traits respectively.

On the other hand, reduction result exposed heat stress (Tables 4, 5 and 6) ranged from -3.56 to 14.15 for number of spikes/m$^2$, -1.01 to 9.81 for 1000-kernel weight and -3.37 to 16.78 for number of kernels/spike, the results are in agreement with those of Kheiralla and Sherif 1992, Sikder *et al.* (2001), and Amin (2006). The means of grain yield (Table 7) showed that genotypes number 1, 2 and 5 gave the highest values for grain yield (18.71, 18.08 and 18.34 Ard./fed.) in the three genotypes, respectively. While the reduction Table 7) in grain yield results late sowing dates (heat stress) ranged from 22.70 to 32.03 %, which are in agreement with the findings of Muhammad *et al.* (2008).

**Stability analysis:-**

The joint regression analysis of variance in days to heading, number of spikes/m$^2$, 1000-kernel weight, number of kernels/spike and grain yield are presented in Table (8). The data showed highly significant differences among genotypes.

**Table 3: Means of days to heading of eight durum wheat genotypes under three sowing dates in three seasons, over all seasons and the reduction of such trait.**

| Ent. No. | Days to heading | | | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 - 2005 | | | | 2005 - 2006 | | | | 2006 - 2007 | | | | |
| | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | |
| 1 | 89.3 | 81.7 | 76.0 | 82.3 | 91.7 | 90.0 | 82.7 | 88.1 | 99.0 | 94.3 | 87.0 | 93.4 | 88.0 |
| 2 | 91.7 | 84.7 | 77.3 | 84.6 | 90.7 | 87.7 | 79.3 | 85.9 | 96.3 | 91.3 | 85.0 | 90.9 | 87.1 |
| 3 | 93.3 | 85.3 | 77.3 | 85.3 | 88.7 | 88.7 | 82.3 | 86.6 | 102.3 | 97.7 | 90.0 | 96.7 | 89.5 |
| 4 | 81.0 | 78.3 | 71.3 | 76.9 | 80.0 | 77.0 | 72.3 | 76.4 | 88.3 | 85.3 | 79.0 | 84.2 | 79.2 |
| 5 | 93.0 | 86.3 | 78.7 | 86.0 | 91.7 | 85.0 | 79.7 | 85.4 | 94.3 | 90.0 | 83.0 | 89.1 | 86.9 |
| 6 | 91.7 | 82.0 | 75.7 | 83.1 | 91.3 | 87.0 | 79.3 | 85.9 | 97.7 | 91.7 | 83.7 | 91.0 | 86.7 |
| 7 | 90.0 | 83.0 | 77.7 | 83.6 | 88.7 | 86.7 | 81.0 | 85.4 | 94.0 | 89.3 | 85.0 | 89.4 | 86.1 |
| 8 | 92.0 | 83.7 | 77.7 | 84.4 | 90.7 | 87.3 | 81.7 | 86.6 | 99.7 | 96.0 | 88.7 | 94.8 | 88.6 |
| Mean | 90.3 | 83.1 | 76.5 | 83.3 | 89.2 | 86.2 | 79.8 | 85.0 | 96.5 | 92.0 | 85.2 | 91.2 | 86.5 |

| L.S.D | 0.05 | 0.01 | | 0.05 | 0.01 |
|---|---|---|---|---|---|
| S = | 0.37 | 0.52 | S×G = | 0.65 | 0.86 |
| D = | 0.37 | 0.52 | D×G = | 0.65 | 0.86 |
| S×D = | 0.58 | 0.77 | S×D×G = | 1.12 | 1.48 |
| G = | 0.37 | 0.49 | | | |

D1 = Normal sowing date ( 20 November ).
D2 = Late sowing date ( 5 December ).
D3 = Very late sowing date ( 20 December ).

Season : S
Date of sowing : D
Genotypes : G

**Table 3: cont.**

| Ent. No. | Over all | | | The reduction of D1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2004 - 2005 | | | 2005 - 2006 | | | 2006 - 2007 | | | Mean |
| | D1 | D2 | D3 | D2% | D3% | Mean | D2% | D3% | Mean | D2% | D3% | Mean | |
| 1 | 93.33 | 88.67 | 81.89 | -0.55 | 22.93 | 11.19 | 4.43 | 15.44 | 9.94 | 2.64 | 22.64 | 12.64 | 11.26 |
| 2 | 92.89 | 87.89 | 80.56 | -2.12 | 23.01 | 10.45 | 0.09 | -2.13 | -1.02 | -1.65 | -0.55 | -1.10 | 2.78 |
| 3 | 94.78 | 90.56 | 83.22 | 12.18 | 18.91 | 15.54 | 3.75 | -6.26 | -1.26 | 7.03 | 17.90 | 12.46 | 8.92 |
| 4 | 83.11 | 80.22 | 74.22 | -14.83 | 19.49 | 2.33 | 5.19 | 15.26 | 10.22 | 9.41 | 22.59 | 16.00 | 9.52 |
| 5 | 93.00 | 87.11 | 80.44 | 3.35 | 22.78 | 13.07 | 9.59 | 18.79 | 14.19 | 7.74 | 2.29 | 5.01 | 10.76 |
| 6 | 93.56 | 86.89 | 79.56 | 1.10 | 26.03 | 13.57 | 18.79 | 23.30 | 21.04 | 7.66 | 16.78 | 12.22 | 15.61 |
| 7 | 90.89 | 86.33 | 81.22 | -20.57 | 11.90 | -4.34 | 2.91 | 9.33 | 6.12 | 0.69 | 7.37 | 4.03 | 1.94 |
| 8 | 94.11 | 89.00 | 82.67 | 7.04 | 33.00 | 20.02 | 4.06 | 2.08 | 3.07 | 7.01 | 14.86 | 10.93 | 11.34 |
| Mean | 91.96 | 87.08 | 80.47 | -1.51 | 22.67 | 10.58 | 6.48 | 10.29 | 8.38 | 5.35 | 13.79 | 9.57 | 9.51 |

D2 = reduction D2 = [(D1 - D2) / D1] *100

D3 = reduction D3 = [(D1 - D3) / D1] *100

Table 4: Means of number of spikes / $m^2$ of eight durum wheat genotypes under three sowing dates, over all seasons and the reduction of such trait.

| Ent. No. | Number of spikes / $m^2$ | | | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 - 2005 | | | | 2005 – 2006 | | | | 2006 - 2007 | | | | |
| | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | |
| 1 | 439 | 455 | 422 | 438 | 454 | 312 | 301 | 355 | 367 | 366 | 295 | 342 | 379 |
| 2 | 375 | 469 | 383 | 409 | 387 | 328 | 298 | 338 | 327 | 390 | 369 | 362 | 370 |
| 3 | 395 | 334 | 443 | 391 | 341 | 339 | 290 | 323 | 448 | 370 | 251 | 356 | 357 |
| 4 | 375 | 396 | 420 | 397 | 381 | 326 | 281 | 329 | 333 | 325 | 241 | 300 | 342 |
| 5 | 411 | 405 | 370 | 395 | 343 | 305 | 296 | 315 | 272 | 315 | 279 | 288 | 333 |
| 6 | 359 | 398 | 375 | 377 | 351 | 332 | 302 | 328 | 405 | 373 | 319 | 366 | 357 |
| 7 | 388 | 363 | 310 | 354 | 343 | 323 | 274 | 313 | 323 | 377 | 343 | 348 | 338 |
| 8 | 369 | 393 | 381 | 381 | 380 | 313 | 290 | 328 | 356 | 317 | 257 | 310 | 340 |
| Mean | 389 | 402 | 388 | 393 | 373 | 322 | 291 | 329 | 354 | 354 | 294 | 334 | 352 |

| L.S.D | 0.05 | 0.01 | | 0.05 | 0.01 |
|---|---|---|---|---|---|
| S = | 4.59 | 6.43 | S×G = | 16.05 | 21.22 |
| D = | 4.59 | 6.43 | D×G = | 16.05 | 21.22 |
| S×D = | 7.22 | 9.55 | S×D×G = | 27.81 | 36.75 |
| G = | 9.27 | 12.55 | | | |

**Table 4: Cont.**

| Ent. No. | Over all | | | The reduction of D1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2004 - 2005 | | | 2005 - 2006 | | | 2006 - 2007 | | | Mean |
| | D1 | D2 | D3 | D2% | D3% | Mean | D2% | D3% | Mean | D2% | D3% | Mean | |
| 1 | 419.67 | 377.56 | 339.11 | -0.55 | 22.93 | 11.19 | 4.43 | 15.44 | 9.94 | 2.64 | 22.64 | 12.64 | 11.26 |
| 2 | 362.89 | 395.67 | 350.00 | -2.12 | 23.01 | 10.45 | 0.09 | -2.13 | -1.02 | -1.65 | -0.55 | -1.10 | 2.78 |
| 3 | 394.67 | 347.44 | 327.89 | 12.18 | 18.91 | 15.54 | 3.75 | -6.26 | -1.26 | 7.03 | 17.90 | 12.46 | 8.92 |
| 4 | 363.22 | 348.78 | 313.67 | -14.83 | 19.49 | 2.33 | 5.19 | 15.26 | 10.22 | 9.41 | 22.59 | 16.00 | 9.52 |
| 5 | 341.89 | 341.33 | 315.11 | 3.35 | 22.78 | 13.07 | 9.59 | 18.79 | 14.19 | 7.74 | 2.29 | 5.01 | 10.76 |
| 6 | 371.78 | 367.56 | 332.11 | 1.10 | 26.03 | 13.57 | 18.79 | 23.30 | 21.04 | 7.66 | 16.78 | 12.22 | 15.61 |
| 7 | 351.33 | 354.56 | 308.78 | -20.57 | 11.90 | -4.34 | 2.91 | 9.33 | 6.12 | 0.69 | 7.37 | 4.03 | 1.94 |
| 8 | 368.56 | 341.22 | 309.56 | 7.04 | 33.00 | 20.02 | 4.06 | 2.08 | 3.07 | 7.01 | 14.86 | 10.93 | 11.34 |
| Mean | 371.75 | 359.26 | 324.53 | -1.51 | 22.67 | 10.58 | 6.48 | 10.29 | 8.38 | 5.35 | 13.79 | 9.57 | 9.51 |

D2 = reduction D2 = [(D1 - D2) / D1] *100

D3 = reduction D3 = [(D1 - D3) / D1] *100

**Table 5: Means of 1000-kernel weight of eight durum wheat genotypes under three sowing dates, over all seasons and the reduction of such trait.**

| Ent. No. | 1000-Kernel weight | | | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 - 2005 | | | | 2005 – 2006 | | | | 2006 - 2007 | | | | |
| | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | |
| 1 | 48.2 | 52.6 | 43.5 | 48.1 | 50.3 | 55.7 | 39.3 | 48.4 | 49.7 | 52.0 | 50.7 | 50.8 | 49.1 |
| 2 | 51.0 | 46.7 | 50.3 | 49.4 | 50.7 | 57.0 | 45.0 | 50.9 | 52.7 | 50.0 | 48.0 | 50.2 | 50.2 |
| 3 | 60.5 | 58.2 | 54.5 | 57.7 | 59.3 | 55.3 | 44.7 | 53.1 | 61.3 | 58.7 | 55.7 | 58.6 | 56.5 |
| 4 | 50.8 | 52.2 | 53.5 | 52.1 | 48.7 | 48.3 | 48.3 | 48.4 | 50.3 | 49.0 | 51.3 | 50.2 | 50.3 |
| 5 | 48.6 | 50.0 | 49.6 | 49.4 | 53.3 | 60.7 | 45.3 | 53.1 | 54.7 | 50.0 | 53.7 | 52.8 | 51.8 |
| 6 | 53.4 | 52.1 | 51.7 | 52.4 | 49.0 | 55.0 | 48.0 | 50.7 | 54.7 | 54.3 | 52.7 | 53.9 | 52.3 |
| 7 | 51.2 | 50.2 | 50.0 | 50.5 | 65.3 | 50.7 | 50.7 | 55.6 | 53.0 | 52.7 | 53.7 | 53.1 | 53.0 |
| 8 | 52.6 | 47.1 | 48.6 | 49.4 | 46.3 | 52.7 | 47.7 | 48.9 | 51.0 | 50.7 | 50.3 | 50.7 | 49.7 |
| Mean | 52.0 | 51.1 | 50.2 | 51.1 | 52.9 | 54.4 | 46.1 | 51.1 | 53.4 | 52.2 | 52.0 | 52.5 | 51.6 |

| L.S.D | 0.05 | 0.01 | | 0.05 | 0.01 |
|---|---|---|---|---|---|
| S = | 0.82 | 1.15 | S×G = | 2.25 | 2.97 |
| D = | 0.82 | 1.15 | D×G = | 2.25 | 2.97 |
| S×D = | 1.29 | 1.70 | S×D×G = | 3.89 | 5.15 |
| G = | 1.30 | 1.72 | | | |

**Table 5: Cont.**

| Ent. No. | Over all | | | The reduction of D1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2004 - 2005 | | | 2005 - 2006 | | | 2006 - 2007 | | | Mean |
| | D1 | D2 | D3 | D2% | D3% | Mean | D2% | D3% | Mean | D2% | D3% | Mean | |
| 1 | 49.39 | 53.42 | 44.51 | -0.55 | 22.93 | 11.19 | 4.43 | 15.44 | 9.94 | 2.64 | 22.64 | 12.64 | 11.26 |
| 2 | 51.46 | 51.24 | 47.77 | -2.12 | 23.01 | 10.45 | 0.09 | -2.13 | -1.02 | -1.65 | -0.55 | -1.10 | 2.78 |
| 3 | 60.39 | 57.39 | 51.60 | 12.18 | 18.91 | 15.54 | 3.75 | -6.26 | -1.26 | 7.03 | 17.90 | 12.46 | 8.92 |
| 4 | 49.92 | 49.83 | 51.04 | -14.83 | 19.49 | 2.33 | 5.19 | 15.26 | 10.22 | 9.41 | 22.59 | 16.00 | 9.52 |
| 5 | 52.21 | 53.56 | 49.52 | 3.35 | 22.78 | 13.07 | 9.59 | 18.79 | 14.19 | 7.74 | 2.29 | 5.01 | 10.76 |
| 6 | 52.36 | 53.80 | 50.80 | 1.10 | 26.03 | 13.57 | 18.79 | 23.30 | 21.04 | 7.66 | 16.78 | 12.22 | 15.61 |
| 7 | 56.52 | 51.17 | 51.43 | -20.57 | 11.90 | -4.34 | 2.91 | 9.33 | 6.12 | 0.69 | 7.37 | 4.03 | 1.94 |
| 8 | 49.98 | 50.13 | 48.86 | 7.04 | 33.00 | 20.02 | 4.06 | 2.08 | 3.07 | 7.01 | 14.86 | 10.93 | 11.34 |
| Mean | 52.78 | 52.57 | 49.44 | -1.51 | 22.67 | 10.58 | 6.48 | 10.29 | 8.38 | 5.35 | 13.79 | 9.57 | 9.51 |

D2 = reduction D2 = [(D1 - D2) / D1] *100

D3 = reduction D3 = [(D1 - D3) / D1] *100

**Table 6: Means of number of kernels/spike of eight durum wheat genotypes under three sowing dates, over all seasons and the reduction of such trait.**

| Ent. No. | Number of kernels/spike | | | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 - 2005 | | | | 2005 – 2006 | | | | 2006 - 2007 | | | | |
| | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | |
| 1 | 46.1 | 51.1 | 51.8 | 49.7 | 48.2 | 32.4 | 26.7 | 35.8 | 46.2 | 46.8 | 39.3 | 44.1 | 43.2 |
| 2 | 44.0 | 56.7 | 45.2 | 48.6 | 33.6 | 30.4 | 32.0 | 32.0 | 46.7 | 39.8 | 36.7 | 41.0 | 40.6 |
| 3 | 39.2 | 44.4 | 41.1 | 41.6 | 33.8 | 26.8 | 31.1 | 30.6 | 42.4 | 52.3 | 45.7 | 46.8 | 39.6 |
| 4 | 45.4 | 46.7 | 35.4 | 42.5 | 39.8 | 36.3 | 36.2 | 37.4 | 52.1 | 43.0 | 37.1 | 44.1 | 41.3 |
| 5 | 50.2 | 39.9 | 35.4 | 41.8 | 48.2 | 36.6 | 26.6 | 37.1 | 46.3 | 52.8 | 41.6 | 46.9 | 41.9 |
| 6 | 47.0 | 47.5 | 39.1 | 44.5 | 40.7 | 45.7 | 27.2 | 37.9 | 44.2 | 40.2 | 43.7 | 42.7 | 41.7 |
| 7 | 50.3 | 45.4 | 41.7 | 45.8 | 25.3 | 32.8 | 25.9 | 28.0 | 42.9 | 37.4 | 39.4 | 39.9 | 37.9 |
| 8 | 51.7 | 47.7 | 47.6 | 49.0 | 44.9 | 38.8 | 36.0 | 39.9 | 51.8 | 33.9 | 43.2 | 43.0 | 43.9 |
| Mean | 46.7 | 47.4 | 42.2 | 45.4 | 39.3 | 35.0 | 30.2 | 34.8 | 46.6 | 43.3 | 40.8 | 43.6 | 41.3 |

| L.S.D | 0.05 | 0.01 | | 0.05 | 0.01 |
|---|---|---|---|---|---|
| S = | 0.94 | 1.32 | S×G = | 3.13 | 4.13 |
| D = | 0.94 | 1.32 | D×G = | 3.13 | 4.13 |
| S×D = | 1.48 | 1.96 | S×D×G = | 5.42 | 7.16 |
| G = | 1.81 | 2.39 | | | |

**Table 6: Cont.**

| Ent. No. | Over all | | | The reduction of D1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2004 - 2005 | | | 2005 - 2006 | | | 2006 - 2007 | | | Mean |
| | D1 | D2 | D3 | D2% | D3% | Mean | D2% | D3% | Mean | D2% | D3% | Mean | |
| 1 | 46.83 | 43.44 | 39.24 | -0.55 | 22.93 | 11.19 | 4.43 | 15.44 | 9.94 | 2.64 | 22.64 | 12.64 | 11.26 |
| 2 | 41.44 | 42.28 | 37.94 | -2.12 | 23.01 | 10.45 | 0.09 | -2.13 | -1.02 | -1.65 | -0.55 | -1.10 | 2.78 |
| 3 | 38.48 | 41.17 | 39.28 | 12.18 | 18.91 | 15.54 | 3.75 | -6.26 | -1.26 | 7.03 | 17.90 | 12.46 | 8.92 |
| 4 | 45.78 | 41.98 | 36.25 | -14.83 | 19.49 | 2.33 | 5.19 | 15.26 | 10.22 | 9.41 | 22.59 | 16.00 | 9.52 |
| 5 | 48.21 | 43.11 | 34.53 | 3.35 | 22.78 | 13.07 | 9.59 | 18.79 | 14.19 | 7.74 | 2.29 | 5.01 | 10.76 |
| 6 | 43.95 | 44.46 | 36.66 | 1.10 | 26.03 | 13.57 | 18.79 | 23.30 | 21.04 | 7.66 | 16.78 | 12.22 | 15.61 |
| 7 | 39.51 | 38.53 | 35.65 | -20.57 | 11.90 | -4.34 | 2.91 | 9.33 | 6.12 | 0.69 | 7.37 | 4.03 | 1.94 |
| 8 | 49.49 | 40.12 | 42.24 | 7.04 | 33.00 | 20.02 | 4.06 | 2.08 | 3.07 | 7.01 | 14.86 | 10.93 | 11.34 |
| Mean | 44.21 | 41.88 | 37.73 | -1.51 | 22.67 | 10.58 | 6.48 | 10.29 | 8.38 | 5.35 | 13.79 | 9.57 | 9.51 |

D2 = reduction D2 = [(D1 - D2) / D1] *100

D3 = reduction D3 = [(D1 - D3) / D1] *100

**Table 7: Means of grain yield of eight durum wheat genotypes under three sowing dates, over all seasons and the reduction of such trait.**

| Ent. No. | Grain yield (ard./fed.) | | | | | | | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2004 - 2005 | | | | 2005 – 2006 | | | | 2006 - 2007 | | | | |
| | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | D1 | D2 | D3 | Mean | |
| 1 | 21.9 | 19.9 | 15.5 | 19.1 | 25.8 | 15.3 | 14.3 | 18.5 | 21.8 | 18.5 | 15.4 | 18.5 | 18.7 |
| 2 | 19.3 | 21.3 | 16.9 | 19.2 | 24.7 | 14.8 | 12.5 | 17.3 | 21.3 | 17.8 | 14.2 | 17.8 | 18.1 |
| 3 | 19.8 | 18.8 | 16.3 | 18.3 | 25.5 | 16.5 | 14.1 | 18.7 | 19.4 | 16.3 | 14.9 | 16.8 | 17.9 |
| 4 | 20.7 | 18.5 | 12.6 | 17.3 | 21.2 | 12.8 | 11.4 | 15.1 | 17.7 | 18.4 | 11.9 | 16.0 | 16.1 |
| 5 | 21.0 | 19.2 | 13.6 | 17.9 | 23.8 | 15.3 | 13.8 | 17.6 | 25.5 | 18.1 | 14.8 | 19.5 | 18.3 |
| 6 | 22.0 | 18.9 | 15.6 | 18.8 | 22.7 | 12.5 | 12.1 | 15.8 | 21.5 | 17.6 | 16.2 | 18.4 | 17.7 |
| 7 | 22.4 | 19.5 | 14.5 | 18.8 | 24.1 | 15.9 | 14.4 | 18.1 | 18.1 | 17.5 | 14.5 | 16.7 | 17.9 |
| 8 | 20.5 | 19.7 | 15.3 | 18.5 | 21.9 | 15.9 | 14.1 | 17.3 | 19.4 | 16.1 | 14.2 | 16.6 | 17.5 |
| Mean | 21.0 | 19.5 | 15.0 | 18.5 | 23.7 | 14.9 | 13.3 | 17.3 | 20.6 | 17.5 | 14.5 | 17.5 | 17.8 |

| L.S.D | 0.05 | 0.01 | | 0.05 | 0.01 |
|---|---|---|---|---|---|
| S = | 0.26 | 0.36 | S×G = | 0.65 | 0.86 |
| D = | 0.26 | 0.36 | D×G = | 0.65 | 0.86 |
| S×D = | 0.40 | 0.53 | S×D×G = | 1.13 | 1.49 |
| G = | 0.38 | 0.50 | | | |

**Table 7: Cont.**

| Ent. No. | Over all | | | The reduction of D1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2004 - 2005 | | | 2005 - 2006 | | | 2006 - 2007 | | | Mean |
| | D1 | D2 | D3 | D2% | D3% | Mean | D2% | D3% | Mean | D2% | D3% | Mean | |
| 1 | 23.20 | 17.91 | 15.04 | -0.55 | 22.93 | 11.19 | 4.43 | 15.44 | 9.94 | 2.64 | 22.64 | 12.64 | 11.26 |
| 2 | 21.75 | 17.97 | 14.52 | -2.12 | 23.01 | 10.45 | 0.09 | -2.13 | -1.02 | -1.65 | -0.55 | -1.10 | 2.78 |
| 3 | 21.57 | 17.19 | 15.08 | 12.18 | 18.91 | 15.54 | 3.75 | -6.26 | -1.26 | 7.03 | 17.90 | 12.46 | 8.92 |
| 4 | 19.85 | 16.56 | 11.97 | -14.83 | 19.49 | 2.33 | 5.19 | 15.26 | 10.22 | 9.41 | 22.59 | 16.00 | 9.52 |
| 5 | 23.42 | 17.56 | 14.04 | 3.35 | 22.78 | 13.07 | 9.59 | 18.79 | 14.19 | 7.74 | 2.29 | 5.01 | 10.76 |
| 6 | 22.07 | 16.32 | 14.63 | 1.10 | 26.03 | 13.57 | 18.79 | 23.30 | 21.04 | 7.66 | 16.78 | 12.22 | 15.61 |
| 7 | 21.51 | 17.66 | 14.44 | -20.57 | 11.90 | -4.34 | 2.91 | 9.33 | 6.12 | 0.69 | 7.37 | 4.03 | 1.94 |
| 8 | 20.60 | 17.23 | 14.52 | 7.04 | 33.00 | 20.02 | 4.06 | 2.08 | 3.07 | 7.01 | 14.86 | 10.93 | 11.34 |
| Mean | 21.75 | 17.30 | 14.28 | -1.51 | 22.67 | 10.58 | 6.48 | 10.29 | 8.38 | 5.35 | 13.79 | 9.57 | 9.51 |

D2 = reduction D2 = [(D1 - D2) / D1] *100

D3 = reduction D3 = [(D1 - D3) / D1] *100

The data also revealed that component Env. + (genotype × environment) was significant or highly significant for studied traits. In additions partitioning Environment + G × E component mean squares indicated that G × E (heterogeneity) mean squares were significant and highly significant for days to heading and 1000-kernel weight, respectively. Similar results were obtained by Kheiralla and Ismail (1995),Amin (2006) and Hamam and khaled (2009).

**Table 8: Mean square of days to heading, number of spikes / m2, 1000 kernel weight, number of kernel per spike and grain yield.**

| S. O. V. | d. f. | M. S. | | | | |
|---|---|---|---|---|---|---|
| | | Days to heading | Number of spikes / m2 | 1000 Kernel weight | Number of kernel per spike | Grain yield |
| Genotypes | 7 | 42422.41 ** | 702755.3 ** | 51.54 ** | 33.40 * | 1792.73** |
| Env. + G×Env. | 64 | 41.45 ** | 2723.74 ** | 14.88 * | 58.20 ** | 14.30 ** |
| a=Env.(linear) | 1 | 2469.44 ** | 107597.8 ** | 260.62 ** | 2132.01 ** | 820.14 ** |
| b=G×Env. | 7 | 6.78 * | 1531.13 NS | 27.00 ** | 12.72 NS | 1.28 NS |
| C=Pooled dev. | 56 | 2.43 ** | 1000.07 ** | 8.98 * | 26.86 ** | 1.53 ** |
| Pooled error | 126 | 0.49 | 295.85 | 5.80 | 11.23 | 0.49 |

Days to heading and 1000-Kernel weight: The joint regression analysis of variance in Table 8 reveal that component of Env. + (Genotype × environment) was highly significant for days to heading and 1000-Kernel weight. In addition, partitioning Env. + G × E component mean squares indicated that G × E (heterogeneity) mean squares was significant for days to heading and highly significant for 1000-Kernel weight. Most of the G × E interaction was a linear function as indicated by the greater magnitude of heterogeneity mean squares in comparison with the pooled dev. mean square for such trait.

For days to heading, stability parameters (Table 9 and Fig. 1) showed that three genotypes (2, 6 and 8) were stable over all the studied environments, while genotype No. 2 was adapted to unfavorable environments, for days to heading.

| Ent. No. | Days to heading | | |
|---|---|---|---|
| | Mean | $b_i$ | $S^2d_i$ |
| 1 | 88.0 | 1.09 | 3.35 ** |
| 2 | 87.1 | 0.98 | 0.57 |
| 3 | 89.5 | 1.18 * | 3.26 ** |
| 4 | 79.2 | 0.85 | 2.02 ** |
| 5 | 86.9 | 0.86 | 4.75 ** |
| 6 | 86.7 | 1.10 | 0.80 |
| 7 | 86.2 | 0.82 * | 0.06 |
| 8 | 88.6 | 1.11 | 0.76 |
| Mean | 86.5 | | |
| L. S. D. $_{0.05}$ | 0.248 | | |

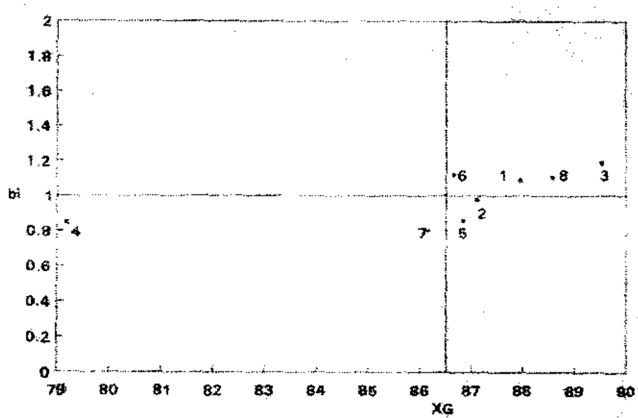


**Table 9 and Fig. 1 Means, $b_i$ and $s^2d_i$ values for eight durum wheat genotypes for days to heading.**

The pooled dev. mean squares were also highly significant for studied traits except 1000-kernel weight which was significant.

For 1000-kernel weight, stability parameters are presented in table (10) and figure (2) showed that all genotypes were stable except genotypes No. 4 and 7 on this trait, while the genotypes 6 (Bani-sawef 4) and 8 (Sohag 3) were stable under unfavorable conditions.

| Ent. No. | 1000-Kernel weight | | |
|---|---|---|---|
| | Mean | $b_i$ | $S^2d_i$ |
| 1 | 49.11 | 1.81 | 0.80 |
| 2 | 50.16 | 1.17 | -0.90 |
| 3 | 56.46 | 1.72 | 3.60 |
| 4 | 50.27 | -0.05 * | -1.98 |
| 5 | 51.76 | 1.53 | 1.22 |
| 6 | 52.32 | 0.74 | -2.53 |
| 7 | 53.04 | 0.59 | 18.22 ** |
| 8 | 49.66 | 0.49 | -1.11 |
| Mean | 51.60 | | |
| L. S. D. $_{0.05}$ | 1.241 | | |

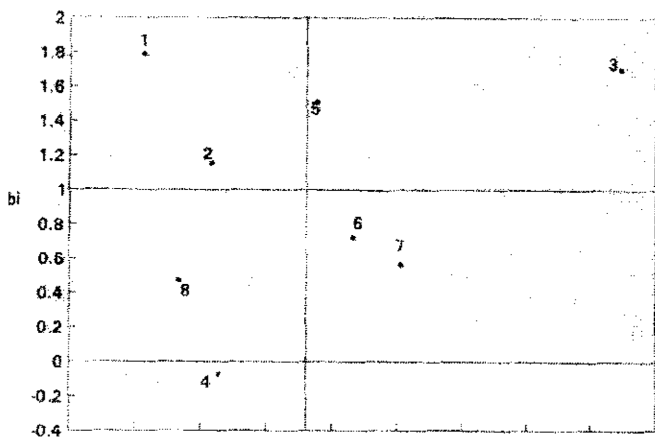


**Table 10 and Fig. 2 Means, $b_i$ and $s^2d_i$ values for eight durum wheat genotypes for 1000-kernel weight.**

The joint regression analysis of variance in Table 8 reveal that component of Env. + (Genotype × environment) was highly significant for number of spikes/m$^2$, number of kernels/spike and grain yield. In addition, partitioning Env. + G × E component mean squares indicated that G × E (heterogeneity) mean squares was not significant, indicating that environments effect was linear function the interaction of genotypes and environments was not linear function for such trait.

This means that response was direct and there is no interaction effected with sowing dates, seasons and genotypes, so that there is no need to do stability parameters for these traits.

**Heat susceptibility index:-**

Heat susceptibility index (HSI), which provides a measure of stress resistance based or minimization of yield loss under stress as compared to optimum conditions, rather than on yield level under stress pre-se, has been used to characterize relative heat tolerance of wheat genotypes.

**Table 11: Grain yield under favorable and heat stress and heat susceptibility index (HSI) of grain yield between 1st and 3rd sowing dates for eight wheat genotypes:**

| Ent. | 2004/2005 | | | 2005/2006 | | | 2006/2007 | | | Over all | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| no. | D1 | D3 | HSI | D1 | D3 | HSI | D1 | D3 | HSI | D1 | D3 | HSI |
| 1 | 21.9 | 15.48 | 1.04 | 25.8 | 14.27 | 1.02 | 21.8 | 15.36 | 1.00 | 23.20 | 15.04 | 1.02 |
| 2 | 19.3 | 16.86 | 0.45 | 24.7 | 12.45 | 1.13 | 21.3 | 14.23 | 1.12 | 21.75 | 14.52 | 0.97 |
| 3 | 19.8 | 16.30 | 0.63 | 25.5 | 14.07 | 1.02 | 19.4 | 14.88 | 0.79 | 21.57 | 15.08 | 0.88 |
| 4 | 20.7 | 12.59 | 1.38 | 21.2 | 11.43 | 1.05 | 17.7 | 11.90 | 1.11 | 19.85 | 11.97 | 1.16 |
| 5 | 21.0 | 13.57 | 1.24 | 23.8 | 13.77 | 0.96 | 25.5 | 14.78 | 1.43 | 23.42 | 14.04 | 1.17 |
| 6 | 22.0 | 15.57 | 1.03 | 22.7 | 12.13 | 1.06 | 21.5 | 16.18 | 0.84 | 22.07 | 14.63 | 0.98 |
| 7 | 22.4 | 14.45 | 1.25 | 24.1 | 14.38 | 0.92 | 18.1 | 14.50 | 0.67 | 21.51 | 14.44 | 0.96 |
| 8 | 20.5 | 15.27 | 0.89 | 21.9 | 14.10 | 0.82 | 19.4 | 14.19 | 0.91 | 20.60 | 14.52 | 0.86 |
| Mean | 21.0 | 15.01 | | 23.7 | 13.33 | | 20.6 | 14.50 | | 21.75 | 14.28 | |

Clarke et al (1984), Bruckner and Frohberg (1987) and Fisher and Wood, (1979) concluded that heat susceptibility index was used to estimate stress injury because it acounted for variation in yield potential and stress intensity. Low stress susceptibility ( HSI < 1) is synonymous with higher stress tolerance. Results in Table 11, indicate that values of heat susceptibility index in the first season ranged from (0.45 to 1.38) for genotypes number 2 and 4, respectively, but genotypes No. 2, 3 and 8 gave the lowest value of heat susceptibility index ( 0.45, 0.63 and 0.89 respectively). While in the second season heat susceptibility index ranged from 0.82 to 1.13 in genotypes No. 8 and 2, but low heat susceptibility index was obtained by genotypes No. 5 (0.96), 7 (0.92 ) and 8 (0.82). In the third season 2006/2007 the values of heat susceptibility index ranged from 0.67 to 1.48 for genotypes No. 7 and 4, respectively, while genotypes No. 3, 6, 7 and 8 gave the lowest value of heat susceptibility index ( 0.79, 0.84, 0.67 and 0.91) for four genotypes respectively. On the other hand, heat susceptibility index over the three years ranged from 0.86 for genotypes No. 8 to 1.16 for genotypes No. 4. Genotypes No. 2, 3, 6, 7 and 8 produced low heat susceptibility index (HSI $< 1$) and the values were 0.97, 0.88, 0.98, 0.96 and 0.86 and grain yield 14.52, 15.08, 14.63, 14.44 and 14.52 ard/fed for the five genotypes, respectively. A superior genotypes for heat tolerance gave the least values of heat susceptibility index ( HSI $< 1$) and high grain yield under heat stress. This genotype was No. 3 and gave grain yield 15.08 ard/fed under heat stress.

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Performance and stability of wheat genotypes

# سلوك وثبات بعض التراكيب الوراثية لقمح الديورم تحت مواعيد زراعة مختلفة في مصر العليا

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اجري هذا البحث في محطة البحوث الزراعية بشندويل – مركز البحوث الزراعية – مصر خلال المواسم الثلاثة ٢٠٠٥/٢٠٠٤ ، ٢٠٠٦/٢٠٠٥ ،٢٠٠٧/٢٠٠٦ وكان الهدف من الدراسة تقييم بعض التراكيب الوراثية لقمح الديورم تحت ثلاثة مواعيد زراعة وكذلك تأثير الزراعة المتأخرة والتعرض للحرارة علي المحصول ومكوناته وبعض الصفات الأخرى وأيضاً التفاعل بين التركيب الوراثي والبيئة وتحليل الثبات.

الصفات التي تمت دراستها هي عدد أيام طرد السنابل(٥٠ %)، عدد السنابل/م٢، وزن الـ ١٠٠٠ حبة (جم)، عدد حبوب السنبلة، محصول الحبوب.

استخدمت في التجربة ثمانية تراكيب وراثية من قمح الديورم ذات اختلافات وراثية واسعة بعضها أصناف محلية وأخري مستوردة، زرعت هذه الأصناف في ثلاثة مواعيد زراعة، الموصي به (٢٠ نوفمبر)، المتأخر (٥، ٢٠ ديسمبر) باستخدام قطاعات كاملة العشوائية مع ثلاثة مكررات وكل قطعة تتكون من ١٢ سطر بطول ٣,٥ م والمسافة بين السطور ٢٠ سم، حللت هذه البيانات إحصائيا طبقاً لـ Gomez and Gomez (1984) ، وحللت للثبات الوراثي طبقاً لـ Eberhart and Russel (1966) ، وتم حساب معامل الحساسية للحرارة طبقاً لـ Fischer and Mourer (1978).

ويمكن تلخيص النتائج المتحصل عليها فيما يلي:-

وجد أن هناك تأثير معنوي لمواعيد الزراعة علي كل الصفات التي درست. كان المتوسط العام لعدد أيام طرد السنابل يتناقص بالتأخير في ميعاد الزراعة وكان التركيب

الوراثي رقم ٤ (بني سويف ١) أبكر الأصناف في طرد السنابل، وكان التركيب الوراثي رقم ٣ ، ٨ أكثر الأصناف تأخيراً في طرد السنابل، وكان النقص في عدد أيام طرد السنابل يتراوح بين (٧,٠٩ إلي ١١,٠٦ %). النتائج أشارت إلي أن ميعاد الزراعة الموصي به أعطي أعلي قيمة لعدد السنابل/م ٢، وزن الـــ١٠٠٠ حبة، عدد حبوب السنبلة، وكانت أعلي القيم للتراكيب الوراثية رقم ١ (٣٧٨,٧٨ سنبلة) والتركيب الوراثي رقم ٣ (٤٦.٥٦ جم) لصفتي عدد السنابل ووزن الـــ١٠٠٠ حبة علي التوالي، بينما كانت أفضل التراكيب الوراثية بالنسبة لعدد حبوب السنبلة رقم ١، ٨ (٤٣,١٧، ٤٣,٩٥ حبة) علي التوالي، وكان النقص يتراوح بين (-٣,٥٦ إلي ١٤,١٥ %) ، (١,٠١ إلي ٩,٨١ %) ، (-٣,٣٧ إلي ١٦,٧٨ %) للثلاث صفات علي التوالي. أوضحت النتائج أن التراكيب الوراثية أرقام ١، ٢، ٥ أعطت محصول حبوب عالي (١٨,٧١، ١٨,٠٨، ١٨,٣٤ أردب للفدان) للثلاثة تراكيب علي التوالي، بينما كان النقص في المحصول نتيجة التأخير في الزراعة (التعرض للحرارة) يتراوح من (٢٢,٧٠ إلي ٣٢,٠٣ %) .

أوضحت نتائج تحليل الثبات أن هناك اختلافاً معنوياً بين التراكيب الوراثية والبيئات والتفاعل بينهم لكل الصفات التي درست. أظهرت القياسات الوراثية لعدد أيام طرد السنابل أن هناك ثلاثة تراكيب وراثية ثابتة (٢، ٦، ٨) وكان التركيب الوراثي رقم ٢ ثابت بالنسبة لظروف تحمل الحرارة (الزراعة المتأخرة) بالنسبة لصفة طرد السنابل. كما أعطت كل التراكيب الوراثية ثباتاً بالنسبة لصفة وزن الـــ ١٠٠٠ حبة ما عدا التراكيب الوراثية أرقام (٤، ٧)، وكان أفضل التراكيب الوراثية رقم ٦ (بني سويف ٤)، ٨ (سوهاج ٣) ثابتة وراثياً ومتحملة للحرارة.

أظهرت النتائج أن معامل الحساسية للحرارة لمحصول الحبوب (أردب/فدان) بين ميعاد الزراعة الموصى به والميعاد المتأخر جداً إلي أنه توجد خمسة تراكيب وراثية هي أرقام (٢، ٣، ٦، ٧، ٨) متحملة للحرارة (الزراعة المتأخرة) وأعطت قيمة لمعامل الحساسية للحرارة أقل من الواحد الصحيح وذات محصول عالي تحت الزراعة المتأخرة.