J. Agric. Sci. Mansoura Univ., 27 (1): 47 - 60, 2002

GENE EFFECT FOR YIELD AND YIELD COMPONENT FOR FOUR DURUM WHEAT CROSSES.

Moustafa, M.A.
Wheat Research Program, Field Crops Research Institute, Agricultural Research Center

ABSTRACT

Four experiments were carried out with two intervarietal crosses:
1 (Beni Sweif 1 x Line 13)
2 (Sohag x Line 21)
3 (Line 9 x Line 14)
4(Line 10 x Line 21. Six populations of each cross were used in this investigation).

Significant positive heterotic effects were obtained for plant height, number of number of spikelets /spike, spike grain weight,1000-grain weight and grain yield/plant in the first cross; for plant height, number of grains/ spike, spike grain weight and 1000 – grain weight in the third cross; for spikes/plant and spike length in the second cross. However, significant negative heterotic effects were found for spike grain weight, 1000 – grain weight and grain yield / plant in the second cross; for spike length and number of spikelets /spike and grain yield / plant in the third cross; for number of spikes/ plant, number of spikelets/spike, number of grains/ spike, spike grain weight, 1000- grain weight and grain yield/ plant in the fourth cross. Hetevolic increase in number of spikelets/spike grain weight and 1000 – grain weight seemed to be accounted for the heterotic yield response observed in the first cross.

Inbreeding depression estimates were found to be significant for all the studied attributes except spike length and number of spikeletes/spike in the first and second crosses; for number of grains/ spike and 1000 – grain weight in the first cross; for plant height, spike length and number of grains/ spike in the third cross.

Over dominance to wards the higher parent for spike grain weight and 1000 – grain weight in the first and third crosses; for number of spikelets/ spike in the first cross and for number of grains/ spike in the third cross. However, over and partial dominance towards the lower parent was obtained for plant height, number of spikes/ plant and spike length in the first and third crosses; for spike grain weight and 1000 – grain weight in the second cross; for number of spikes/ plant, number of grains / spike and grain weight in the third cross. While, partial dominance was obtained for number of grains / spike and grain yield / plant in the first cross; for plant height, spike length, number of spikelets / spike, number of grains / spike and grain yield / plant in the second cross; for number . of spikelets / spike in the third cross and for plant height, number of spikelets / spike and 1000 – grain in the fourth cross. However, Complete dominance was found for number of spikes / plant in the second cross and for spike length and grain yield / plant in the fourth cross.

F2 deviation (E1) and back cross deviation were found to be signifcant for most of the attributes under investigation.

The additive gene effect were found to be significant for all traits in all cross except for plant height in the first cross and for spike length and number of spikelets / spike in the second cross. Suggesting the potential for obtaining further improvements of most characters studied. Both dominance and epistasis were found to be significant for most of the attributes under investigation.

High to moderate values of heritability estimates were found to be associated with high and moderate genetic advance as percentage of F2 mean in most traits investigated.

INTRODUCTION

Wheat is the world' s leading grain crop. Wheat breeders are always looking for means and sources of genetic improvements in grain yield and its components and other agronomic characters. Genetic diversity is the main tool for the breeders to have better recombinants by creating heritable variability upon which selection can be practiced. Knowledge of genetic relationship among individuals or populations is essential to breeders for planning crosse to grain better selections for high yield and developing new promising lines. Crumpacker and Allard (1962) reported that efficiency in breeding of self-pollinating crop plant depends, first, on accurate identification of hybrid combinations that have the potentiality of producing maximum improvements and second, on identifying in early segregating generstions, superior lines among the progeny of the most promising hybrids. Therefore, information on the genetics and gene effect of breeding materials could ensure long-term election gains and better genetic improvements. This study was conducted to study the gene effect of four durum wheat crosses derived from six parental durum wheat genotypes using six populations of each cross.

MATERIALS AND METHODS

The four crosses used in the present study derived from six parental Egyptian wheat cultivars or lines. Pedigree of parental genotypes are given in table (1) these genotypes were used to obtain the following four crosses, Beni Sweif 1 x Line 13, Sohag 3 x Line 21, Line 9 x Line 13 and Line 10 x Line 21.

In the first season (1997/98), the parental genotypes were evaluated in complete block design with three replications, at the meantime pair crosses were performed to obtain F_1 seeds. In the second season (1998/1999), four F_1's seed were sown to produce F_1 plants. Each of F_1 plants were crossed back to their respective parent to produce first backcross (B1) and second backcross (B2) in the mean time, pair cross were made to produce more F_1 seeds, the F_1 plants were selfed to produce F_2 seeds. In the third season (1999/2000) the obtained seeds of the six populations P_1, P_2, F_1, F_2, BC_1 and BC_2 of the four crosses were evaluated using a randomized complete block design with three replications. Rows was 2m long, spaces between rows were 20 cm, which it was 5 cm between plants, resulting in plot area of six meters and consisted of 15 rows, two rows for each parent, F_1 and backcross progenies and five rows for F_2 generation. Data were recorded on an individual guarded plants of six populations in each cross for plant height, number of spikes/plant, spike length, number of spikelets/spike, number of grains/spike, spike grain weight, 1000-grain weight and grain yield/plant.

Various biometrical parameters in this study, would only be calculated if the F_2 genetic variance was found to be significant. Heterosis (%) was expressed as percentage increase of the F_1 performance above the better parent value. Inbreeding depression (Id %) was estimated as the average percentage decrease of the F_2 from the F_1. In addition, F2 – deviation (E_1) and backcross deviation (E_2) were measured as suggested by Mather and Jinks (1971). Potence ratio (P) was also calculated according to petr and Frey (1966).

Genetic analysis of generation means to give estimates of mean effect parameter (m), additive (a), dominance (d), additive x additive (aa), additive x dominance (ad) and dominance x dominance (dd)were obtained by the methods illustrated by Gamble (1962).

Heritability was calculated in both broad and narrow sense according to Mather's procedure (1949). The predicted genetic advance under selection was computed according to Johanson *et al.* (1955). This genetic gain represented as percentage of the F_2 mean performance was obtained according to Miller *et al.* (1958).

Table (1): The six parental durum wheat cultivars and lines used in the present study.

No.	Name	Cross / Pedigree
1	Beni weif	Jo"S" / AA / g "S"
2	Sohag 3	Mexi"S" / Mgh / 51792 / Durum 6
3	Line 9	CMH.79-1168 / Mex175 // OFN / 50M013 /Chen"S"/KBC//Hul"S"/ Tub"S" SDD 1422- 135D – 25D – 15D – 05D.
4	Line 10	CMH77.774/Mex175//CMH77.774/3/OMRABI 5 SDD44 – 15D – 15D – 15D – 0SD.
5	Line 13	Gediflo//Krf/Tell 76 ICD 89 – 0595 – 0Ap – 0Sh – 8Sh – 8Sh.
6	Line 21	Mojo ICD 84315 – 4YRC – 040M – 030YRL – 2PAP – 0Y

RESULTS AND DISCUSSION

Varietal differences in response to their genetic background were found to be significant in most traits under investigation. The genetic variance within F_2 population was also found to be significant for all traits studied in four crosses, therefore the different biometrical parameters used in this investigation were estimated. Means and variances of the six population P_1, P_2, F_1, F_2, BC_1 and BC_2 for the traits studied in the four crosses are presented in table (2).

Heterosis, inbreeding depression percentage and different gene action parameters in the four crosses for the eight traits studied are given in table (3). Significant positive heterotic effects were obtained for number of spikelets per spike, spike grain weight, 1000- grain weight and grain yield per plant in the first cross; plant height, number of spikes per plant and spike length in the second cross; plant height, number of grains per spike, spike length and 1000 – grain weight in the third cross. However, significant negative heterotic effects were found for spike length, 1000- grain weight and grain yield per plant in the second and fourth crosses; number of spikelets per spike and grain yield per plant in the third cross and number of spikes per plant, number of spikelets per spike and number of grains per spike in the fourth cross. Similar results were reported by Gautam and Jain (1985), Moshref (1996), Hendawy (1998) and El-Hosary *et al.* (2000).

3Number of spikes per plant, number of grains per plant and 1000 – grain weight are the main components for grain yield per plant. Hence, heterotic increase if found in one or two or three of the yield components, may load to favourable yield increase in hybrids. The lack of significant in heterosis of number of spikes per plant and number of grains per plant, which may be due to the lower magnitude of the non-additive gene action, would indicate that the increase in 1000- grain weight of the first cross (11.962 %) was the major contributing factor to heterosis of yield. These results are in agreement with Amaya *et al.* (1972), Ketata *et al.* (1976), El-Rassas and Mitkees (1985).

The pronounced heterotic effect detected for spike grain weight and 1000 – grain weight in the first cross would indicate that the cross Beni Sweif x Line 13 would be of interest in a breeding programme for high yielding ability by selecting for higher spike grain weight and 1000 – grain weight.

The potence ratio indicated the overdominance towards the higher percent for spike length, spike grain weight and 1000 – grain weight in the first cross; number of grains per spike, spike grain weight and 1000 – grain weight in the third cross. There was overdominance towards the lower parent plant height, number of spikes per plant, spike length, number of spikelets per spike and grain yield per plant in the third cross; spike grain weight and 1000 – grain weight in the second cross; number of spikes per plant, number of grains per spike and spike grain weight in the fourth cross. Complete dominance was found for number of spikes per plant toward the higher parent in the second cross. There were over dominance towards the lower parent for spike length and grain yield per plant in the fourth cross and partial dominance towards the higher parent for number of grains per spike and grain yield per plant in the first, while partial dominance toward the lower parent plant height, number of spikelets per spike, number of grains per spike and grain yield per plant in the second cross, plant height and 1000 – grain weight in the fourth cross. The existence of overdominance in grain yield per plant was previously reported by partial dominance for plant height by Eissa *et al.* (1994), for spike length by Mosaad *et al.* (1990), for number of grains per spike by Jatasra and Paroda (1980), for grain yield per plant by El-Haddad (1979). Complete dominance was previously detected for grain yield per plant by Rady *et al.* (1981).

Overdominance was obtained for plant height by Ketata *et al.,* (1976), Mosaad *et al.* (1990); number of spikes per plant by Abul-Nass *et al.* (1991); number of spikelets per spike by Eissa (1994); number of grains per spike by Al-Kaddoussi *et al.*(1994); for ear yield by Jatasra and Paroda (1980), Eissa (1994); for 1000 – grain weight by Rady *et al.* (1981); Al-Kaddoussi (1994); for grain yield per plant by Al-Kaddoussi *et al.*(1994) and Eissa *et al*.(1994).

Significant positive values of inbreeding depression were found for plant height in the first and spike grain weight in the first and third crosses. However, significant negative inbreeding depression values were detected for plant height, number of spikes per plant, spike length, number of spikelets per spike, number of grains per plant, spike grain weight, 1000 – grain weight and grain yield per plant in the first cross; number of spikes per plant, number of spikelets per spike and grain yield per plant in the third cross; plant height, number of spikes per plant, number of grains per spike, spike grain weight, 1000 – grain weight and grain yield per plant in the second cross; number of spikes per plant and grain yield per plant in the first cross (table 3). This was logical, since the expression of heterosis in F1 will be followed by considerable reduction in F2 performance. The obtained result for most cases were in harmony with that exception which was also reached by Gautam and Jain (1985) and Khalifa *et al.* (1997).

Significant heterosis and insignificant inbreeding depression were obtained for number of spikelets per spike in the first cross; number of grains per spike in the third cross and 1000 – grain weight in first cross. On the contrary, plant height in the first cross exhibited significant heterotic effect but insignificant inbreeding depression. The contradiction between heterosis and inbreeding depression estimates could be due to the presence of linkage between genes in these materials (Van der Veen, 1959).

Significant positive F_2 deviation were only found for number of spikes per plant and grain yield per plant in all crosses; plant height; number of grains per spike, spike grain weight and 1000 – grain weight in the second and fourth crosses; number of spikelets per spike and 1000 – grain weight in the third cross; spike length in the second cross and number of grains per spike in the first cross. While significant negative values were obtained for spike grain weight (table 3). These results may refer to the contribution of epistatic gene effects in the formance of these traits. On the other hand, insignificant F2 deviations were detected for plant height, spike length, number of spikelets per spike and 1000 – grain weight in the first cross; plant height, spike length, number of grains per spike and spike grain weight in the third cross; number of spikelets per spike in the second and fourth crosses; spike length in the fourth cross. This may indicate that the epistatic gene effects have minor contribution in the inheritance of these traits.

Backcross deviations (E2) was found to be significant for spike grain weight and 1000 – grain weight in all crosses; number of spikes per plant, number of grains per spike and grain yield per plant in the second and third crosses; spike length, number of spikelets per spike and number of grains per spike in the first; plant height in the third and fourth crosses; number of spikes per plant, spike length, number of spikelets per spike and gain yield per plant in the fourth cross. These results would ascertained the presence of epistasis in such larg magnitude as to warrant grat deal of attention in a breeding programme.

Nature of gene action was investigated according to the relationships illustrated by Gamble (1962). The estimated mean effect parameters (m), which reflects the contribution due to the over- all mean plus the locus effect and interactions of the fixed loci, was found to be highly significant. The additive gene effects were found to be significant for plant height, spike grain weight, 1000 – grain weight and grain yield per plant in the third cross; spike length, number of spikelets per spike and 1000 – grain weight in the first; number of spikes per plant in the second cross. Suggesting the potential for obtaining further improvements of these traits by using pedigree selection program. Similar results were abtained by Amaya *et al.* (1972); Hendawy

(1998); El-Hosary *et al.* (2000).

Significant negative additive effect was obtained for plant height and grain yield per plant in the second cross; spike length and grain yield per plant in the fourth cross, indicating that the additive effects was less important in the inheritance of that trait.

Dominance gene effects was found to be significant for all traits examind, except plant height and number of spikelets per spike in the first cross; spike length and number of spikelets in the second cross and spike grain weight in the third cross, indicating the importance of dominance gene effects in the inheritance of all traits. Additive x additive types of epistasis was detected to be significant for character studied except plant height in the first cross; spike length and number of spikelets per spike in the second cross. Significant additive x dominance types of epistasis was found for spike length and 1000 – grain weight in the first cross; plant height, number of spikes per plant and grain yield per plant in the second cross; plant height, spike grain weight in the third cross and grain yield per plant in the fourth cross only. Dominance x dominance types of gene action were found to be significant for all traits in the three crosses except spike length and number of spikelets per spike in the second cross.

The presence of both additive and non-additive gene action in all the studied attributes except spike length and number of spikelets per spike in the second cross would indicate that selection procedures based on the accumulation of additive effects should be very successful in improving these traits. However, to maximize selection advance procedures which are known to be effective in shifting gene frequency when both additive and non-additive genetic variation are important would be preferred. Similar conclusion was obtained by Gouda *et al.* (1993); Al-Kaddoussi *et al.* (1994) and El-Hossary *et al.* (2000).

Heritability in both broad and narrow senses and genetic advance under selection are presented in table (4). High heritability values in broad sense were detected for all traits studied except plant height in the second and fourth crosses; spike grain weight and grain yield per plant in the second cross where moderate broad sense heritability.

High estimates of narrow sense heritability was found for number of spikes per plant, spike length, 1000 – grain weight and grain yield per plant in the third cross; number of spikelets per spike, spike grain weight, 1000 – grain weight and grain yield per plant in the fourth cross; number of grains per spike and grain yield per plant in the first and 1000 – grain weight in the second cross. Moderate narrow sense heritability estimates were found for number of spikes per plant and number of grains per spike in the fourth cross, plant height and spike grain weight in the third cross; spike grain weight and 1000 – grain weight in the second and first crosses respectively, while, low heritability for the remaining characters. The differences in magnitude of both broad and narrow sense heritability estimates for all traits studied would as certained the presence of both additive and non-additive gene action in the inheritance of all traits in all crosses as previously obtained from gene action parameters study. Some results previously obtained by Jatasra and Paroda (1980); Mosaad *et al.* (1990); Gouda *et al.* (1993) and Moshref

(1996).Genetic advance under selection (Δg %) was found to be high in magnitude for 1000 – grain weight and grain yield per plant in the four crosses; number of spikes per plant in the third and fourth crosses; spike length and number of grains per spike in the third and fourth crosses respectively. Moderate gain was found for plant height, number of grains per spike, spike grain weight in the third cross; spike length, number of spikelets per spike and spike grain weight in the fourth cross; number of spikes per plant in the first and second crosses; spike length and spike grain weight in the first and second crosses. Relatively low gain was found for plant height in the first, second and fourth crosses; number of spikelets per spike in the first, second and third crosses; spike length in the second cross; number of grains per spike and spike grain weight in the second and first crosses. Dixit *et al.* (1970) pointed out that high heritability is not always associated with high genetic advance, but in order to make effective selection, high heritability should be associated with high genetic gain. In this study, high to moderate genetic advance (Δg %) were found to be associated with high to moderate narrow sense heritability estimates for spike length, 1000 – grain weight and grain yield per plant in the first, third and fourth crosses and number of grains per spike in the second, third and fourth crosses. Consequently, selection for these traits should be effective and satisfactory. Relatively low genetic gain was associated with low heritability values in most traits in the first and second crosses. Hence, selection for this trait may be less effective. As it is well known, expected improvement of selection is directly proportional to the heritability values. Also, the expected response to selection, varies with the phenotypic standard deviation of population means. This figure is measure of the total variability in the trait and therefore, reflect the total response that could realized by breeding techniques.

Generally, the most biometrical parameters resulted from the third and fourth crosses were found to be higher in magnitude than those obtained from the first and second crosses. Consequently, it could be concluded that the cross Line 9 x Line 13 and Line 10 x Line 21 would be interest in a breeding programme for brining about the maximum genetic improvement in the attributes studied.

REFERENCES

Abul-Nass, A.A.;A.A.El-Hosary and M.Asakr (1991). Genetical studies on durum wheat (*Triticum durum* L.) Egypt J.Agron., 16 (1-2) : 81-94.

Al-Kaddoussi, A.R.;M.M.Eissa and S.M.Salama (1994). Estimates of genetic variance for yield and its components in wheat (*Triticum astivum* L.) Zagazig J.Agric. Res., 21 (2): 355-366.

Amaya, A.A.;R.H. Busch and K.L. Lebsock (1972). Estimates of genetic effects of heading date, plant height and grain yield in durum wheat. Crop Sci., 12: 478-481.

Crumpacker, D.W. and R.W. Allerd (1962). A diallel cross analysis of heading date in wheat. Hilgardi, 32: 275-277.

Dixit, P.K.; P.D. Saxena and L.K. Bhatia (1970). Estimation of genotypic variability of some quantitative characters in groundnut. Indian J. Agric. Sci., 40 – 197.

Eissa, M.M.; A.R.AL. Kaddoussi and S.M. Salama (1994). General and specific combining ability and its interaction with sowing dates for yield and its components in wheat.. Zagazig J.Agric Res., 21 (2): 345 - 354.

El-Hosary, A.A.; M.E. Riad; Nagwa. R.A. and Manal A.H. (2000). Heterosis and combining ability in durum wheat. Proc. Gth Conf Agron., Minufiya Univ., Sep., 2000: 101 – 117.

El-Haddad, M.M. and M.I.Ali (1979). Genetical analysis of diallel crosses in spring wheat . III- General and specific combining ability in on segregation and segregation generation. Egypt J. Genet. Cytol., 8: 137-156.

El-Rassas, H.N. and R.A. Mitkees (1985). Hterosis and combining ability in bread wheat (*Triticum astivum* L.). Annals of Agric. Sci., Moshtohor., 23 (2): 695 – 711.

Gamble, E.E. (1962). Gene effects in corn (*Zea mays L.*) I. Separation and relative importance of gene effects for yield. Canadian J. of plant Sci., 42: 339 – 348.

Gautam, P.L. and K.B.L. Jain (1985). Heterosis for various characters in durum wheat. Indian J. Genet., 45: 159 – 165.

Gouda, M.A.; M. M. El-Shami and T.M. Shehab El-Din (1993). Inheritance of grain yield and some related morphophsiological traits in wheat. J. Agric. Res. Tant. Univ., 19 (3): 537 – 546.

Hendawy,H.I.(1998).Combining ability and genetics of specific characters in certain diallel wheat crosses. Ph.D. Thesis. Faculty of Agric, Menofiya Univ. Egypt.

Jastasra, D.S.and R.S.Paroda (1980).Genetics of yield and yield components in bread wheat. Indian J. of Agric.Sci., 50(5): 379-382.

Johanson, H.W.; H.F. Robinson and R.E. Comstock (1955). Estimation of genetic and environmental variability in soybeans . Agron. J., 47: 314.

Ketata, H.; E.L. Smith; L.H.Edwards and R.W.McNew (1976). Detection of epistatic, additive and dominance variation in winter wheat. (*Triticum astivum* L.em. Thell.) Crop Sci., 16 (1): 1-4.

Khalifa, M.A.; E.M. Shalaby; A.A. Ali and M.B. Towfelis (1997). Inheritance of some physiological traits yield and its componenets in durm wheat. I. Morphophysiological. Assiut J. of Agric. Sci., 28 (4): 143 – 161.

Mather, K. (1949). Biometrical Genetics, Dover Publications Inc., London.

Mather, K. and J.L. Jinks (1971). Biometrical Genetics. 3rd Ed Chapman and Hall, London.

Miller, P.A.; J.C. Williams; H.F. Robinson and R.E. Comstock (1958). Estimation of genotypes and environmental variances in upland cotton and their implications in selection. Agron. Jour., 50: 126-131

Mosaad, M.G.; M.A. El-Morshidy; B.R. Bakheit and A.M.Tamam (1990). Genetical studies of some morpho-physiological traits in durum wheat crosses. Assiut J Agric Sci., 21 (1): 79-94.

Moshref, M.K. (1996). Genetical and statistical studies in wheat. Ph.D. Thesis. Faculty of Agric., Al-Azhar Univ. Egypt.

Petr, F.C. and K.J. Frey (1966). Genotypic correlation dominance and heritability of quantitative characters in oats. Crop Sci., 6: 259 – 262.

Rady, M.S.; M.S. Gomaa and A.A.Nawar (1981). Genotypic variability and correlation coefficient in quantitative characters in a cross between Egyptian and Mexican wheat (*Triticum astivum* L.) Menofiya J. Agric. Res., 4:211-229.

Van der Veen, J.H. (1959). Test of non-allelic interaction and linkage for quantitative characters in generations derived from two diploid pure lines. Genetica, 30: 201.

التأثير الجينى لمحصول الحبوب ومكوناته فى أربعة هجن من قمح الديورم

مصطفى عزب مصطفى

معهد بحوث المحاصيل الحقلية- قسم بحوث القمح- مركز الحوث الزراعية.

أجرى هذا البحث في محطة البحوث الزراعية بالنوبارية خلال أعوام ٩٨/٩٧ و ٢٠٠٠/٩٩ م على أربع هجن من قمح المكرونة واشتملت الدراسة على كل من الأبوين والجيل الأول والجيل الثانى والجيلين الرجعيين وكانت النتائج كما يلى:

1- كانت قوة الهجين معنوية وموجبة لصفات طول النبات وعدد السنابل بالنبات وطول السنبلة فى الهجين الثانى وصفة عدد السنيبلات فى السنبلة ووزن السنبلة ووزن ١٠٠٠ حبة ومحصول النبات الفردى فى الهجين الأول وكانت صفة طول النبات وعدد الحبوب بالسنبلة ووزن السنبلة ووزن ١٠٠٠ حبة للهجين الثالث بينما تحصل على قوة الهجين معنوية وسالبة لصفات وزن السنبلة ووزن ١٠٠٠ حبةومحصول النبات الفردى فى الهجين الثانى وصفة طول السنبلة وعدد السنيبلات فى السنبلة ومحصول النبات الفردى فى الهجين الثالث وصفة عدد السنابل بالنبات وعدد السنيبلات بالسنبلة وعدد الحبوب بالسنبلة ووزن ١٠٠٠ حبة ومحصول النبات الفردى فى الهجين الرابع وأن قوة الهجين لصفة محصول النبات الفردى فى الهجين الأول كانت نتيجة لقوة الهجين فى عدد السنيبلات فى السنبلة ووزن السنبلة ووزن ١٠٠٠ حبة.

2- كان معامل التربية الداخلية معنويا ماعدا صفة طول السنبلة وعدد السنيبلات فى السنبلة فى الهجين الأول والثانى وصفة عدد الحبوب فى السنبلة ووزن ١٠٠٠ حبة فى الهجين الأول وصفة طول النبات وطول السنبلة وعدد الحبوب بالسنبلة فى الهجين والثالث .

3- بالنسبة لدليل السيادة فقد كانت السيادة الفائقة فى إتجاة الأب الأعلى لصفات وزن السنبلة ووزن ١٠٠٠ حبة فى الهجين الأول والثالث وصفة عدد السنيبلات للهجين الأول وعدد الحبوب للهجين الثالث وكانت السيادة الفائقة فى إتجاة الأب المنخفض لصفة طول النبات وعدد السنابل وطول السنبلة فى الهجين الأول والثالث وصفة وزن السنبلة ووزن ١٠٠٠ حبة فى الهجين الثانى وعدد السنابل بالنبات وعدد الحبوب بالسنبلة ووزن السنبلة فى الهجين الثالث وقد ظهرت سيادة جزئية فى إتجاة الأب المنخفض لصفة عدد الحبوب بالسنبلة ومحصول النبات الفردى فى الهجين الأول وصفة طول النبات وطول السنبلة وعدد السنيبلات بالسنبلة وعدد الحبوب بالسنبلة ومحصول النبات الفردى فى الهجين الثانى وعدد السنيبلات فى السنبلة للهجين الثالث وصفة طول النبات وعدد السنيبلات فى السنبلة ووزن ١٠٠٠ حبة فى الهجين الرابع بينما ظهرت السيادة الكاملة لصفة عدد السنابل فى الهجين الثانى وطول السنبلة ومحصول النبات الفردى فى الهجين الرابع .

4- كانت إنحرافات الجيل الثانى (E1) وانحرافات الأجبال الرجعية معنوية لمعظم الصفات فى الهجن تحت الدراسة مما يوضح أهمية الفعل الجينى التفوقى فى وراثة هذه الصفات .

5- أظهرت التأثيرات الوراثية المضيفة وكذلك الفعل الجينى الغير مضيف دورا هاما فى مظهر معظم الصفات المدروسة .

6- وجد أن قيم الكفاءة الوراثية العالية والمتوسطة مرتبطة بنسب تحسين عالية ومتوسطة وكانت قيم الكفاءة الوراثية المنخفضة مرتبطة بنسب تحسين وراثى منخفضة .

مماسبق يتضح أنه يمكن لمربى القمح أن يعتمد على صفة وزن ١٠٠٠ حبة ومحصول السنبلة وعدد السنيبلات فى السنبلة فى الهجين (بنى سويف ١ X السلالة ١٣) لتحسين المحصول به.

Table (2). Means and variances of P_1, P_2, F_1, F_2, BC_1 and BC_2 populations of cross 1 (Beni Sweifx Line 13), cross II (Sohag 3 x Line 21), cross III (Line 9 x Line 13) and cross VI (Line 10 x Line 21) in 1997/98 through 1999/2000 seasons.

Character	Statistics	Cross 1						CrossII					
		P_1	P_2	F_1	F_2	BC_1	BC_2	P_1	P_2	F_1	F_2	BC_1	BC_2
Plant height	X^2	82.5	85.833	86	83.2	83.04	83.92	84.0	69.75	81.25	86.0	74.6	80.04
	S^2	15.217	34.058	20.696	74.432	75.386	79.504	55.636	56.543	52.717	99.324	77.388	100.366
No. of spike/plant	X^2	4.917	5.417	4.833	6.92	4.44	5.28	4.583	6.667	6.75	7.44	5.32	4.08
	S^2	1.471	3.558	1.71	4.21	3.925	7.879	0.949	0.58	0.37	4.628	4.875	3.422
Spike length	X^2	6.583	6.667	6.917	6.88	6.36	5.76	4.583	6.667	6.333	6.44	6.06	6.48
	S^2	0.949	0.754	0.428	2.702	2.113	2.145	0.775	0.928	0.58	2.824	2.619	2.928
No. of spikelets/spike	X^2	15.083	14.917	16.00	15.8	15.36	14.52	15.0	16.0	15.083	15.64	15.4	16.08
	S^2	0.949	0.775	0.696	4.297	5.133	4.01	0.87	0.667	0.949	5.261	5.00	4.402
No. of grains/spike	X^2	43.083	44.75	44.25	47.32	40.72	37.92	50.5	44.833	46.917	52.4	40.72	40.2
	S^2	36.775	24.891	19.848	171.318	104.099	102.687	14.522	26.232	16.428	84.00	81.185	70.367
Spike grain weight	X^2	2.009	1.973	2.39	2.088	1.835	1.773	1.976	2.025	1.73	2.456	1.729	1.777
	S^2	0.015	0.018	0.017	0.116	0.089	0.111	0.054	0.038	0.032	0.117	0.078	0.072
1000-grain weight	X^2	35.158	38.425	44.683	43.076	40.057	31.844	40.175	45.242	34.167	49.124	40.96	41.32
	S^2	14.083	18.811	12.831	203.558	164.381	102.688	9.807	16.505	4.814	124.036	51.089	42.0
Grain yield/plant	6.558	8.833	8.616	14.731	7.67	7.803	9.388	9.388	16.831	9.852	15.328	7.344	8.412
	2.349	1.988	3.105	17.889	6.948	10.616	1.708	1.708	3.083	2.558	7.388	5.351	6.527

Table (2). Cont.

Character	Statistics	Cross III						Cross VI					
		P1	P2	F_1	F_2	BC_1	BC_2	P1	P2	F_1	F_2	BC_1	BC_2
Plant height	X^2	78.333	84.167	85.917	86.000	79.64	73.4	83.333	72.083	78.25	84.8	74.36	71.96
	S^2	34.319	21.014	38.341	131.757	99.5	74.939	40.58	36.775	22.978	100.297	63.745	94.162
No.of spikes/plant	X^2	5.833	5.583	5.5	7.56	4.0	4.16	5.417	6.917	4.583	7.36	4.44	4.72
	S^2	1.362	1.297	0.783	6.574	2.857	3.402	0.775	1.123	0.601	4.855	3.19	3.144
Spike length	X^2	6.417	7.00	6.25	6.76	6.12	6.2	6.25	6.917	6.25	6.88	5.52	6.26
	S^2	0.601	0.696	0.891	3.59	2.026	2.531	0.543	0.601	0.717	3.837	3.357	2.635
No. ofspikelets/spike	X^2	15.333	14.667	13.833	15.36	14.24	14.56	14.167	15.75	14.333	15.16	13.8	14.04
	S^2	0.761	0.928	0.667	3.909	3.37	3.10	0.667	1.065	0.657	5.325	3.265	3.304
No. of grains/spike	X^2	45.917	43.917	47.167	45.12	42.16	39.96	46.25	44.167	35.083	49.524	40.56	38.72
	S^2	24.254	21.819	18.58	103.404	86.831	82.815	31.5	39.449	25.123	135.825	72.007	53.92
Spike grain weight	X^2	1.97	1.879	2.063	1.945	1.936	1.77	1.876	1.946	1.628	2.348	1.640	1.713
	S^2	0.007	0.012	0.014	0.118	0.049	0.034	0.009	0.014	0.007	0.11	0.052	0.041
1000-grain weight	X^2	42.1	36.092	42.867	44.144	41.588	32.956	38.033	42.742	38.208	49.384	31.304	31.22
	S^2	25.805	21.982	17.048	141.723	63.273	105.327	15.463	22.896	14.766	174.045	89.135	81.58
Grain yield/plant	X^2	9.255	10.499	8.622	18.106	8.637	6.71	8.58	15.664	8.45	14.306	7.281	8.906
	S^2	0.769	1.900	0.705	37.289	7.591	8.721	3.162	2.76	1.895	17.008	6.674	6.732

Table (3). Heterosis, potence ratio, inbreeding depression percentages and gene action parameters for the four crosses

Character	Cross	Heterosis (%)	Inbreeding Depression	Gene action parameters								Potance Ratio (P)
				m	a	d	aa	ad	dd	E1	E2	
Plant Height	**I**	2.178	3.256 *	83.20**	- 0.880	2.954	1.120	0.787	5.293	- 1.883	- 3.207	- 1.100
	II	5.691 *	- 5.846 *	86.00**	- 5.44**	-30.345**	-34.720**	-12.565**	41.690 **	6.938 **	- 3.485	- 0.614
	III	5.744 **	- 0.097	86.00**	6.24**	-33.253**	- 37.92 **	9.157 **	66.174 **	2.417	-14.127**	- 1.60
	VI	0.697	- 8.371 **	84.80**	2.40	-46.018**	- 46.56 **	- 3.225	65.836 **	6.821 **	- 9.638**	- 0.096
No. of spikes/ plant	I	-6.464	- 43.182**	6.92**	- 0.84	- 8.574 **	- 8.24 **	- 0.59	8.80 **	1.92 **	- 0.28	- 1.336
	II	20.00 **	- 10.222*	7.44**	1.24**	- 9.835 **	- 10.96 **	2.282 **	16.91 **	1.253 **	- 2.975**	1.080
	III	- 3.644	- 37.455**	7.56**	- 0.16	-14.128**	- 13.92 **	- 0.285	20.016 **	1.956 **	- 3.048**	- 1.664
	VI	- 25.685**	- 60.593**	7.36**	- 0.28	-12.704**	- 11.12 **	0.47	14.30 **	1.985 **	- 1.59**	- 2.112
Spike length	I	4.408	0.535	6.88**	0.600*	- 2.988 **	- 3.28 **	0.642 *	6.124 **	0.109	- 1.422**	6.952
	II	12.587**	- 1.69	6.44**	- 0.42	0.028	- 0.68	0.622	-0.484	0.461 *	0.582	0.679
	III	-6.835 *	- 8.16	6.76**	- 0.08	- 2.859 **	- 2.40 *	0.212	3.677 *	0.281	- 0.639	- 1.577
	VI	-5.066	-10.08 *	6.88**	- 0.74*	- 4.293 **	- 3.96 **	- 0.407	6.067 **	0.463	- 1.053**	- 1.003
No. of spikelets/ Spike	I	6.667 **	1.25	15.80**	0.84*	- 2.44	- 3.44 **	0.757	5.68 **	0.30	- 1.12*	12.048
	II	-2.69	- 3.693	15.64**	- 0.68	- 0.017	0.40	- 0.18	-2.194	0.349	0.897	- 0.834
	III	-7.78 **	- 11.039 **	15.36**	- 0.32	- 5.007 **	- 3.84 **	- 0.653	3.906 **	0.943**	- 0.033	- 3..505
	VI	-4.182 **	- 5.77 **	15.16**	- 0.24	- 5.585 **	- 4.96 **	0.552	7.863 **	0.514	- 1.451**	- 0.794

Table (3). Cont.

Character	Cross	Heterosis (%)	Inbreeding Depression	Gene action parameters								Potance Ratio (P)
				m	a	d	aa	ad	dd	E1	E2	
No. of grains/ Spike	**I**	0.759	- 6.938	47.32**	2.80	-31.667**	-32.00**	3.634	51.053**	3.237*	-9.527**	0.400
	II	- 1.572	- 11.687**	52.40**	0.52	- 48.51**	-47.76**	-2.313	75.087**	5.108**	-13.663**	-0.265
	III	5.009*	4.34	45.12**	2.20	- 13.99*	-16.24**	1.20	36.168**	- 0.922	-9.964**	2.25
	VI	- 22.397**	- 41.162**	49.524**	1.84	-49.661**	-39.536**	0.799	41.559**	9.378**	-1.011	-9.727
Grain spike weight	I	20.04**	12.636**	2.088**	0.062	-0.737**	-1.136**	0.044	2.682**	- 0.103*	-0.773**	22.167
	II	- 13.522**	- 41.965**	2.456**	-0.048	-3.083**	-2.812**	-0.023	3.261**	0.591**	-0.225**	-11.292
	III	7.197**	5.72**	1.945**	0.166**	-0.23	-0.368*	0.12**	0.931**	- 0.049	-0.281**	3.067
	VI	- 14.809**	- 44.22**6	2.348**	-0.079	-2.957**	-2.674**	-0.044	3.034**	0.579**	-0.18**	-8.086
1000- grain weight	I	21.449**	3.596	43.076**	8.213**	-20.611*	-28.502**	9.846**	47.649**	2.339	-9.573**	4.832
	II	- 20.00**	- 43.776**	49.124**	-0.36	-40.478**	-31.936**	2.174	21.127**	10.686**	5.404**	-3.372
	III	9.645**	- 2.979	44.144**	8.632**	-23.717**	-27.488**	5.628**	42.326**	3.163*	-7.419**	1.256
	VI	- 5.396*	- 29.25**	49.384**	0.084	-74.667**	-72.488**	2.439	104.631**	10.086**	-16.072**	-0.926
Grain yield / Plant	I	11.962*	- 70.973**	14.731**	-0.133	-27.057**	-27.978**	1.005	29.655**	6.575**	-0.839	0.809
	II	- 24.848**	- 55.583**	15.328**	-1.068*	-33.057**	-29.80**	2.654**	44.211**	3.847**	-7.206**	-0.876
	III	- 12.706**	- 109.998**	18.106**	1.927**	-42.985**	-41.73**	2.549**	48.034**	8.857**	-3.152**	-2.018
	VI	- 30.292**	- 69.302**	14.306**	-1.625**	-28.522**	-24.85**	1.917**	33.62**	4.02**	-4.385**	-1.037

***, ** significant at 0.05 and 0.01 probability levels respectively**

Table (4). Heritability in broad and narrow sense, genetic advance as a percent of F2 mean and genetic coefficient of variation for the characters studied in four crosses of durum wheat.

Cross	Parameter	Plant height	No. of spikes/plant	Spike length	No. of spikelets/spike	No. of grains/spike	Spike grain weight	1000-grain weight	Grain yield/plant
I	h. broad	73.031	79.541	73.723	85.042	84.329	85.345	92.512	89.443
	h. narrow	6.968	30.825	42.413	10.176	79.297	27.586	68.80	77.503
	Δg	1.244	1.302	1.436	0.436	21.382	0.194	20.22	6.753
	Δg %	1.495	18.815	20.872	2.759	45.186	9.291	46.94	45.842
II	h. broad	44.661	86.322	73.052	84.243	77.308	69.173	94.98	66.838
	h. narrow	21.036	20.722	3.576	21.289	19.581	63.158	74.987	39.226
	Δg	4.311	0.917	0.125	1.007	3.700	0.445	17.207	2.195
	Δg %	5.013	12.325	1.941	6.439	7.061	18.119	35.028	14.32
III	h. broad	76.301	87.924	79.694	79.918	79.158	87.008	84.751	98.62
	h. narrow	67.606	72.531	73.064	34.485	35.939	60.236	81.036	71.498
	Δg	15.985	3.829	2.854	1.405	7.52	0.427	19.865	8.994
	Δg %	18.587	50.648	42.219	9.147	16.667	21.954	45.00	49.674
VI	h. broad	66.655	82.842	83.842	84.413	85.422	93.902	91.806	91.143
	h. narrow	42.561	69.537	43.836	76.638	66.338	77.439	82.072	70.04
	Δg	6.326	3.154	1.768	3.642	15.917	0.529	22.313	5.947
	Δg %	7.46	42.853	25.698	24.024	32.14	22.53	45.183	41.57