INT. J. BIOL. BIOTECH., 14 (1): 117-121, 2017.

ESTIMATION OF GENETIC PARAMETERS IN F_2 POPULATION OF WHEAT DERIVED FROM INTER-CULTIVARAL HYBRIDIZATION

Z.A. Soomro[1], M. Arsal[1], S. Mari[1], M.I. Keerio[2] and T.A. Baloch[1]

[1]*Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam-70060, Pakistan*
[2]*Department of Crop Physiology, Sindh Agriculture University, Tandojam-70060, Pakistan*

ABSTRACT

The present study was conducted to determine the heritability of grain yield with various yield components in six F_2 populations of bread wheat originated from ten parental varieties. The experiment was carried out in Randomized Complete Block Design (RCBD) with 3 replications. Parameters viz., environmental variance, phenotypic variance, genetic variance, and broad sense heritability were calculated for different important traits such as plant height (cm), tillers plant^{-1}, spike length (cm), spikelets spike^{-1}and grains spike $^{-1}$. The results regarding mean squares depicted that the genotypes were highly significant at P< 0.01 level for as plant height (cm), tillers plant^{-1}, spikelets spike^{-1}and grains spike $^{-1}$. The crosses Qafzah-16 x Mehran showed highest performance in spike length (12.58cm), spikelets spike^{-1} (12.5) and grains spike $^{-1}$ (74.75). The heritability in broad sense showed that all the crosses had high heritability in all the traits studied. Cross Katila-12 x Khirman showed highest heritability in plant height (86.74%) and spikelets per spike (86.33%) whereas Gamdow x TD-1 showed highest heritability 97.48 and 90.66 in grains spike $^{-1}$ and tillers plant^{-1}, respectively.

Key-words: Bread wheat, yield parameters, F_2 population.

INTRODUCTION

The population of Pakistan is increasing day after day which is a challenge to the breeders to evolve better and even better varieties of wheat to fulfill the food requirement. Many efforts have been made to increase per acre grain yield but a great task of further improvement still lies ahead. Yield potential of present wheat varieties is much lower than other wheat growing countries. Therefore, it is important to conduct research on food crops particularly on wheat for evolving new and better varieties. Genetic diversification in wheat provides many opportunities of developing new and favorable genotypes through hybridization and other breeding techniques. Therefore, understanding of genetic factors governing the yield components is very important. The search of new and desirable germ plasm is continuous process and development of new varieties is an unending goal of plant breeders. The heritability is valuable in determining the parameters and predicting the magnitude and genetic gain that can be used for selection of any desirable character (Aycicek and Yildirim. 2006, Memon *et al*. (2007), Laghari *et al*. (2010). Mangi *et al*. (2010) and Abinasa *et al*. (2011) have worked on heritability estimates and have reported high heritability and high genetic advance for yield and yield components. The present investigation is also aimed to investigate the inheritance, for yield, and its components in F_2 generation.

MATERIALS AND METHOD

The experiment was carried out at Botanical Garden, Department of Plant Breeding and Genetics, Sindh Agriculture University Tandojam. The experiment was conducted in Randomized Complete Block Design (RCBD) with three replications, six crosses *viz*. Gamdow X TD-1, Katila-12 X Khirman, Gamdow X Marvi, Jouhar-78 X Girwil and Qafzah-16 X Mehran and 10 varieties viz Gamdow, TD-1, Katila-12, Khirman, Marvi, Jouhar-78, Girvil, Quimma, Qafzah-16, and Mehran were planted during rabi season 2012-13. The sowning was done by hand dibbling keeping 30 cm apart between rows. First thinning was done after 25 days to maintain 15 cm distance between plants. At maturity 10 plants per population per replication were tagged for recording data for plant height (cm), tillers plant^{-1}, spike length (cm), spikelets spike^{-1}and grains spike^{-1}.

The collected data were analyzed through analysis of variance (ANOVA) as described by Gomez and Gomez (1984), the means were compared using least significant difference at 5%. The genetic parameters were determined as follows:

Genetic variance = $\partial^2 g = \partial^2 ph - \partial^2 e$
Phenotypic variance = $\partial^2 ph = \partial^2 g + \partial^2 e$

Heritability = $\partial^2 g/\partial^2 ph$
$\partial^2 e$ = enviromental variance
$\partial^2 g$ = genotype
$\partial^2 ph$ = phenotypic variance

RESULTS

Analysis of Variance

Analysis of variance and mean performance of six F2 populations and their parental lines of bread wheat is presented in Table 1 and 2 respectively. Results showed that genotypes / parents were highly significant at 0.01 level for plant height (cm), tillers plant^{-1}, spikelets spike^{-1}, grain spike^{-1}.

Table 1. Analysis of variance for plant height, number of tillers plant^{-1}, spikelets spike^{-1} and grains spike^{-1}

Source of varation	D.F	Plant height	No. Tillers Plant^{-1}	Spikelets spike^{-1}	Grains spike
Replication	2	29.95	2.99	18.79	53.13
Genotypes	15	1060.47**	57.45**	19.08**	850.32**
Error	30	9.45	1.87	4.66	14.02
Total	47	-	-	-	-

Table 2. Mean performance of parents and their F2 populations: plant height, number of tillers plant^{-1}, spikelets spike^{-1} and grains spike^{-1}

Parents F_2 population	Plant height(cm)	Tillers plant^{-1}	Spikelets spike^{-1}	Grain spike^{-1}
Gamdow X TD-1	68.85 f	8.4 e	17.16 def	49.6 ef
Katila-12 X Khirman	68.84 b	7.33 e	18.11 cdef	53.8 e
Gamdow X Marvi	91.92 e	7.4 e	17.73 cdef	54.26 de
Jouhar-78 X Girvil	92.10 e	7 e	15.93 ef	46 e
Qafzah-16 X Mehran	64.83 f	4.66 e	25.5 a	74.75 a
Quimma X Khirman	53.23 g	2.83 f	15.33 f	2.09 g
Gamdow	101.57 bcd	15.36 ab	20.28 bcd	60.31 cd
TD-1	102.21 bcd	16.25 a	21.29 bc	64.04 bc
Katila-12	106.44 b	14.45 abc	19.54 bsd	54.14 de
Khirman	102.48 bcd	13.72 bcd	19.49 bcde	55.08 de
Marvi	97.84 d	16.1 a	21.99 ab	68.37 b
Jouhar-78	100.89 cd	15.5 ab	22.04 ab	64.49 bc
Girvil	104.59 bc	12.67 cd	18.5 bcdef	47.37 f
Quimma	100.53 cd	13.57 bcd	20.4 bcd	51.45 ef
Qafzah-16	113.35 a	11.79 d	18.75 bcdef	52.07 ef
Mehran	118.25 a	14.26 abc	19.44 bcde	77.19 a

Mean followed by similar letters are not significantly different from each other

Plant height

The perusal of Table 3 showed that cross Gamdow x TD-1 exhibited high heritability (96.95 %) followed by cross Katilla x Khirman (96.74 %). Genetic variance of cross Gamdow x TD-1 was also higher (63.6) showing more genetic contribution of these cross.

Tillers plant^{-1}:

The results pertaining to tillers plant^{-1} are given in Table 3 for different cross combinations and their heritability estimates. The data revealed that cross Gamdow x TD-1 indicated highest heritability (90.66 %) followed by cross Gamdow x Marvi (89.20 %) Genetic variance was higher for cross Gamdow x TD1 (10.97) showing more genetic contribution of these crosses for tillering attribute.

Spikelet's spike^{-1}:

The results regarding spikelets spike^{-1} are mentioned in Table 3 for different combination and their heritability estimates, cross Katilla-12 x Khirman and Gamdow x TD-1 proved highest heritability (86.33 and 83.75%) followed by cross Gamdow x Marvi (80.77 %) Genetic variance of crosses Gamdow x TD-1and Gamdow x Marvi were also higher (17.06 and 14.20 %, respectively) showing more genetic contribution of these crosses for spikelets spike^{-1} character.

Grain spike^{-1}:

The results of heritability estimates for grain spike^{-1} are presented in Table 3 for different cross combinations .Highest heritability was exhibited by cross Gamdow xTD-1 (97.48 %) followed by cross Katilla-12 x Khirman (96.83 %). Results for Genetic variance of crosses Gamdow x Marvi and Gamdow x TD -1 were higher (13.11 and 130 .82 respectively) thus more genetics contribution of these recombination.

Table 3. Heritability estimates of different F_2 populations for different yield traits.

S. No.	Crosses	Phenotypic variance	Genotypic variance	Enviromental variance	Heritabiliy (%)
Plant height					
1	Gamdow X TD-1	63.6	61.66	1.94	96.95
2	Katila-12 X Khirman	61.37	59.37	2.0	96.74
3	Qafzah-16 X Mehran	18.66	15.25	3.41	81.72
4	Gamdow X marvi	64.66	55.23	9.43	85.41
5	Jouhar-78 X Girvil	36.61	34.53	2.08	94.31
6	Quimma X Khirman	36.51	35.02	1.49	95.91
Tillers plant^{-1}					
1	Gamdow X TD-1	12.01	10.97	1.04	90.66
2	Katila-12 X Khirman	10.34	8.09	2.25	78.24
3	Qafzah-16 X Mehran	10.34	8.78	1.56	84.91
4	Gamdow X Marvi	9.26	8.26	1.00	89.20
5	Jouhar-78 X Girvil	6.66	3.55	3.11	53.30
6	Quimma X Khirman	19.10	9.97	9.13	52.19
Spikelets spike^{-1}					
1	Gamdow X TD-1	20.37	17.06	3.31	83.75
2	Katila-12 X Khirman	13.76	11.88	1.88	86.33
3	Qafzah-16 X Mehran	2.46	1.00	1.46	40.65
4	Gamdow X Marvi	17.58	14.20	3.38	80.77
5	Jouhar-78 X Girvil	2.97	1.96	1.01	65.99
6	Quimma X Khirman	9.16	7.35	1.81	80.24
Grains spike^{-1}					
1	Gamdow X TD-1	134.2	130.82	3.38	97.48
2	Katila-12 X Khirman	125.27	121.31	3.96	96.83
3	Qafzah-16 X Mehran	41.96	25.49	16.47	60.74
4	Gamdow X Marvi	135.91	131.11	4.8	96.46
5	Jouhar-78 X Girvil	21.9	16.17	5.73	73.83
6	Quimma X Khirman	69.89	66	3.89	94.43

DISCUSSION

Heritability is a convenient expression of phenotypic value. For improvement of a desirable character, heritability estimate is very essential to assess the relative effect of genotype and environment in order to document the extent of possible improvement. The heritability estimates of 60% and above are considered as high below 60% up to 40% as medium and less than 40% as low (Soomro, 2000).

Heritability estimates revealed that all the crosses had moderate range of genotypic and phenotypic variances for the character plant height. Among them, the cross Gamdow x TD1 showed the highest heritability (96.95%). High heritability suggests the simpler the process of selection, which helps in identifying better genotypes in early generation. Larik *et al*. (1997) reported that high heritability was due to the presence of additive and additive x additive gene effects. Further our results match with the results of previous researchers like Aycicek and Yieldirim. (2006), Aydin *et al*. (2010), Karim and Jahan (2013) who got the similar results from their research. Heritability estimates revealed that all the crosses showed moderate range of genotypic and phenotypic variances for the character tillers plant^{-1}. Among them, the cross Gamdow x TD1 showed the highest heritability (90.66%). High heritability estimates helps in identifying the parents for better cross combination in early generation. Further more our results are in confirmation with the results of previous researchers like Rafi Ullah *et al*. (2007), Abinasa *et al*. (2011), Sial *et al*. (2013)

For the character spikelets spike^{-1} all the crosses showed moderate and high range of genotypic and phenotypic variances . Katilla x Khirman shows the highest heritability (86.33%). Larik *et al*. (1997) reported that high heritability was due to the presence of additive and additive x additive gene effects. Further our results are in agreement with the results of previous researchers like Memon *et al*.(2007), Khan and Naqvi (2011)., and Ilker *et al*. (2013). Heritability estimates revealed that all the crosses showed high range of genotypic and phenotypic variances for the character grains spike^{-1}. The cross Gamdow x TD1 showed the highest heritability (97.48%). Higher the heritability simpler the selection process and more response of the genotypes in early generation. Further our results are in confirmation with the results of previous researchers like Yagd *et al*. (2007), Khalid *et al*. (2011).

REFERENCES

Abinasa,1.M., A. Ayana and G. Bultosa (2011). Genetic variability, heritability and trait associations in durum wheat (*Triticum turgidum* L. var. durum) genotypes. *African J. of Agricultural Research*, 6(17): 3972-3979.

Aycicek, M. and T. Yildirim. (2006). Heritability of yield and some yield components in bread wheat (*Triticum aestivum* L.) genotypes. *Bangladesh J. Bot.*, 35(1): 17-22.

Aydin. N., Z. Mut and H. Ozcan (2010). Estimation of broad-sense heritability for grain yield and some agronomic and quality traits of bread wheat (*Triticum aestivum* L.). *J. of Food, Agriculture & Environment*, 8 (2): 419 - 421.

Ilker, E., F. A. Tonk, M. Tosun and O. Tatar (2013). Effects of direct selection process for plant height on some yield components in common wheat (*Triticum aestivum* L.) genotypes. *Int. J. of Agri. Biol.*, 15(4): 795–797

Karim. M.D.H. and M. A. Jahan (2013). Comparative study of yield and yield contributing traits of different genotypes, In bread wheat. *J. of Agri. Biol. Sci.*, 8(2): 147-151

Khalid, M, I. H. Khalil, Farhatullah, A. Bari, M. Tahir, S. Ali, S. Anwar, A. Ali, and M. Ismai (2011). Assessment of heritability estimates for some yield traits in winter wheat (*Triticum aestivum* L). *Pak. J. Bot.*, 43(6): 2733-2736.

Khan, N. and F.N. Naqvi (2011). Heritability of morphological traits in bread wheat advanced lines under irrigated and non Irrigated conditions. *Asian J. of Agri. Sci.*, 3(3): 215-222.

Laghari, K. A., M. A. Sial, M. A. Arain, A. A. Mirbahar, A. J. Pirzada, M.U. Dahot and S.M. Mangrio (2010). Heritability studies of yield and yield associated traits in bread wheat. *Pak. J. Bot.*, 42(1): 111-115.

Larik, A.S., S.R. Ansari and M.B. Kumbhar (1997). Heritability analysis of yield and quality components in *Gossipiem hirsutum* L. *Pak. J. Bot.*, 29 (1): 97-101.

Mangi, S. A., A. A. Sial, B. A. Ansari, M. A. Arain, K. A. Laghari and A. A. Mirbahar (2010). Heritability studies for grain yield and yield components in F_3 segregating generation of spring wheat. *Pak. J. Bot.*, 42(3): 1807-1813.

Memon, S., M.D. Qureshi, B. A. Ansari and M. A. Sial (2007). Genetic heritability for grain yield and its related characters in spring wheat (*Triticum aestivum* L). *Pak. J. Bot.*, 39(5): 1503-1509.

Rafi Ullah, M. Zahir , I. H. Khalil and Asad Ullah (2007). Heritability for heading, maturity, plant height, spike length and tillers production in winter wheat (*Triticum aestivum*). *Pak. J. Pl. Sci.*, 13 (1): 67-73.

Soomro, Z.A. (2000). Genetic architecture of qualitative and quantitative traits in *Gossypium hirsutum* L. M.Phil. Thesis, submitted to Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam, Pakistan.

Sial, M. A., J. Akhter, A. A. Mirbahar, K. D. Jamali, and Hadi Bux (2013). Genetic studies of some yield contributing traits of F_2 segregating generation of bread wheat. *Pak. J. Bot.*, 45(5): 1841-1846.

Yagd, K , E. Sozen and E. A. Cifci (2007). Heritability and correlation of yield and quality traits in durnm wheat (*Triticum durum*). *Indian J. of Agri. Sci.*, 77(9): 216-221.

(*Accepted for publication November 2016*)