Available online at www.elixirpublishers.com (Elixir International Journal)

Agriculture

Elixir Agriculture 81 (2015) 31425-31426

ISSN: 2229-712X

Study of Variance Components of Combining Ability for Yield, its Attributing Traits in Common Bread Wheat

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ARTICLE INFO

Article history:

Received: 25 February 2015;

Received in revised form:

15 March 2015;

Accepted: 31 March 2015;

Keywords

Variance components,
Combining ability,
Diallel crosses,
Yield,
Bread wheat.

ABSTRACT

Combining ability and nature of gene interactions that contribute to grain yield and its attributing traits of wheat were investigated using 21 bread wheat hybrids developed by crossing 7 commercial varieties in a half diallel mating design. The estimates of variance due to specific combining ability (σ2 SCA) were absolutely greater value over variance of general combining ability for yield and yield attributing traits. Thus the results revealed that non-additive genetic variances accomplished an important role in the expression of different characters. The GCA and SCA ratio was less than unity for all the traits. This indicated that non-additive components played relatively greater role in the inheritance of these traits. Thus, use of diallel mating with recurrent selection could provide the better conditions for recombination and accumulation of desirable genes.

Introduction

Bread wheat (Triticum aestivum L.), an allohexaploid (2n=6x=42), a cereal grass of the Poaceae family and of the genus Triticum, is one of the premier food crops of the world. It is staple food for nearly 35 per cent of the world population. Wheat is consumed in the form of bread, chapattis, biscuits and several other useful products. Nutritional value of wheat is good as it contains 11.8g proteins, 71.2g carbohydrates, 1.5 g fat, 1.2 g crude fibre, 41mg calcium and 306 mg phosphorus per 100 g wheat. It provides 20 per cent of total food calories to the human population throughout the world (Nagarajan and Singh 2011, Rai and Mauria, 2012). Combining ability analysis (Sprague and Tatum, 1942) is one of the powerful tools available which gives the estimates of combining ability effects and aids in selecting desirable parents and crosses for further exploitation. The combining ability analysis elucidates the nature and magnitude of various types of gene actions involved in the expression of quantitative characters which help in choosing the parents for hybridization programme.

Materials and methods

The present investigation was carried out at G B Pant University of Agriculture and Technology, Pantnagar. India. The material for the present study was developed during Rabi 2012-13 and the progenies were evaluated in the next Rabi season of 2013-14.Seven genetical diverse wheat varieties i.e. WH 542, HD 2967, PBW 621, UP 2526, QLD 40, UP 2672 and UP 2425 was crossed in diallel mating design excluding reciprocals. The parents and F1 seeds of 21 crosses along with 2 checks i.e. DPW 621-50, UP 2526 were planted in a randomized complete block design with 3 replications. Parents and F1 were grown in two rows plot of 1 meter length in each replication during Rabi 2013-14. The plant to plant distance was maintained at 10 cm and row to row as 20 cm. Wheat varieties were crossed with each other in a half-diallel mating design, resulting in 21 hybrid combinations, equal to p (p - 1)/2, where p is the number of parents used. The parents, F1 hybrids and checks were grown in a randomized block design in three replications. Observations were recorded on the whole plot basis for days to 75% heading and days to maturity, whereas the character like plant height, number of effective tillers per plant, spike length, number of spikelet per spike, number of grains per spike, grain weight per spike, 1000 grain weight, grain yield per plant, biological yield and harvest index were taken over five randomly selected competitive plants from each plot. Harvest index was calculated in percentage by the proportion of total grain yield in comparison to biological yield .For estimation of quality parameter in terms of protein content and sedimentation value samples were analyzed with the help of NIT based Whole Grain Analyzer (Infratech 1241 Grain Analyzer). Data collected were subjected to analysis of variance according to Steel and Torrie (1980). Combining ability effects were computed according to Griffing (1956).

Result and Discussion

This study presented in this dissertation described significant genetic variability and performance among seven wheat varieties and their F1 hybrids along with two checks for yield and its traits under study (Fig.1 and Fig.2).

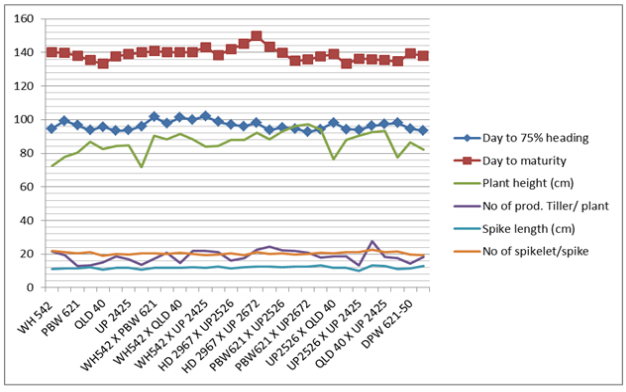

Fig 1. Performance of some morphological traits of Parent and their crosses

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Table 1. Estimates of Components of Variation for General and Specific Combining Abilities

	Character	σ^2 (GCA)	σ^2 (SCA)	(σ^2gca/ σ^2sca) ratio	Square root of(σ^2sca/ σ^2gca)
1	Days to 75% heading	3.35	13.62	0.246	0.496
2	Days to maturity	33.35	64.63	0.516	0.718
3	Plant height (cm)	2.87	28.71	0.100	0.316
4	Productive tillers/ plant	0.12	5.96	0.021	0.144
5	Spike length (cm)	0.04	0.30	0.132	0.363
6	Number of spikelets/spike	71.04	261.66	0.271	0.521
7	No. of grains/spike	0.27	0.56	0.484	0.696
8	Grain weight / spike	0.02	0.73	0.022	0.148
9	1000-grain weight (g)	16.94	73.97	0.229	0.479
10	Biological yield/ plant (g)	2.71	26.78	0.101	0.318
11	Grain yield/plant	147.82	1426.53	0.104	0.322
12	Harvest index (%)	27.89	198.17	0.141	0.375
13	Protein content	0.01	0.39	0.18	0.424
14	Sedimentation value	0.38	3.33	0.12	0.346

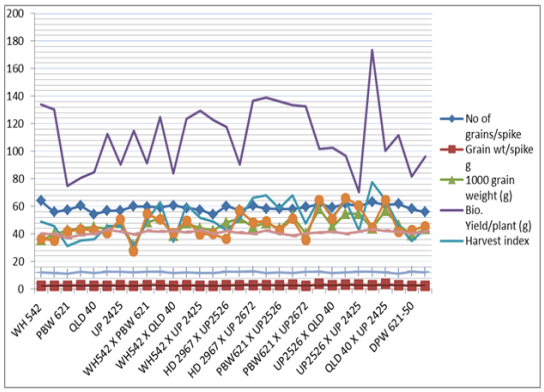

Fig 2. Yield and its contributing traits of F1 Diallel Cross and their parents

The estimates of variance due to general combining ability (σ2 GCA) and specific combining ability (σ2 SCA) are presented in Table1.The data showed that the variance of specific combining ability was absolutely greater value over variance of general combining ability for yield and yield attributing traits i.e. days to 75% heading, days to maturity, plant height, number of effective tillers per plant, spike length, number of spikelet per spike, number of grains per spike, grain weight per spike, 1000 grain weight, grain yield per plant, biological yield and harvest index, protein content and sedimentation value. The variance of GCA for different characters was found minimum (0.01) for protein content followed by grain weight per spike (0.02),however, greatest value(147.82) was calculated for grain yield per plant followed by results disparity with number of spikelet per spike(71.04).With regard to variance of SCA for different characters was noticed minimum (0.30) for spike length next to protein content(0.39) ,whereas, greatest value(1426.53) was computed also for grain yield per plant followed by number of spikelet per spike(261.66). The estimates of the ratio of GCA variances to SCA variances for all the characters are less than one which indicated the predominance of non-additive gene action.

Thus the results revealed that non-additive genetic variances accomplished an important role in the expression of different characters. Variance components depicted (Table 1) greater SCA variance than GCA indicating the importance of non-additive gene effects for different character studied. These results are in accordance with Chowdhry et al. (1992), Bebyakin and Starichkova (1992), Asad et al. (1992), Hassan et al. (2007) also reported non-additive effects for these characters in wheat.

Reference

[1] Asad, M.N., K. Alam and M.A. Chowdhry. 1992. Combining ability computation from diallel crosses comprising five bread wheat cultivars. J. Agri. Res. 30(3): 307-314.

[2] Bebyakin, V.M. and N.I. Starichkova. 1992. Genetic control of characters determining yield in spring durum wheat. Tsitologlya i Genetica 26(2): 60-64.

[3] Chowdhry, M.A., M. Rafiq and K. Alam. 1992. Genetic architecture of grain yield and certain other traits in bread wheat. Pak. J. Agric. Res. 13(3):216-220.

[4] Griffing, B. 1956.Concept of general and specific combining ability in relation to diallel crossing system. Aust, J. Biol., 51 : 551-554.

[5] Hassan, G. Fida, M. Afridi, S. S. and Khalil, I.2007 combining ability in the f1 generations of diallel cross for yield and yield components in wheat sarhad j. agric. vol. 23, no. 4

[6] Nagarajan, S. and Singh, G. 2011.Sustaining wheat (Triticum aestivum) revolution-retrospect and prospect. Indian Journal of Agric. Sci., 68 : (8) special issue. 396-404.

[7] Rai and Mauria, 2012.Sustaining wheat (Triticum aestivum) revolution- retrospect and prospect. Indian Journal of Agric. Sci., 68 : (8) special issue. 396-404.

[8] Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedure of statistics. McGraw-Hill Book Co. Inc., New York, USA.

[9] Shoran, J.; Lakshmi Kant and Singh, R. P. 2003.Winter and spring wheat: an analysis of combining ability. Cereal Research Communications, 31 (3/4): 347-354.

[10] Sprague, G. F. and Tatum, L. A. 1942.General vs. specific combining ability in single crosses of corn. J. Amer. Soc. Agron., 34: 923-932.