Research in Plant Biology 2017, 7: 21-23
doi: 10.25081/ripb.2017.v7.3428
http://updatepublishing.com/journal/index.php/ripb

ISSN: 2231-5101

REGULAR ARTICLE

# COMBINING ABILITY STUDIES OF GRAIN YIELD AND RELATED TRAITS IN PEARL MILLET

**MUHAMMAD SIDDIQUE[1], MUHAMMAD IRSHAD-UL-HAQ[1], SAEEDA KHANUM[1], NAVEED KAMAL[2], MUHAMMAD ARSHAD ULLAH[3]**

[1]Millets Research Station, Rawalpindi, Pakistan

[2]Maize Breeding Sub Station, Chharrapani (Murree), Pakistan

[3]National Agricultural Research Centre, Park Road, Islamabad 45500, Pakistan

## ABSTRACT

The present study was undertaken to explore the genetic architecture of pearl millet through combining ability analysis in a 5X5 diallel fashion. Both GCA and SCA mean squares were significant in grain yield, plant height, panicle length and days to flowering. However, these were non-significant for number of productive tillers and panicle girth. General combining ability estimates revealed that genotype MGP-322 was good general combiner for all the traits under study except for days to flowering for which MGP-335 and 13RBS-01 were good general combiners but these were poor general combiners for all other traits under study. The crosses MGP-322XMGP-328, MGP-322XMGP-335, MGP-328X13RBS-13, 13RBS-01X13RBS-13 and MGP-322X13RBS-01 were best specific combiners for grain yield and some other attributes respectively. All these crosses involved at least one good general combiner except MGP-328X13RBS-13. This suggested that good general combiners are the best tool in improving the crop yield by manipulating the genetic architecture. Combining ability variances revealed that although both GCA and SCA variances were important, however, SCA variances were higher than GCA variances suggesting that non additive type of gene action was more prominent in the inheritance of characters under study.

**Keywords**: Combining ability, Pearl millet, and Diallel cross, Grain yield

## INTRODUCTION

For boosting per acre yield through genetic improvement, the selection of suitable parents is very crucial. Information about genetic architecture is the best tool for the selection of best parents. Combining ability analysis (CAA) is one of the best techniques for exploring the genetic mechanism of crop plants [1, 2 and 3]. Such study also elucidate the genetic variability which can successfully be used in future hybridization programs. Equipped with such information, a breeder can select desirable parents which when crossed would produce best performing segregates [1]. This technique also provides information to choose an appropriate and efficient breeding scheme for selection in the segregating population.

The present study were, therefore, under taken to identify and assess the pattern of inheritance of grain yield and other quantitative traits and to select the parents having good GCA and cross combinations with good SCA values through 5 x 5 diallel analysis in pearl millet.

## MATERIALS AND METHODS

In present studies, five diverse pearl millet genotypes were crossed in all possible combinations during kharif-2014. Twenty crosses along with their five parents were sown on 07-07-2015 in the research area of Millets Research Station, Rawalpindi (Pakistan). Randomized complete block design was used with three replications having inter row and inter plant distances of 60 cm and 15 cm respectively. The recommended agronomic and cultural practices were performed to obtain a good crop stand. Data were recorded from ten randomly selected plants of each entry for grain yield and its related components. Mean values were analysed using the procedure of [4] table-1. General and specific combining ability analyses were preformed following the procedure given by [5] using method-I model-II.

## RESULTS AND DISCUSSION

Analysis of variance (Table-1) showed highly significant differences for all the characters under study except for number of productive tillers per plant and panicle girth which indicated that sufficient genetic variability is present

Received 22 September 2017; Accepted 27 December 2017

*Corresponding Author

Muhammad Siddique

Millets Research Station, Rawalpindi, Pakistan

Email: siddiqueab2015@gmail.com

among the parents. General and specific combining ability effects were highly significant for all the traits except for number of productive tillers and panicle girth. Reciprocal effects were highly significant for plant height and grain yield only and non significant for all other characters under study (Table-2). GCA estimates (Table-3) revealed that the genotype MGP-322 was good general combiner for all the traits except for days to flowering. The genotypes MGP-335 and 13RBS-01 were good general combiners for only days to flowering, while the genotype 13RBS-13 was good general combiner for panicle girth, panicle length and plant height. The genotype MGP-328 was the poorest general combiner for all the traits under study.

SCA estimates (Table-4) revealed that the MGP-322XMGP-328, MGP-322XMGP-335, MGP-328X13RBS-13, 13RBS-01X13RBS-13, MGP-328XMGP-335 and MGP-322X13RBS-01 were best combinations for grain yield respectively. All the above crosses involved at least one good general combiner except the MGP-328X13RBS-13 whose both parents are poor general combiners. This clearly indicated that increase in yield can easily be obtained through manipulating genetic architecture of crop plants using good general combiners.

Variance components (Table-5) revealed that both GCA and SCA variances for grain yield and most of its component traits were prominent, however, SCA variances were higher than GCA variances for all the traits under study suggesting non additive type of gene action for the inheritance of these traits. Similar findings have been reported by [1, 3.6, 7and 8].

**Table 1: Mean square values for yield and yield components in 5x5 diallel cross in pearl millet**

| Source of variation | Degree of freedom | Days to flowering | No. of tillers/plant | Panicle girth (cm) | Panicle length(cm) | Plant height(cm) | Grain yield/plant |
|---|---|---|---|---|---|---|---|
| Replications | 2 | 5.773 | 0.104 | 0.093 | 10.729 | 1.24 | 62.855 |
| Treatments | 24 | 8.902** | 0.384* | 0.436* | 14.743** | 970.319** | 379.753** |
| Error | 48 | 1.495 | 0.141 | 1.982 | 4.949 | 16.671 | 33.070 |

* and ** Significant at 5 % and 1 % level, respectively.

**Table 2: Combining ability mean square values for yield and yield components in 5x5 diallel cross in pearl millet**

| Source of variation | Degree of freedom | Days to flowering | No. of tillers/plant | Panicle girth (cm) | Panicle length (cm) | Plant height (cm) | Grain yield/plant |
|---|---|---|---|---|---|---|---|
| GCA | 4 | 12.37** | 0.25 | 0.32 | 10.12 | 671.08 | 183.66 |
| SCA | 10 | 2.05* | 0.14 | 0.27 | 5.77 | 267.54 | 86.40 |
| Reciprocals | 10 | 0.12 | 0.07 | 0.16 | 1.97 | 240.28 | 144.19 |
| Error | 48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 3: General combining ability estimates for yield and yield components in 5x5 diallel cross in pearl millet**

| Parents | Days to flowering | No. of tillers/plant | Panicle girth (cm) | Panicle length(cm) | Plant height (cm) | Grain yield/plant |
|---|---|---|---|---|---|---|
| MGP-322 | -0.71 | 0.27 | 0.27 | 1.23 | 9.65 | 7.55 |
| MGP-328 | -0.61 | -0.01 | -0.15 | -0.33 | -7.39 | -0.79 |
| MGP-335 | 1.92 | -0.03 | -0.11 | 0.21 | -0.85 | -2.86 |
| 13RBS-01 | 0.02 | -0.08 | -0.11 | -1.50 | -8.42 | -2.04 |
| 13RBS-13 | -0.61 | -0.14 | 0.09 | 0.39 | 7.01 | -1.86 |

**Table 4: Specific combining ability estimates for yield and yield components in 5x5 diallel cross in pearl millet**

| Parents | Days to flowering | No. of tillers/plant | Panicle girth (cm) | Panicle length (cm) | Plant height (cm) | Grain yield/plant |
|---|---|---|---|---|---|---|
| MGP-322XMGP-328 | -1.02 | 0.41 | 0.38 | -0.43 | -8.41 | 8.48 |
| MGP-322XMGP-335 | 1.61 | 0.11 | -0.20 | 1.33 | 9.89 | 8.57 |
| MGP-322X13RBS-01 | 0.35 | 0.18 | 0.29 | 1.23 | -2.05 | 0.61 |
| MGP-322X13RBS-13 | -1.02 | -0.18 | -0.57 | -2.38 | -10.48 | -9.55 |
| MGP-328X MGP-335 | 0.51 | 0.04 | -0.14 | 0.92 | -2.25 | -4.74 |
| MGP-328X13RBS-01 | 0.75 | -0.03 | -0.57 | -2.19 | 8.49 | -2.68 |
| MGP-328X13RBS-13 | 1.21 | 0.10 | 0.19 | 1.56 | -5.95 | 5.39 |
| MGP-335X13RBS-01 | -1.12 | 0.14 | 0.25 | -0.40 | -5.88 | -3.23 |
| MGP-335X13RBS-13 | -0.82 | 0.12 | -0.06 | -2.63 | -10.81 | -1.52 |
| 13RBS-01X13RBS-13 | 0.08 | 0.05 | 0.45 | 1.49 | -2.75 | 7.96 |

**Table 5: Variance components for yield and yield components in 5x5 diallel cross in pearl millet**

| Parents | Days to flowering | No. of tillers/plant | Panicle girth (cm) | Panicle length (cm) | Plant height (cm) | Grain yield/plant |
|---|---|---|---|---|---|---|
| Vg | 0.42 | 0.00 | 0.00 | 0.19 | 16.65 | 4.05 |
| Vs | 1.22 | 0.08 | 0.16 | 3.43 | 159.25 | 51.43 |
| Vr | 0.06 | 0.03 | 0.08 | 0.99 | 120.14 | 72.10 |
| Ve | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## REFERENCES

1. Jeeterwal R. C., Sharma L. D. and Nehra A. Combining ability studies through diallel analysis in pearl millet [*Pennisetum glaucum* (L.) R. Br.] under varying environmental conditions. J. Pharmacognosy and Phytochemistry. 2017;6:1083-1088.
2. Mungra K. S., Dobariya K. L., Sapodadiya M. H. and Vabdiya P. A. Combing ability and gene action for grain yield and its components traits in pearl millet. Electonic J. Plant Breed. 2015;6:66-73.
3. Jagendra Singh and Sharma R. Assessment of combining ability in Pearl millet using linex tester analysis. Adv. Crop Sci. Tech. 2014:2-4.
4. Steel, R. G. D and Torrie J. H. Principles and procedures of statistics. A biological approach 2nd ed., Mc Graw Hill Inc., New York. 1980.
5. Griffing, B. Concept of general and specific combing ability in relation to diallel crossing system. Aus. J. Biol. 1956;9:363-393.
6. Bhanderi H. S., Dangaria C. J. and Dhedhi K. K. Daillel analysis for yield and yield components in pearl millet. Asian J. Bio. Sci. 2007;2:162-166.
7. Vagadiya K. J., Dhedhi K. K., Joshi H. J., Vekariya H. B. and Bhadelia A. S. Genetic architecture of grain yield and its components in pearl millet. Int. J. pl. sci. 2010;5:582-586.
8. Irshad HM. Siddique M., Khanum S., Kamal N. and Chaudhary M. H. Genetic architecture of various morphological characters in Pearl millet. Int. J. Biol. Biotech.2016;13:575-579.