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**Deshmukh KH**
Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**Chinchane VN**
Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**HV Kalpande**
Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**AV Shinde**
Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**Corresponding Author:**
**Chinchane VN**
Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

# Combining ability studies for yield and yield contributing traits in *desi* cotton (*Gossypium arboreum* L.)

**Deshmukh KH, Chinchane VN, HV Kalpande and AV Shinde**

**Abstract**
In the present investigation an attempt was made to obtain information on general combining ability effects (GCA) of parents and specific combining ability effects (SCA) of crosses for different characters through combining ability analysis. Combining ability studies was conducted in twenty four crosses by using four female lines and six male lines in cotton. The analysis of variance for combining ability revealed significant differences among the genotypes. The female PAIG 380 was found as the best general combiner for four characters *viz.*, days to 50 percent flowering, number of sympodia/plant, number of bolls/plant and seed index. The female AKA 8 was the best general combiner for number of bolls per plant, while male Phule Dhanwantry was the best general combiner for boll weight and plant height (cm). JLA 505 found best general combiner for days to 50 per cent flowering, number of sympodia per plant, lint index and ginning out turn. The cross combinations PA 839 x AKA 7, PA 839 x PA 812, PA 839 x AKA 8 and PA 811 x JLA 505 exhibited significant and desirable specific combining ability effects for most of the yield contributing traits, indicating potential for exploiting hybrid vigour in breeding programme.

**Keywords:** Combining, ability, contributing, *desi*, *Gossypium arboreum* L.

## Introduction
Cotton plays a dominant role in the industrial economy of the country. It provides basic raw material to cotton textile industry. The oldest cotton textile were found in graves and city ruins of civilization from all climates where the fabric did not decay completely. It is one of the leading fibre crop. It has an extensive potential in providing employment both in rural and urban sectors. Cotton in India provides direct livelihood to 6 million farmers and about 40-50 million people are employed in cotton trade and its processing. Cotton being a major crop in India, has a major impact on overall Indian agriculture. Area under cotton cultivation constitutes almost 9% of the total area under agricultural crops in India. Cotton crop contributes about 14-16% to the total agricultural crop in India. India has the largest area under cotton (9 million ha) in the world constituting 26% of total world cotton area. India presently produces 4.59 million tonnes (27 million bales of 170 kgs each) while constituting 18% of the world cotton production. 60 million people including 4.5 million farmers depends on cotton for their livelihood. India is the pioneer country in the world for commercial exploitation of hybrids in cotton. Allard (1960) pointed out that, the common approach for selection of parents for hybrid development on the basis of per se performance is not good indication of their combining ability. The choice of breeding has to be based on the genetic information and a knowledge of combining ability becomes more important.

## Materials and Methods
The experiment material consisted of 24 crosses developed from the four lines and six tester parents along with PKVDH 1 and PKV Suvarna as standard checks. The male and female parental material was planted during summer 2019-2020, in a Randomized Block Design at Cotton Research Station, Mahboob Baugh Farm, VNMKV, Parbhani. Two sets of parental lines were sown at an interval of 8 days to ensure synchrony in flowering and for getting the quality hybrid seed. The line (4) x tester (6) crossing programme was effected and total 24 crosses were obtained. Data on five randomly selected plants in each genotype was collected for Days to 50% flowering, Plant height (cm), Number of sympodia, Number of bolls/plant, Boll weight (g), Seed index, Seed cotton yield/plant (g) and Lint index.

Combining ability analysis was based on the procedure developed by Kempthorne (1975) [4] related to design II of Comstock and Robinson (1952).

**Result and Discussion**

Analysis of variance of combining ability for all yield contributing characters that were under study is summarized in Table 1. The mean squares for female were non-significant for all characters studied except four characters *viz.*, days to 50 per cent flowering, number of sympodia per plant, number of bolls per plant and seed cotton yield per plant. Most of the crosses and Line X Tester interactions showed significant variance for all character studied except seed index. The data on general combining ability effects (GCA) of parents and specific combining ability effects (SCA) of crosses indicated that the effects varied significantly for different characters for different parents. The best general and specific combiners for different characters are listed in Table 2 and 3.

In the present investigations, the female parent PAIG 380 (-3.000) expressed significant negative general combining ability effect (GCA) for days to 50 per cent flowering. While the male parent AKA 8 (-2.375) and JLA 505 (-2.125) exhibited negative desirable general combining ability effects (GCA). The hybrid PAIG 380 x AKA 7 (-3.625) exhibited highest negative significant specific combining ability effects (SCA) for days to 50 per cent flowering. While the cross PAIG 380 x JLA 505 (4.125) exhibited highest significant positive specific combining ability effect (SCA).

For number of sympodia per plant in female lines PA 808 (3.664) and PAIG 380 (3.660) recorded significant positive general combining ability effects (GCA), while in male testers AKA 7 (-11.331) showed highest negative significant general combining effects (GCA). The hybrid PA 839 x Phule Dhawantary (3.740) had recorded highest positive significant specific combining ability effects (SCA) followed by PA 839 x PA 08 (3.525) and PA 811 x PA 812 (3.479).

The female lines PA 808 (3.664) and PAIG 380 (3.660) recorded significant positive general combining ability effects (GCA), whereas the male parents Phule Dhawantary (17.844), PA 08 (6.419) and PA 812 (6.019) exhibited positive significant general combining ability effects (GCA) for plant height. The hybrid PA 811 x JLA 505 (19.090) recorded highest positive significant specific combining ability effects (SCA) followed by PAIG 380 x PA 812 (17.165) and PA 839 x Phule Dhanwantry (14.015) for plant height.

For number of bolls per plant the female lines, PAIG 380 (8.210) and PA 808 (2.052) while in male parents, AKA 8 (3.569) and Phule Dhanwantry (2.831) exhibited significant positive general combining ability effects (GCA).The cross PAIG 380 x PA 08 (7.440) showed significant positive specific combining ability (SCA) for number of bolls per plant. Similar results were reported by Saravan (2010), Nidagundi *et al.* (2011) [8], Kumar *et al.* (2013) and Shinde *et al.* (2018).

Female parent, line PAIG 380 (0.031) and PA 808 (0.023) while the male parent Phule Dhawantary (0.135) and PA 812 (0.085) expressed positive general combining ability effect (GCA) for boll weight. Where as the cross combination PA 811 x AKA 7 (0.104) exhibited significant positive specific combining ability effects (SCA) for boll weight. Similar findings were observed Dhamayanthi (2011) [2], Mendez-Natera *et al.* (2012) [6] and Solanke *et al.* (2015).

The female parent PAIG 380 (10.584) and PA 808 (4.653) where as male parents Phule Dhanwantry (7.244), AKA 8 (4.219) and PA 08 (0.457) exhibited significantly positive general combining ability effects (GCA) for seed cotton yield per plant.The hybrid PAIG 380 x AKA 8 (15.691) showed highest positive significant specific combining ability effects (SCA) followed by PA 808 x PA 08 (9.435), PA 839 x Phule Dhanwantry (8.739) and PA 811 x JLA 505 (6.625) for seed cotton yield per plant. Results were reported by Ashokkumar *et al.* (2010), Saravan (2010), Nidagundi *et al.* (2011) [8], Kumar *et al.* (2013) and Shinde *et al.* (2018).

The female parents, PA 811 (0.180) and PA 811 (0.180), in case of the male parents, JLA 505 (0.272), Phule Dhanwantry (0.089) and AKA 8 (0.053) recorded significant positive general combining ability effects (GCA) for lint index. The hybrid PA 380 x PA 08 (0.608) showed the highest significant positive specific combining ability effects (SCA) followed by PAIG 380 x AKA 8 (0.420) for lint index. Similar results were reported by Saravan (2010) and Kumar *et al.* (2013) and Munir *et al.* (2017) [7].

For seed index among the female lines, PA 808 (0.174) and PAIG 380 (0.163) exhibited positive general combining ability effects (GCA) while in case of male parents PA 08 (0.127) exhibited highest positive significant general combining ability effects (GCA) followed by Phule Dhanwantry (0.098). Only two crosses exhibited significantly positive specific combining ability effects (SCA) *viz.* PA 811 x JLA 505 (0.566) and PA 811 x AKA 7 (0.101). The results are in agreement with the reports of Giri *et al.* (2006) [3], Saravan (2010), Kumar *et al.* (2013) and Munir *et al.* (2017) [7] for economic traits

**Table 1:** Analysis of variance for combining ability analysis

| Source | d.f. | Days to 50% flowering | Number of sympodia/plant | Number of bolls/plant | Boll weight (g) | Plant height (cm) | Seed cotton yield/plant (g) | Lint index | Seed index (g) |
|---|---|---|---|---|---|---|---|---|---|
| Replications | 1 | 0.083 | 0.003*** | 0.035 | 0.004 | 0.017 | 0.658* | 0.001 | 0.117 |
| Crosses | 23 | 24.174*** | 29.223*** | 112.070*** | 0.028*** | 469.237*** | 259.720*** | 0.309*** | 0.216 |
| Females | 3 | 70.889** | 143.818*** | 532.968*** | 0.012 | 313.515 | 1028.767*** | 0.261 | 0.461 |
| Males | 5 | 35.200* | 7.026 | 60.364 | 0.071* | 1126.741* | 271.183 | 0.253 | 0.075 |
| M X F | 15 | 11.156*** | 13.703*** | 45.126*** | 0.017* | 281.214*** | 102.089*** | 0.337*** | 0.215 |
| Error | 23 | 0.257 | 0.000 | 0.046 | 0.006 | 0.063 | 0.0944 | 0.000 | 0.118 |

**Table 2:** General combining ability (GCA) effects for various characters

| Parents | Days to 50% flowering | No. of sympodia/plant | No. of bolls/plant | Boll weight (g) | Plant height (cm) | Seed cotton yield/plant (g) | Lint index (g) | Seed index (g) |
|---|---|---|---|---|---|---|---|---|
| **Lines** | | | | | | | | |
| PA 811 | 2.500** | -4.108** | -7.248** | -0.024 | -7.190** | -9.548** | 0.180** | -0.141 |
| PA 839 | -0.833 | -1.025** | -3.015** | -0.030 | -0.115** | -5.689** | 0.052** | -0.196 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PA 808 | 1.333** | 1.009** | 2.052** | 0.023 | 3.644** | 4.653** | -0.075** | 0.174 |
| PAIG 380 | -3.000** | .4.124** | 8.210** | 0.031 | 3.660** | 10.584** | -0.157** | 0.163 |
| S.E. (Gi) | 0.1503 | 0.0352 | 0.0611 | 0.0204 | 0.0731 | 0.1774 | 0.0054 | 0.0895 |
| S.E. (Gi-Gj) | 0.2125 | 0.0497 | 0.0865 | 0.0288 | 0.1034 | 0.2509 | 0.0076 | 0.1265 |
| CD @5% | 0.3108 | 0.0728 | 0.1265 | 0.0422 | 0.1512 | 0.3671 | 0.0111 | 0.1850 |
| CD @1% | 0.4218 | 0.0987 | 0.1717 | 0.0572 | 0.2052 | 0.4981 | 0.0150 | 0.2511 |
| **Testers** | | | | | | | | |
| AKA 8 | -2.375** | 0.091* | 3.569** | -0.007 | -9.944** | 4.219** | 0.053** | -0.019 |
| JLA 505 | -2.125** | 1.142** | -1.244** | -0.078* | -9.006** | -2.133** | 0.272** | -0.136 |
| PA 812 | 0.000 | 0.168** | -3.769** | 0.085* | 6.019** | -9.718** | -0.035** | -0.029 |
| AKA 7 | 0.125 | -1.731** | -1.056** | -0.027 | -11.331** | -0.068 | -0.170** | -0.041 |
| PA 08 | 1.125** | 0.191** | -0.331** | -0.108** | 6.419** | 0.457* | -0.210** | 0.127 |
| Phule Dhanwantary | 3.250** | 0.139** | 2.831** | 0.135** | 17.844** | 7.244** | 0.089** | 0.098 |
| S.E. (Gi) | 0.1840 | 0.0609 | 0.1059 | 0.0353 | 0.0895 | 0.3073 | 0.0093 | 0.1549 |
| S.E. (Gi-Gj) | 0.2603 | 0.0431 | 0.0749 | 0.0250 | 0.1266 | 0.2173 | 0.0066 | 0.1096 |
| CD @5% | 0.3807 | 0.0891 | 0.1549 | 0.0516 | 0.1852 | 0.44961 | 0.0136 | 0.2266 |
| CD @1% | 0.5166 | 0.1209 | 0.2102 | 0.0701 | 0.2513 | 0.610 | 0.0184 | 0.3076 |

**Table 3:** Estimates of specific combining ability (SCA) for crosses

| Hybrids | Days to 50% flowering | Number of sympodia/plant | Number of bolls/plant | Boll weight (g) | Plant height (cm) | Seed cotton yield/plant (g) | Lint index | Seed index (g) |
|---|---|---|---|---|---|---|---|---|
| PA 811 x AKA 8 | -0.625 | -0.738** | -2.452** | 0.024 | 6.277** | -1.728** | 0.039* | 0.175 |
| PA 811 x JLA 505 | -3.375** | 0.811** | 6.660** | 0.015 | 19.090** | 6.625** | 0.095** | 0.566* |
| PA 811 x PA 812 | -1.500** | 3.479** | 1.385** | -0.069 | -7.985** | 0510 | 0.281** | -0.480* |
| PA 811 x AKA 7 | 3.875** | -0.643** | 1.573** | 0.104* | -0.435* | 0.160 | -0.039* | 0.101* |
| PA 811 x PA 08 | -0.625 | -2.192* | -8.725** | -0.085 | -12.335** | -5.965** | -0.599** | -0.371 |
| PA 811 x Phule Dhanwantary | 2.250** | -0.826** | 1.585** | 0.011 | -4.610** | 0.398 | 0223** | 0.008 |
| PA 839 x AKA 8 | 0.208 | -1.078** | -2.885** | 0.080 | -14.848** | -10.186** | 0112** | 0.054 |
| PA 839 x JLA 505 | 0.958* | -1.904** | -5.573** | -0.083 | 4.365** | -1.733** | -0.117** | -0354 |
| PA 839 x PA 812 | 1.333* | -2.595** | 1.102** | 0.068 | -9.010** | 1.552* | 0230** | 0.179 |
| PA 839 x AKA 7 | -0.292 | -1.879** | 0.490* | -0.104* | -5.360* | -0.798 | -0.225** | -0.299 |
| PA 839 x PA 08 | -0.292 | 3.525** | 3.715** | 0.007 | 10.840** | 2.427** | -0.140** | 0.358 |
| PA 839 x Phule Dhanwantary | -1.917** | 3.740** | 3.152** | 0.068 | 14.015** | 8.739** | 0.141** | 0.062 |
| PA 808 x AKA 8 | 0.542 | 2.894** | 6.698** | -0.183** | 4.344** | -3.778** | -0.571** | -0.141 |
| PA 808 x JLA 505 | -1.708** | 0.932** | -2.590** | 0.028 | -4.994** | -4.375** | 0220** | -0.149 |
| PA 808 x PA 812 | 1.167* | -0.434** | -0.215 | 0.035 | -0.169 | 3.410** | 0081** | 0.394 |
| PA 808 x AKA 7 | 0.042 | -0.560** | 0.423* | 0.087 | 5.081** | 1.010* | -0.084** | 0.006 |
| PA 808 x PA 08 | -0.958* | -2.291* | -2.402** | 0.078 | 3.581** | 9.435** | 0.131** | 0.138 |
| PA 808 x Phule Dhanwantary | 0.917* | 0.176 | -1.915** | -0.045 | -7.844** | -5.702** | 0.223** | -0.348 |
| PAIG 380 x AKA 8 | -0.125 | -0.627** | -1.360** | 0.079 | 4.227** | 15.691** | 0.420** | -0.189 |
| PAIG 380 x JLA 505 | 4.125** | -0.357** | 1.502** | 0.040 | -18.460** | -0.517 | -0.198** | -0.063 |
| PAIG 380 x PA 812 | -1.000* | 0.746** | -2.273** | -0.034 | 17.165** | -5.472** | -0.592** | -0.094 |
| PAG 380 x AKA 7 | -3.625** | 2.324** | -2.485** | -0.051 | 0.715** | -0.372 | 0348** | 0.192 |
| PAIG 380 x PA 08 | 1.875* | 1.324** | 7.440** | 0.000 | -2.085** | -5.897** | 0.608** | -0.125 |
| PAIG 380 x Phule Dhanwantary | -1.250* | -3.624** | -2.823** | -0.034 | -1.560** | -3.434** | -0.586** | 0.279 |
| S.E.+ | 0.761 | 0.178 | 0.310 | 0.103 | 0.370 | 0.899 | 0.027 | 0.453 |

## References


1. Ashok Kumar K, Ravi Kesavan R. Genetic studies of combining ability estimates for seed oil, seed protein and fibre quality traits in upland cotton (*G. hirsutum L.*). Res. J Agri. And Biolo. Sci 2008;4(6):798-802.
2. Dhamayanthi KPM. Study of interspecific hybrids (*Gossypium hirsutum x Gossypium barbadense*) for heterosis and combining ability. World Cotton Research Conference - 5. Mumbai, India 2011, 51-55.
3. Giri RK, Nirannia KS, Dutt Y, Sangwan RS. Combining ability studies for yield and quality traits in upland cotton (*Gossypium hirsutum* L.). J Cotton Res. Dev 2006;20(2):178-180.
4. Kempthorne O. An Introduction to Genetic Statistics John Wiley and Sons Inc., New York 1957, 453-471.
5. Kumar KS, Ashokkumar K, Ravikesavan R. Genetic effects for combining ability studies for yield and fibre quality traits in diallel crosses of upland cotton (*Gossypium hirsutum* L.). Academic Journals 2014;13(1):119-126.
6. Mendez-Natera, Randon JR, Hernandez AJ, Merazo-Pinto JF. Genetic studies in upland cotton (*G. hirsutum* L.). General and specific combining ability. J Agri Sci. and Tech 2012;14(3):617-627.
7. Munir S, Qureshi MK, Shahzad AN, Manzoor H, Shahzad MA, Aslam K *et al.* Assessment of gene action and combining ability for fibre and yield contributing traits in interspecific and intraspecific hybrids of cotton. Czech J Genet. Plant Breed 2017;54(1):04-10.
8. Nadagudi JM, Deshpande SK, Patil BR, Mane RS. Combining ability and heterosis for yield and fibre quality traits in American cotton. Crop Improv 2011;38(2):179-185.
9. Saravanan S, Koodalingam K. Exploitation of hybrid vigour among interspecific crosses of *Gossypium arboreum* L. and *Gossypium herbaceum* L. Electronic Journal of Plant Breeding 2011;2(1):143-146.