

Original Research Article

<https://doi.org/10.20546/ijcmas.2017.611.057>

Identification of Best Combiners for Soybean Improvement at Chhattisgarh Plains

Preeti Painkra*, Sunil Kumar Nag and Ishu Khute

Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya Raipur (C.G.) 492012, India

*Corresponding author

ABSTRACT

An investigation was carried out to assess the combining ability and nature of gene action in soybean using a half diallel mating design (without reciprocal crosses) with 5 genotype of soybean namely, JS 97-52, MACS-1336, MAUS-504, MACS-1140 and MACS-1340. The experiment was conducted in a randomized complete block design (RCBD) with 3 replications during *kharif* season of 2013-14 at AICRP on soybean, Department of Genetics and Plant Breeding, College of Agriculture, IGKV, Raipur Chhattisgarh. Observations were recorded on five genotypes and ten F_1 's. General combining ability analysis revealed that MACS-1336 is best general combiner for days to 50% flowering, days to maturity, number of seeds per pod and 100 seed weight (g) whereas for plant height (cm), pod bearing length (cm), number of pod bearing nodes and number of pods per plant, JS-97-52 was found to be best general combiner. However, the desirable SCA effects were observed cross MAUS-504 x MACS-1336 for most of the characters *viz.*, oil content (%), days to 50% flowering, 100 seed weight(g), protein content (%) and seed yield per plant(g). Gene action analysis revealed that there is a preponderance of both additive and non-additive genes for seed yield and its contributing characters. Hence, MACS-1336 and JS-97-52 along with cross combination MACS-504xMACS-1336 will be suitable especially for soybean improvement for Chhattisgarh plains.

Keywords

Combining ability,
General combiner,
Specific combiner.

Article Info

Accepted:
04 September 2017
Available Online:
10 November 2017

Introduction

Soybean (*Glycine max* L. Merrill) is a major oil seed crop in the world and is called as a golden bean or miracle bean because of its versatile nutritional qualities having 18-20% oil and 38 to 43 percent protein, which has biological value as meat and fish protein. Soybean accounts for 37.4 percent of the global area under oilseeds, and contributes to 28 percent of vegetable oil production. The crop contributes to 62.5 percent of the *kharif* oilseed production and 47 per cent of total oilseeds production in the country, about 28.6

percent of the total vegetable oils and two-thirds of the oil meals supplies during the corresponding period. Even after being a leading oilseed crop, the yield level is well below the potential and almost stagnated at around 10-11 qt/ha in the country from the variation through recombination followed by selection. In any breeding programme, the choice of parent is the secret of success in developing high yielding varieties. It is important to understand the genetic mechanisms of the inheritance and which will

increase the efficiency of the selection of the parents to be used in the crossing programme. Hence, According to Griffing (1956b), choosing the hybrids with high specific combining ability effects and including at least one parent with high or average GCA effects for a particular trait is a good strategy for soybean improvement. The general combining ability (GCA) refers to the average behavior of an inbred parent in a series of hybrid combinations, and it is associated with the additive action of the genes.

The specific combining ability (SCA) refers to those instances in which certain hybrid combinations are either better or poorer than would be expected on the average performance of the inbred parents considered, or it is associated to non-additive genetic effects (Rojas and Sprague, 1952). The diallel analysis permits the evaluation and identification of more promising crossings for the development of superior segregating lines or for use in generating hybrid populations. Looking at the growing importance of the crop an improvement in yield and quality of self-pollinated crops like soybean (*Glycine max* L. Merrill) is effective mainly through selection of genotypes with desirable characters.

Information on genetic potential of the cultivars, as well as, on their combining abilities would results in the identification of promising segregating populations (Griffing, 1956 a, b). An attempt was made during present investigation to identify best general and specific combining abilities of soybean for yield and yield improvement characters.

Materials and Methods

The experimental material comprised of five genotypes of soybean *viz.*, JS 97-52, MACS-1336, MAUS-504, MACS-1140 and MACS-1340, which were crossed in a half diallel

crossing patter resulting in ten crosses without reciprocals. The cross combinations along with their parents were planted in randomized block design with three replications during *kharif* 2013. Each entry was grown in a single row of 2 m length spaced at 30 cm and 20 cm between plants and the crop was raised following optimal agronomic practices. Data were recorded on 12 quantitative traits *viz.*; days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, pod bearing length, number of pod bearing nodes, number of pods per plant, number of seeds per pod, 100 seed weight (g), protein content (%), oil content (%) and seed yield per plant (g), for which five competitive plants were randomly selected (Table 1).

The data recorded for twelve characters were subjected to analysis of variance (Cochran and Cox, 1957) and Combining ability analysis was carried out by the procedure giving by Griffing (1956 a, b) as per the method II. This is applied for the set of data involving parents and F_1 's excluding reciprocals.

Results and Discussion

The best general and specific combiners for twelve character of soybean have been presented in Table 2. The GCA values are important for breeders who work with autogamous plants due to the additive variance. Some of the parents were good general combiners for days to 50 % flowering, yield and yield contributing characters. In these investigations we found that the parent MACS-1336 was best general combiner for days to 50% flowering, days to maturity, number of seeds per pod and 100 seed weight (g). With respect to plant height (cm), pod bearing length (cm), number of pod bearing nodes and number of pods per plant the parent JS-97-52 was found to be best general combiner for all these characters.

Table.1 List of the genotypes and its source

S.No.	Genotypes	Source
1.	JS 97 -52	Jabalpur (M.P.)
2.	MACS 1336	Pune (M.S.)
3.	MAUS 504	Parbhani (M.S.)
4.	MACS 1140	Pune (M.S.)
5.	MACS 1340	Pune (M.S.)

S. No.	F ₁ 's
1	JS-97-52 x MAUS-504
2	JS-97-52 x MACS-1140
3	JS-97-52 x MACS-1340
4	JS-97-52 x MACS-1336
5	MAUS-504 x MACS-1140
6	MAUS-504 x MACS-1340
7	MAUS-504 x MACS-1336
8	MACS-1140 x MACS-1340
9	MACS-1140 x MACS-1336
10	MACS-1340 x MACS-1336
	Check
1.	JS 97 -52

Table.2 Best general combiners and specific combiners for seed yield obtaining characters

S. No.	Characters	Parents	F ₁ S
1	Days to 50% flowering	MACS-1336	MACS-1340 x MACS-1336, MAUS-504xMACS-1340, MAUS-504 x MACS -1336
2	Days to maturity	MACS-1340, MACS-1336	JS-97-52 x MACS-1336 JS-97-52 x MACS-1340
3	Plant height (cm)	JS-97-52	MAUS-504xMACS-1340 JS-97-52 x MAUS-504
4	Number of primary branches per plant	MACS-1340	MACS-1140xMACS-1340 MACS-1140 x MACS-1336
5	Pod bearing length (cm)	JS-97-52	MAUS-504xMACS-1340 JS-97-52 x MAUS-504
6	Number of pod bearing nodes	JS-97-52	MAUS-504 x MACS-1140
7	Number of pods per plant	JS-97-52	MAUS-504xMACS-1336 JS-97-52xMACS-1340 JS-97-52 x MACS-1140
8	Number of seeds per pod	MACS-1336	-
9	100 seed weight (g)	MACS-1336	MACS-1140 x MACS-1340
10	Protein content (%)	MAUS-504	MACS-1340 x MACS-1336
11	Oil content (%)	MACS-1140	MACS-1140xMACS-1340 MAUS-504 x MACS-1336
12	Seed yield per plant (g)	MACS-1140	MAUS-504 x MACS-1336

For days to maturity and number of primary branches per plant the parent MACS-1340 was best general combiner. For the traits oil content (%) and seed yield per plant (g) parent MACS-1140 was most suitable general combiner, whereas MAUS-504 was found suitable for protein content. In majority of the cases, good general combiners showed better mean performance, indicating that the parent may be selected either based on GCA, mean performance or by combination of them. So, these parents could be used extensively in breeding program to increase soybean yield with quality.

Based on the specific combining ability estimates the cross MAUS-504 x MACS-1336 had the greatest performance for days to 50% flowering, number of pod per plant, oil content (%) and seed yield per plant (g), from out of twelve characters which shows this cross was the best specific combiner for those characters, while the cross MAUS-504 x MACS-1340 was the best performed cross for days to 50% flowering, plant height (cm) and pod bearing length (cm). For days to 50% flowering and protein content (%) cross MACS-1340 x MACS-1336 was found to be the good specific combiner. Among the F₁ population the cross MACS-1140xMACS-1340 was the best specific combination for number of primary branches per plant, 100 seed weight (g) and oil content (%). The cross JS-97-52 x MACS-1340 was found to be best specific combination for two traits viz., days to maturity and number of pods per plant, while for plant height(cm) and pod bearing length(cm) the cross JS-97-52 x MAUS-504 was the best specific combination. The four crosses JS-97-52 x MACS-1336, MACS-1140 x MACS-1336, MAUS-504 x MACS-1140 and JS-97-52 x MACS-1140 were found to be best specific combination for only once character viz., days to maturity, number of primary branches per plant, number of pod bearing nodes and number of pod per plant.

From the present research work to estimate the best combiner of soybean for Chhattisgarh plain the following conclusions have been derived; Analysis of variance showed significant differences for the genotypes. It helps in estimation of inbred in terms of their genetic value and in the selection of best parents for hybridization. Further it also helps in identification of superior cross combinations which may be utilized for exploitation of heterosis commercially. Parental genotypes MACS-1336 and JS-97-52 were best general combiners whereas, cross combinations MAUS-504 x MACS-1336 and MAUS-504 x MACS-1340 were best specific combinations, respectively therefore could be used in future breeding program for soybean improvement for seed yield and its components for Chhattisgarh plains

References

- Cochran and Cox 1957. Experimental Designs. Asia Publication House, Bombay.
- Dhasarathan, M., Babu, C. And Iyanar, K. 2015. Combining ability and gene action studies for yield and quality traits in baby corn (*Zea Mays L.*). *SABRAO J. Breed.Genet.*, 47 (1):60-69.
- Gravina, G., de A., Sediya, C. S., Filho, S. M., Moreira, M. A., Barros, E. G.de, Cruz, C. D. 2004. Multivariate analysis of combining ability for soybean resistance to *Cercospora sojina* Hara. *Genet. Mol. Biol.*, 27(3).
- Griffing, B., 1956a. Concept of general and specific combining ability in relation to diallel crossing systems. *Aust J BiolSci.*, 9:463-493.
- Griffing, B., 1956b. Concept of general combining and specific combining ability in relation to diallel crossing systems. *Aust J Biol Sci.*, 9:463-493.
- Muhammad, A., Ashiq Muhammad, R., Aziz Ur Rahman, H. R., and Ali, Imtiaz.

2014. Combining ability and heritability studies for important traits in F₂ of *Brassica napus*. *Am-Euras. J. Agric. & Environ. Sci.*, 14 (6): 509-515.

Rojas, B.A., and Sprague, G.F. 1952. A

comparison of variance components in corn yield trials. III. General and specific combining ability and their interaction with location and years. *Agron J*, 44: 462-466.

How to cite this article:

Preeti Painkra, Sunil Kumar Nag and Ishu khute. 2017. Identification of Best Combiners for Soybean Improvement at Chhattisgarh Plains. *Int.J.Curr.Microbiol.App.Sci*. 6(11): 478-482. doi: <https://doi.org/10.20546/ijcmas.2017.611.057>