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Stability Analysis for Major Yield Traits in Soybean [*Glycine max* (L.) Merrill]

Ghanshyam Bamaniya[1*], Deepesh Kumar Ahirwar[2], D.K. Raidas[3], Jeevan Rathore[1], Jayesh Raman[2] and S. R. Ramgiry[4]

[1]M.Sc. Student, Department of Genetics and Plant Breeding, RVSKVV-RAK College of Agriculture, Sehore (Madhya Pradesh), India.
[2]M.Sc. Student, Department of Horticulture (Vegetable Science), RVSKVV-RAK College of Agriculture, Sehore (Madhya Pradesh), India.
[3]Assistant Professor, Department of Plant Physiology, RVSKVV-RAK College of Agriculture, Sehore (Madhya Pradesh), India.
[4]Principal Scientist, Department of Genetics and plant Breeding, RVSKVV-RAK College of Agriculture, Sehore (Madhya Pradesh), India.

(Corresponding author: Ghanshyam Bamaniya)*
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ABSTRACT: Soybean is grown in Rabi crop as rainfed crop which express wide production gap due to wide environments. Therefore, development stable soybean varieties may minimize the production gap at high sustainable advantages. Stability explains why genotypes' average performance across a wide range of environments is an important characteristic in current breeding lines. Keeping the aforementioned factors in mind, the current study was carried out in randomized block design with three replications to examine 20 advanced breeding lines created as part of the All India Coordinated Research Project on Soybeans at RAK College of Agriculture, Sehore (M.P.). Under present investigation adoptive potential and relative stability of 30 genotypes of soybean for yield and its contributing traits have been determined. The pooled analysis of variance carried out to know the response of different characters. To various environmental factors, revealed that genotype × environment interactions were significant for number of primary branches per plant, plant height, number of pods per plant, biological yield per plant, number of seeds per plant, seed yield per plant and 100 seed weight. This suggested that these characters were highly sensitive to the changes in the environmental conditions. Whereas interactions for days to 50% flowering, days to maturity and harvest index were non-significant which indicated that these traits and show least effect to the changes in the environmental conditions.

Keywords: Variability, heredity, genetic advancement, stability, association.

INTRODUCTION

Soybean is grown in Rabi as rainfed crop which express wide production gap due to wide environments. Therefore, development stable soybean varieties may minimize the production gap at high sustainable advantages. Nevertheless, in order to achieve sustainable output, these cultivars still require development in terms of yield, quality, and disease resistance. Given the variety of environments in which soybeans are cultivated, stable variation in the environment is preferable for the highest possible production levels in Madhya Pradesh. Stability explained that the average performance of genotypes over wide range of environments as given by Eberhard & Russell (1966) is useful traits in present breeding lines. Selection is the most important activity in all plant breeding programme. The success of selection programme largely depends on the extent of genetic variability present in the population and the heritability of the concerned character. Selection is generally more effective for characters which have high heritability than those having low heritability. Bhat *et al.* (2012) observed high heritability values for traits *viz.*, number of pods per plant and harvest index. Desissa (2017) evaluated sixteen soybean genotypes and found high heritability with high genetic advance as percent of mean were found for plant height, pod length, and biomass yield, respectively. Whereas high heritability was associated with moderate genetic advance were found for number of pod/plant and days to 95% maturity respectively.

MATERIAL AND METHODS

The experiment was carried out in Randomized Block Design with three replications and experiment was sown on 30 November 2020. Each genotype was planted in row 3m long, 40 cm row to row spacing and 10 cm plant to plant spacing. Fertilizer dose 20:60:20:20 NPKS Kg/ha was applied uniformly over the soil and recommended package of practices were adopted for optimum crop growth and development with proper plant protection under rain fed condition. A random selection of ten plants in each plot was made and various observations were recorded on each selected plants. Eberhart and Russell (1966) model was used for estimation of stability parameters.

$y_{ij} = \mu_i + \beta_i I_j + \delta_{ij}$

The model provides a mean of partitioning the variety × environment interaction of each variety into two parts.

1. The variation due to the response of the varieties to varying environmental indexes (S.S. due to regression), and,
2. The unexplainable deviation from the regression on the environmental index.

RESULTS AND DISCUSSION

Selection of good parents for hybridization had always been a problem for plant breeders. Stability in performance of different traits indicate number of genes involved in its control. Monogenic or Oligogenic traits are least influenced by the environmental conditions and therefore, better suited for selection. Genotypes having such traits may easily be chosen as parents for hybridization.

The stability of yield and yield components revealed that days to maturity and plant height were most stable trait as these remained stable in most of the genotypes i.e. 18, followed by days to 50% flowering which was stable in 17 also reported similar findings by Singh *et al.* (2010). number of primary branches per plant as also reported by Karnwal and Singh (2009) and number of pods per plant stable in 16 of 15 genotypes, respectively. It indicated that these traits are governed by few genes and therefore, can be given due weight age while selecting parents for hybridization. Biological yield per plant was the least stable trait because this was stable only for 14 genotypes. It suggested that biological yield per plant was least stable and selection of genotypes based on these traits in different environments would be unpredictable. Among genotypes, RVS2012-21 was observed most stable, as this was stable for all 10 traits followed by RVS2012-10, RVS2012-29, RVS2012-5, and RVS2012-29 which were stable for 9 traits including seed yield per plant. RVS2012-3, RVS2012-8, RVS2012-7, RVS2012-12, RVS-28, RVS-18, Himso1689 were found stable for 8 traits including seed yield per plant similarity RVS2012-7 and RVS2012-15 which was stable for 7 traits including seed yield per plant reported by Sirohi *et al.* (2007). Stable genotypes may be used as parents in breeding programmes for wider adaptability traits (presented in Table 1 and Fig. 1).

Table 1: Estimates of stability parameters for seed yield per plant.

Characters	Seed yield per plant		
	Mean	**Reg. Coeff. (b)**	**S^2d**
RVS2012-3	5.21	0.70	0.07
RVS2012-10	6.98	1.28	0.15
RVS2012-8	4.51	-0.09*	0.25
RVS2012-7	4.79	0.25	0.34
RVS2012-21	5.36	0.77	1.13
RVS2013-13	8.56	1.96	1.15
RVS2012-10	5.07	1.47	-0.08
RVS2012-12	9.14	2.24**	1.90
RVS-28	7.22	0.80	-0.06
RVS 2012-15	6.58	1.72	-0.10
RVS 2012-29	4.74	0.26	-0.09
RVS 2012-63	4.29	0.86	0.04
RVS 2012-54	4.29	0.86	0.04
RVS 2012-29	4.74	0.26	-0.09
RVS 2012-26	6.97	2.13**	2.16
RVS-2018	5.28	1.14	0.00
RVS2011-35	4.66	0.77	1.29
JS21-72	4.46	0.39	-0.10
JS-2094	10.72	2.58**	-0.09
Himso-1689	6.03	-0.15**	1.14
Mean	**6.23**	1.00	-
S.Em (±)	**0.54**	0.70	-

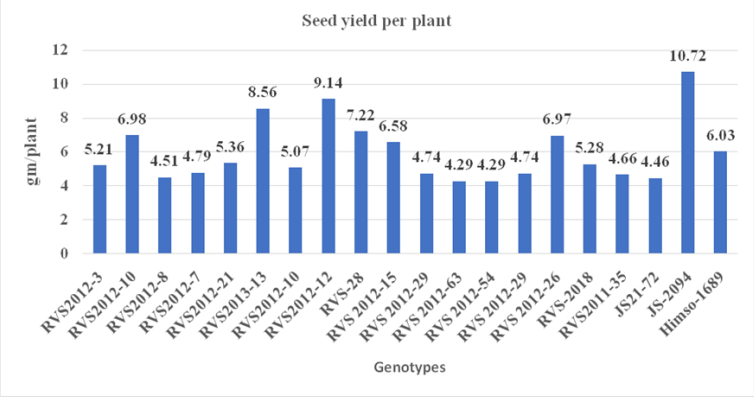

Fig. 1. Seed yield per plant.

CONCLUSIONS

Stability performance furnished information about the adaptation of genotypes in different environments. Genotypes, RVS2012-6 and RVS2012-5 Showed stability for major yield and yield components and could be recommended for cultivation in western part of the Vindhyan Plateau of Madhya Pradesh during Rabi season. The traits *viz*., days to maturity, plant height, number of branches per plant and pods per plant have been identified as major yield contributing traits through association analysis. High estimates of heritability accompanished by high genetic advance were recorded for plant height, number of pods per plant, number of seeds per plant over environments suggested that direct selection on these traits can improved the seed yield.

FUTURE SCOPE

The adaptive capability and phenotypic stability of the genotypes require additional assessment in a variety of contexts. To create stable, high-yielding varieties, one might take use of the heterogeneity seen in soybean genotypes. The genotypes that have been identified must be used for both commercial growth and as parents to create improved cultivars. A deeper comprehension of the real links among features through path analysis necessitates more investigation into correlation at the phenotypic and genotypic levels. To evaluate the consistency of performance, evaluation of additional minor yield and qualitative attributes of genotypes should be done throughout the course of seasons and years.

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