The Pharma Innovation Journal 2023; 12(10): 1941-1943

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 1941-1943

www.thepharmajournal.com
Received: 14-07-2023
Accepted: 17-08-2023

Nutan Verma
Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

Shreya Singh
Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

Sourav Ranjan Nanda
Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

Corresponding Author:
Nutan Verma
Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

Stability analysis in soybean (*Glycine max* (L.) Merrill)

Nutan Verma, Shreya Singh and Sourav Ranjan Nanda

Abstract
In present investigation total 30 genotypes of soya bean (*Glycine max* (L.) Merrill) were sown in Randomized block design in three sowing environments in kharif season 2020. Stability parameter based on the Eberhart and Russell model (1966). Based on mean, unit regression (bi=1.0 i.e., b_i= SEm $\pm$ 1) and least deviation from regression coefficient $S^{-2}d_i$ =0 genotypes it was evident that JS 97-52, BSS-2, JS 80-21, JS 335, and BS-1 were most stable genotype under three different environments. Traits like days to 50% flowering, days to maturity, and harvest index were stable across environments. On the basis of finding it may conclude that JS 97-52, BSS-2, JS 80-21, JS 335, and BS-1 were stable towards the environment in the Jharkhand state and are recommended for commercial cultivation.

Keywords: Soybean, stability analysis, genotype x environment interaction

Introduction
Soybean (*Glycine max* (L.) Merrill) is a self-pollinated oilseed crop with diploid chromosome number 2n = 40 and belonging to family Leguminosae and subfamily Papilionaceae. A seed of soybean contains around 20% oil as well as 40% quality protein, thus making it only an oilseed crop which is also a valuable source of protein. This is why soybean is recognized in the world over as the 'Golden bean' of the 21st century. Its productions and consumption are fast growing. In India, Madhya Pradesh, Maharashtra and Rajasthan together contribute about 93% in terms of area and production of soybean. In recent years, however, Telangana, Karnataka and Gujarat are also making their marks as far as the expansion of soybean cultivation is concerned. The agro climatic condition of Jharkhand too provides ideal conditions for soybean production. The state is largely inhabited by tribal population and is socio-economically poor; quite a large section of tribal population is still practicing primitive type of agriculture.

As the protein calorie malnutrition poses a serious threat to the poor tribal farmers of the area, increased production and consumption of soybean is the best way to overcome this problem. Though soybean has established its potential as a major oilseed crop in India, many states of the country are still lagging behind in productivity, mainly due to narrow genetic base of soybean varieties and limited varietal stability.

Considering this, the present investigation has been carried out to identify phenotypically stable genotypes of soybean which could perform uniformly under different environmental conditions.

Material and Methods
An experiment was carried out during Kharif 2020 at Birsa Agricultural University, Ranchi. The experimental materials composing of thirty soybean genotypes were sown in randomized block designs with three replications under three different environments created by three sowing dates *viz* 25th June 2020 (E_1), 10th July 2020 (E_2) and 25th July 2020 (E_3). Each genotype was sown in three rows of 3-meter length with spacing of 45 cm row to row and 5-6 cm plant to plant. The recommended package of practices was followed with the application of 20:40:40:40 kg NPKS per hectare at the time of field preparation. The observations were recorded on five competitive plants for ten quantitative characters *viz*. days to 50% flowering, days to maturity, number of primary branches per plant, plant height (cm), number of pods per plant, number of seeds per plant, biological yield per plant (g), 100 seed weight, seed yield per plant (g) and harvest index (%).

Before threshing the mean weight of harvested 5 competitive plants (seed + straw) was considered as the biological yield.

The recorded biological yield was expressed in g/plant. After sun drying and threshing, the weight of threshed seeds was recorded and expressed as g/plant.

The straw yield was obtained after deducting the seed yield from the biological yield. Harvest index (HI) was calculated by dividing seed yield by biological yield and expressed in percentage.

The stability analysis was carried out using Eberhart and Russell model (1966) [4] according to which an ideal stable genotype would be the one, which has high mean (greater than the population mean), regression coefficient equivalent to unity (bi=1) and non-significant or zero deviation from regression coefficient (S^2di=0).

Results and Discussion

The pooled analysis of variance carried out to know the response of different characters to various environmental factors where pooled analysis of variance for different genotypes showed significant difference for all the traits studied (Table 1). Mean square arising due to genotype x environment (G X E) interaction was found significant for plant height, number of primary branches per plant, number of pods per plant, number of seeds per plant, 100 seed weight, biological yield and seed yield, revealing that these characters were highly sensitive to the changing environments, while interactions for days to 50 per cent flowering, days to maturity and harvest index were non-significant revealing that these three characters were well adapted to the varying environmental conditions.

Significant variance due to genotype x environment (linear) was observed for all the traits except pods per plant revealing the differential response of genotypes to various agro-climatic conditions. Similar findings were reported by Alghandi (2004) [1] and Deshmukh *et al*. (2009) [3].

The stability parameters, *viz* mean, regression coefficient (bi) and mean square deviation from the regression (S^2di) for all the characters of each genotype were estimated (Table-2). The non-linear

component (pooled deviation) arising due to heterogeneity measured as mean square due to pooled deviation was significant for the characters days to 50% flowering, number of primary branches per plant, plant height (cm) pods per plant, 100 seed weight (g), seed yield (g/plant) and harvest index (%) revealing the presence of non-linear response of the genotypes to the changing environments. The significance of pooled deviation for these characters confirmed the contribution of non-linear component to the total G X E interaction. In the present study (Table-1) five genotypes, JS97-52, BSS-2, RKS-18, JS 80-21 & JS 335 were found stable for all the 10 characters; genotypes BAUS-96, RAUS-5, RKS-18 and BAUS-40 showed stability for 9 characters and three genotypes BAUS-100, BAUS-102 and Bragg showed stability for 7 characters, while one genotype PK 1024 exhibited stability for only 2 characters. Findings were reported by Parmar and Raragiry (2012), Krisnawati *et al*. (2016) [5], Bhartiya *et al.* (2017) [2].

Table 1: Different characters to various environmental factors where pooled analysis of variance for different genotypes showed significant difference for all the traits studied

	Genotypes	Days to 50% Flowering	Days to Maturity	Plant Height (cm.)	Primary Branches /plant	Pods/plant	Seeds/plant	Biological yield (g/plant)	100 Seed Wt. (g)	Seed Yield (g/plant)	Harvest Index (%)	Total Stable Character
1.	BAUS-100	*	*	*	*			*		*	*	7
2.	SL 688	*	*	*	*				*		*	6
3.	BAUS-96	*	*		*	*	*	*	*	*	*	9
4.	PS1447	*	*	*	*		*		*			6
5.	RAUS-5	*	*	*		*	*	*	*	*	*	9
6.	BAUS-27	*	*	*	*					*	*	6
7.	BAUS-102	*	*		*	*		*		*	*	7
8.	BAUS-65	*	*		*		*		*	*		6
9.	JS 97- 52	*	*	*	*	*	*	*	*	*	*	10
10.	BAUS-72	*	*	*	*		*				*	6
11.	BSS-2	*	*	*	*	*	*	*	*	*	*	10
12.	PS1347	*	*		*				*	*	*	6
13.	BAUS101	*	*	*	*		*	*				6
14.	JS 71-05	*	*	*	*				*		*	6
15.	JS 95-60	*	*	*	*		*		*			6
16.	RKS-18	*	*	*	*		*	*	*	*	*	9
17.	Bragg	*	*	*	*	*			*		*	7
18.	PS1556	*		*	*		*	*			*	6
19.	BAUS103	*			*		*		*	*	*	6
20.	JS 80-21	*	*	*	*	*	*	*	*	*	*	10
21.	JS 335	*	*	*	*	*	*	*	*	*	*	10
22.	BAUS-71	*		*			*	*	*		*	6
23.	PK472			*	*				*	*	*	5
24.	Pb-1		*		*	*	*	*	*			6
25.	PK1024	*	*									2
26.	BAUS-40	*	*		*	*	*	*	*	*	*	9
27.	BAUS-60	*	*	*	*			*	*			6
28.	PK1029			*		*	*		*	*		5
29.	BAUS-59			*	*		*		*		*	5
30.	B.S-1	*	*	*	*	*	*	*	*	*	*	10

Table 2: Grouping of genotypes based on stability parameters

Characters	Group-I	Group-II	Group-III
Days to 50% flowering	BAUS-96, RAUS-5, RKS18, PK1024, PS1447, BAUS-72, PS1556, BAUS-102	BAUS 102, Bragg, BAUS-40, SL688, JS 71-05, BAUS-71	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1
Days to Maturity	PK1024, BAUS-100	SL688, BAUS-40, BAUS-96, JS 71-05, Bragg, BAUS-02	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1
Plant height	BAUS-27, BAUS-72, BAUS-101, JS 95-60	Nil	PK1029, JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1
Primary branches	BAUS-100, SL688, Pb-1, PS1556	Nil	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, PS1347, Bragg
Pod/plant	BAUS-96, RAUS-5, RKS-18	Nil	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, PS1447
Seeds/plant	BAUS-40	PK1029	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, BAUS-100
Biological yield	Bragg, PS1447	Pb-1	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, BAUS-65, JS 71-05
100 seed weight	BAUS-96, RAUS-5, RKS-18, Pb-1	Nil	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, BAUS-71
Harvest index	SL688, PK1029, BAUS-100	Nil	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, BAUS-96, BAUS-102
Seed yield/ plant	BAUS-96, RAUS-5, RKS-18, PK1029	BAUS-40, JS 71-05, BAUS-102, Bragg, SL688	JS 97-52, BSS-2, JS 80-21, JS 335, BS-1, Pb-1, PK472, PK1024

As far as stability of different character was concerned, the number of primary branches/plant and days to 50% flowering were found the most stable in 26 genotypes, followed by days to maturity which was found stable in 24 genotypes. The character, 100 seed weight was found stable in 23 genotypes while plant height and harvest index were found stable in 22 genotypes. 20 genotypes showed stability for the character, number of seeds per plant. The seed yield per plant was found stable in 17 genotypes, biological yield/plant was found stable in 16 genotypes while number of pods per plant was least stable trait, found only in 12 genotypes. All the thirty genotypes were categorized into three groups based on stability parameters (Table-2). The genotypes falling in Group I have high mean, regression coefficient values around one with non-significant or zero deviation from regression coefficient indicating stability over environments. Under group II, genotypes with high mean, less than unity regression value and non-significant or zero deviation from regression coefficient were taken, indicating suitability towards a poor environment. Under group III the genotypes with high mean, more than unity regression coefficient value and non-significant deviation from regression coefficient were taken, indicating the suitability of genotypes towards favourable environments.

According to the grouping based on stability parameters, under group I (bi=1) three genotypes, BAUS-96, RAUS-5 & RKS-18 were stable for four traits *viz*., days to 50% flowering, pods/plant, 100 seed weight and seed yield/plant, thus these three genotypes were stable over environments. Under group II (bi<1), five genotypes, SL688, BAUS-40, JS71-05, Bragg and BAUS-102 were stable for three traits *viz*. days to 50% flowering, maturity and seed yield/plant indicating stability of genotypes in unfavourable environments, while five genotypes, JS97-52, BSS-2, JS80-21, JS335 and BS-1 were placed in group III (bi>1) exhibited stability for all the traits studied indicating suitability of these genotypes under favourable environment. Thus, the five genotypes JS97-52, BSS-2, JS80-21, JS335 and BS-1 exhibited stable performance for yield and all the yield contributing traits (Table 1 & 2) could be recommended for commercial cultivation and would be useful in future breeding programmes.

Conclusion

Traits like days to 50% flowering, days to maturity, and harvest index were stable across environments. Five genotypes namely JS 97-52, BSS-2, JS 80-21, JS 335, and BS-1 showed stability for all the traits and are recommended for commercial cultivation in Jharkhand state.

References

1. Alghandi SS. Yield stability of some soybean genotypes across diverse environments. Pakistan Journal of Biological Sciences. 2004;7(12):2109-2114.
2. Bhartiya A, Aditya JP, Singh K, Pushpendra, Purwar JP, Agarwal A. AMMI & GGE biplot analysis of multi environment yield trial of soybean in North Western Himalayan state Uttarakhand of India. Legume Research. 2017;40(2):306-312.
3. Deshmukh MP, Shinde SR, Mulik SP, Hasure RR, Pawar PK. Yield stability of promising soybean genotypes. Journal of Oilseed Research. 2009;26(Special issue):26-28.
4. Eberhart SA, Russell WA. Stability parameters for comparing varieties. Crop Science. 1966;6:36-40.
5. Krisnawati A, Basunanda P, Nasrullah, Adie MM. Genotype stability analysis of soybean using Additive Main Effect and Multiplicative Interaction (AMMI) methods. Informatika Pertanian. 2016;25(1):41-50.
6. Parmar D, Ramgiry SR. Stability analysis for growth and yield attributes in soybean (*Glycine max* (L.) Merrill). Soybean Research. 2012;10:10-23.
7. Ramana MV, Satyanarayana A. Stability analysis for quality characters in soybean (*Glycine max* L. Merrill). Legume Research. 2006;29(4):274-277.
8. Ramtete Rajkumar, Husain SM. Evaluation of soybean (*Glycine max* L. Merrill) varieties for stability of yield and its components. Indian Journal of Agricultural Science. 2008;78(7):625-628.