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STABILITY BEHAVIOUR OF SOME SOYBEAN [*GLYCINE MAX* (L.) MERILL] GENOTYPES UNDER ENVIRONMENTAL VARIABILITY

S. D. DEKA* AND P. TALUKDAR

Department of Plant Breeding and Genetics, Assam Agricultural University Jorhat 785013

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ABSTRACT

Stability behaviour of twenty one germplasm collection of soybean was studied for yield and some of the yield attributes under five different environments. Significant genotype x environment interactions were observed for almost all the characters. For characters like 100-seed weight and yield per plant, only linear component contributed significantly towards GE interaction variance. For rest of the characters both linear and nonlinear components contributed towards GE interaction variance. Genotypes Moti, PK-308, PK-472, BD-1, BD-12, Bragg and PK-73-203 showed average stability for seed yield. Whereas DS-16-1-37-1 had above average stability.

Key words: Soybean, environmental variability, stability.

Soybean (*Glycine max* (L.) Merill), along with groundnut and rapeseed mustard has established itself as third important oilseed crop of India. With 20–21% good quality oil and 42–45% protein it is a highly remunerative crop to the farmers. As a result its area increased from about 0.6 million hectares in 1980 to about 2 million hectares in 1989–90. However, its productivity has been hovering around 9 q/ha as against world average of 18 q/ha. Stability of yield performance of soybean cultivars is an important consideration while selecting them for different agroclimatic niches.

Studies on genotype x environment (interaction (G x E) facilitate identification of genotypes for phenotypic stability. Screening of genotypes for stability under varying environmental condition is an essential component of a breeding programme. The present investigation was undertaken to evaluate genotype environment interaction (G x E) and phenotypic stability of soybean genotypes.

*Present address: Department of Agronomy, Assam Agricultural University, Jorhat 785013.

MATERIALS AND METHODS

In the investigation twenty one germplasm collection of soybean were included as listed in the Table 1. The genotypes were sown at two different dates during kharif and at three dates in spring season of 1989 and 1990, respectively. Each environment comprised a separate experiment and was laid out in randomised block design.

The observations were recorded for days to maturity, number of pods per plant, number of seeds per pod, 100-seed weight and yield per plant. For each character the mean observation of each genotype over the replications were subjected to pooled analysis of variance in order to study G x E interaction and phenotypic stability by following the model of Eberhart and Rusell [1].

RESULTS AND DISCUSSION

The pooled analysis of variance for genotype x environment interaction indicated that the genotypes differed significantly for all the characters (Table 2). The influence of environmental effect on expression of characters was also evident. For the characters 100-seed weight and yield per plant only the linear component contributed significantly towards GE interaction variance. Thus the performance of these two characters could be well predicted. For rest of the characters both linear and nonlinear components contributed towards GE interaction variance, linearity being more pronounced for days to maturity and number of pods per plant.

Table 1. List of soybean cultivars/lines included in the experiment

Cultivar or line (G)	Cultivar or line (G)	Cultivar or line (G)
BD-11	PK-472	PS-14
DS-76-1-37-1	PK-327	Punjab-1
BD-22	PK-74-261	H-365
H-108	SD-1	BD-25
Lee	Moti	PK-71-21
PK-73-203	BD-12	Bragg
PK-306	NH-6/9	HIMSO-553

As sufficient G x E interaction for all the characters was present, stability parameters, viz., deviation mean square (Sd^2_i), regression co-efficient (b_i), mean (M) were estimated for each genotype separately for each character. Genotype with high mean performance, regression coefficient approaching one and low deviation mean square was considered to be an average stable genotype, which could be expected to perform uniformly well over variable environments whereas, b_i being less than unity indicates a genotype to be above average stable which will be specifically adapted to low yielding environments and b_i more than unity indicates a genotype with below average stability. Such a genotype would perform better in high yielding environments but its performance will be lower in stress environments compared to its genetic potentiality. The maximum average stability for seed

Table 2. Pooled analysis of variance for genotype x environment interactions for different characters in soybean

Source	d.f.	Mean squares				
		days to maturity	pods per plant	seeds per pod	100-seed weight	yield per plant
Genotype (G)	20	373.5**	1611.7**	0.4*	6.56**	13.5**
Env. + (G x E)	84	214.0**	467.4**	0.43**	0.02**	2.9**
Env. (linear)	1	867.5**	536.6**	19.84**	0.39**	187.7**
G x E (linear)	20	592.8**	1237.8**	0.50**	0.05**	1.6**
Pooled deviation	63	107.3**	208.4**	0.09	0.002	0.5
Pooled error	210	0.1	0.1	0.0005	0.00004	0.1

Note. *P = 0.05; **P = 0.01.

yield was exhibited by Moti followed by PK-308, PK-472, BD-1, Bragg, PK-73-203, BD-12 and BD-11, respectively (Table 3). The genotypes PK-73-203 and BD-1 exhibited average stability for early maturity and number of seeds per pod and BD-12 exhibited average stability for number of seeds per pod and number of pods per plant and above average stability for 100-seed weight. BD-1 an average stable genotype for yield per plant also exhibited above average stability for 100-seed weight. The stability in grain yield results from genetic homeostasis [2] due to compensation among component characters over variable environments. Present study indicates that the mechanism of stability promotion of different genotype were different. However, stability for maturity, number of seeds per pod and 100-seed weight and plasticity for the other characters contributed maximum to most of the genotypes showing average stability for yield per plant.

Results on stability analysis in soybean [3, 4] suggest average stability for seed yield and days to maturity and plasticity for characters like plant height, branches per plant.

In this investigation there was only one genotype DS-16-1-37-1 which exhibited average stability for yield per plant and seeds per pod. This genotype although not a very high yielder deserves consideration in soybean breeding programme for transfer of linear stability to otherwise high yielding desirable genotypes.

Development of early maturing high yielding genotypes is an important aim of soybean breeders for multiple cropping system. For this purpose average stable genotypes for early maturity like BD-11, H-108, PK-73-203, PK-472, PK-327 and Punjab-1 hold considerable promise.

Table 3. Mean and stability performance of some outstanding soybean genotypes

Cultivar	Days to maturity		Pods/plant		Seeds/pod		100-seed wt.		Yield/plant	
	mean	stability performance	mean	stability performance	mean	stability performance	mean (g)	stability performance	mean (g)	stability performance
BD-11	153.9	Average	41.8	Unstable	3.4	Average	10.8	Unstable	7.5	Average
DS-76-1-37-1	158.3	Unstable	83.3	Unstable	2.9	Above average	10.0	Unstable	8.0	Above average
BD-22	152.2	Unstable	40.7	Average	3.0	Above average	10.1	Unstable	7.6	Unstable
PK-73-203	153.9	Average	22.8	Unstable	2.9	Average	10.3	Unstable	7.8	Average
PK-472	153.7	Unstable	42.3	Unstable	2.8	Unstable	10.3	Unstable	10.0	Average
PK-308	162.3	Unstable	17.1	Unstable	2.6	Unstable	15.3	Unstable	10.3	Average
PK-327	154.6	Average	50.2	Unstable	2.8	Unstable	10.4	Unstable	5.8	Unstable
BD-1	157.3	Average	46.9	Unstable	2.6	Average	10.5	Above average	9.1	Average
Moti	156.0	Unstable	77.0	Unstable	2.7	Unstable	10.2	Unstable	10.7	Average
BD-12	157.3	Unstable	80.3	Average	2.9	Average	10.5	Above average	7.7	Average
Punjab-1	154.7	Average	46.0	Unstable	3.3	Average	10.5	Average	5.7	Unstable
H-365	151.6	Above average	69.6	Unstable	2.8	Unstable	10.7	Above average	5.5	Unstable
BD-25	158.1	Unstable	38.0	Unstable	3.2	Average	10.5	Above average	5.9	Unstable
Bragg	157.5	Unstable	67.5	Unstable	2.6	Unstable	10.5	Above average	8.5	Average

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