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ASSESSMENT OF YIELD TRAITS IN INDIAN GERMPLASM OF SOYBEAN

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ABSTRACT

Correlation and path coefficient analyses for yield and yield components were estimated for 80 genotypes of soybean [Glycine max (L.) Merrill] during kharif 2012. The heritability estimates in broad sense ranged from 84.1 to 98.4 for different characters. The highest value was found for seeds per plant followed by days to maturity, days to 50% flowering, number of pods per plant, biological yield per plant, 100 seed weight, seed yield per plant, plant height, harvest index, seeds per pod, and primary branches per plant The genetic advance ranged from 0.90 to 15.98 and highest value of genetic advance as % of mean was recorded in harvest index followed by seed yield per plant, biological yield per plant, seeds per pod, seeds per plant, pods per plant,100 seed 3weight, primary branches per plant, days to50% flowering and plant height. Correlation analysis revealed that yield per plant exhibited highly significant and positive association with biological yield per plant followed by harvest index, 100 seed weight, pods per plant, days to maturity, days to 50% flowering and plant height .Path coefficient showed that Biological yield per plant had the highest positive direct effects on seed yield followed by100 seed weight, days to maturity, harvest index, primary branches per plant and seeds per plant.

Key words: Heritability, genetic advance, correlation coefficient and path coefficient

INTRODUCTION

Soybean [*Glycine max* (L.) Merrill] is widely grown during kharif season for oil and protein in our country. Grain yield, an extremely complex trait, is the result of the expression and association of several plant growth components. The *Glycine* is now comprised of 16 wild perennial inbreeding species The subgenus Soja includes the cultivated soybean, *Glycine max* and the wild annual soybean, *G.soja*. Correlation coefficients, although very useful in quantifying the degree and direction of trait associations, which can be misleading if the high correlation between two traits is a consequence of the indirect effect of other traits. Wright (1921) proposed a method called path analysis, which partitions the estimated correlations into direct and indirect effects of traits over a basic one, in order to better understand the association among traits and finally apply direct selection on yield traits. Soybean experienced phenomenal growth rate of 15-20% annum^{-1} which is the highest among oil seed crop. In India the nearly 95 soybean cultivars have been developed having their ancestry record from Bragg, JS 335 and Panjab-1, which needs to broaden the genetic base in new variety for sustainable yield level looking to change in climate and cropping pattern. Hence, the study was imititaed to asses yield traits in soybean.

MATERIAL AND METHODS

The experimental material consisted 80 germplasms of soybean collected from the gene stocks of All India Coordinated Research Project on Soybean (AICRPS), R.A.K. College of Agriculture, Sehore. The experiment was carried out in randomized block design with three replications. The genotypes were sown on 7 July 2012. Each genotype was planted in 3m row length with 50 cm row to row spacing and 5-7cm plant to plant spacing. The N, P, K and S @ 20:60:20:20 Kgha^{-1} was applied uniformly and recommended package of practices and plant Protection measures were adopted to raise the normal crop. A random selection of five plants in each genotype and replication was made and detailed observations were recorded on each selected plant. The average data were subjected to standard statistical techniques for analysis of variance to test the significance level of variation among the genotypes for different characters according to Steel and Torrie (1980). Genetic parameters, correlation coefficients were computed as per method suggested by Singh and Chaudhary (1979). The significance of genotypic correlation coefficients was tested with the help of standard errors as suggested by Reeve and Rao (1981). Path coefficients were worked out by the methods used by Dewey and Lu (1959) whereas genetic distances were calculated using WARDS method (Sneath and Sokal, 1973).

RESULTS AND DISCUSSION

Heritability

The heritability estimates in broad sense ranged from 84.1 to 98.4 for different characters. The highest value was found for seeds per plant (98.4) followed by days to maturity (98.2), days to 50%

flowering (96.3), number of pods per plant (97.8), biological yield per plant (90.5), 100 seed weight (96.7), seed yield per plant (94.1), plant height (95.5) harvest index (94.7), seeds per pod (88.5) and primary branches per plant (84.1) High heritability estimates have been reported for 100 seed weight, plant height and numbers of pods by Jagtap and Mehtre (1994) and Ganesamurthy and Seshari (2004).

Table 1: Genetic parameter for seed yield and its contributing traits in germplasm of soybean

Character	Mean	Range		SEm ±	GCV	PCV	h2	GA
		Min	Max					
Days to 50% flowering	53.25	46.67	61.67	0.783	9.18	9.35	96.3	9.88
Days to maturity	92.44	53.67	101.67	0.630	6.10	6.16	98.2	11.52
Plant height (cm)	54.46	45.43	64.63	0.781	8.14	8.33	95.5	8.93
Branches per plant	8.09	6.47	10.67	0.297	10.36	11.30	84.1	1.58
Pods per plant	26.89	15.57	40.73	0.601	18.05	18.25	97.8	9.89
Seeds per pod	2.12	1.29	3.47	0.137	21.98	23.36	88.5	0.90
Seeds per plant	48.73	34.87	64.60	0.815	16.05	16.18	98.4	15.98
100 seed weight (g)	17.59	9.45	24.84	0.612	22.98	23.37	96.7	8.19
Biological yield (g)	18.78	8.53	32.42	1.274	25.65	26.96	90.5	9.44
Harvest index	8.27	6.09	12.03	0.246	15.42	15.85	94.7	2.56
Seed yield per plant (g)	3.21	1.85	6.14	0.182	27.59	28.45	94.1	1.77

Genetic advance

The genetic advance ranged from 0.90 to 15.98 and highest value of was recorded in harvest index (15.98) followed by seed yield per plant (1.77), biological yield per plant (9.44), number of seeds per plant (15.98), number of pod per plant (9.89), 100 seed weight (8.19), primary branches per plant (1.58) days to 50% flowering (9.88), plant height (8.98) while it was low for days to maturity (11.52). Moderate genetic advance as per cent of mean was reported for plant height, primary branches per plant, number of seeds per pod, harvest index, 100 seed weight by Genesamurthy and Seshadri (2004); Chettri (2005) and Bhairav *et.al.* (2006).

Correlation coefficients

Seed yield per plant exhibited significant and positive association with biological yield per plant (0.567**) followed by harvest index (0.470**), hundred seed weight (0.443*). However it had negative correlation with seeds per plant (-0.038**) followed by primary branches per plant (-0.048**), and seeds per pod (-0.157). Days to 50% flowering had shown highly significant relationship with days to maturity (0.474**) followed by 100 seed weight (0.128) whereas it showed low magnitude of positive association with seed yield per plant (0.032). It had negative association with plant height (-0.030) followed by biological yield per plant (-0.089). Days to maturity was positively associated with primary branches per plant (0.192) followed by biological yield per plant (0.149). However, this trait showed negative correlation with seeds per plant (-0.009) and plant height (-0.095). Plant height had positive association with primary branches per plant (0.328**) followed by seeds per pod (0.087). These findings matched the findings of Banger *et al.* (2003) for 100 seed weight. Primary branches per plant recorded significant positive association with harvest index (0.096) while it showed negative correlation with biological yield per plant (-0.007) followed by seeds per pod (-0.033). Pods per plant had significant positive association with seeds per plant (0.527**) followed by biological yield per plant (0.305**). Likewise, it had negative correlation with 100 seed weight (-0.045). These findings corroborated the results of Masoudi *et al.* (2008), Bhat and Basavaraja (2011) and Aditya *et al.* (2011) for seed yield^{-1} and Banger *et al.* (2003) for seed weight. Seeds per pod was found to be positively associated with seeds per plant (0.427**) and negative association with harvest index (-0.124).Seeds per plant had significant and positively association with biological yield per plant (0.172) and negative one with harvest index (-0.021). Test weight had positive and significant association with seed yield per plant (0.443**) followed by harvest index (0.237*). It has negative association with biological yield per plant (-0.448). Biological yield per plant had positive and significant association with seed yield per plant (0.567**) followed by harvest index (0.227*). Harvest index showed positive and significant association with seed yield per plant (0.470**). Saharan *et al.* (2006), Turkec (2005), Gaikwad *et al.* (2007) reported similar results for pods per plant, 100 seed weight, biological yield per plant and harvest index.

Table 2: Phenotypic correlation coefficients among different characters of the genotypes of soybean

Character	Days to maturity	Plant height	Branches / plant	Pods /plant	Seeds /pod	Seeds/ plant	Test weight	Biological yield / plant	Harvest index	Seed yield /plant
Days to 50% flowering	**0.474****	-0.030	0.063	-0.103	-0.158	-0.175	0.128	-0.089	0.094	0.032
Days to maturity		**-0.095**	0.192	0.111	0.010	-0.009	-0.125	0.149	0.064	0.094
Plant height (cm)			**0.328***	0.001	0.087	0.021	-0.032	0.011	0.077	0.011
Branches per plant				**-0.106**	-0.033	-0.098	-0.107	-0.007	-0.096	-0.048
Pods per plant					**0.289****	0.527**	-0.045	0.305**	0.048	0.247*
Seeds per pod						**0.427****	-0.247	0.126	-0.124	-0.157
Seeds per plant							**-0.227**	0.172	-0.021	-0.038
100 seed weight (g)								**-0.448**	0.237*	0.443**
Biological yield /plant									**0.227***	0.567**
Harvest index (%)										**0.470****

**= significant at 5% level of significant, **= significant at 1% level of significant*

Path coefficient

Direct effect

Biological yield per plant had the highest positive direct effect (0.929**) on seed yield followed by100 seed weight (0.855**), Days to maturity showed low direct effect on plant height (0.026). It showed low negative direct effect on pods per plant (-0.002) followed by days to 50% flowering (-0.045) (Table 3). The present findings were in agreement of Karnwal and Singh (2009) for number of pods plant^{-1}, plant height, biological yield plant^{-1} and harvest index.

Indirect effect

Days to 50% flowering had positive indirect effects on seed yield through 100 seed weight (0.110) followed by day to maturity (0.037), seeds per pod (0.012). However, its negative indirect effects were observed through plant height (-0.001) followed by seeds per plant (-0.037). Days to maturity had shown the positive indirect effects on seed yield through biological yield per plant (0.139) followed by primary branches per plant (0.006). Plant height had positive indirect effects on seed yield through primary branches per plant (0.011) followed by biological yield per plant (0.010). However, its negative indirect effects was through day to maturity (-0.007) followed by 100 seed weight (0.027). Primary branches per plant had shown the maximum positive indirect effects on seed yield through day to maturity (0.015) followed by plant highs (0.009), seeds per pod (0.003). Pods per plant showed positive indirect effects on seed yield through biological yield per plant (0.283*) followed by seeds per plant (0.014). Seeds per pod had shown positive indirect effects on seed yield through biological yield per plant (0.117) followed by seeds per plant (0.012). Seeds per plant showed positive indirect effects on seed yield through biological yield per plant (0.160) followed by days to 50% flowering (0.008) and negative indirect effects through days to maturity (-0.001) followed by primary branches per plant (-0.003).

Table 3: Direct and indirect effects of yield components on seed yield in advance generation line of soybean

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Branches /plant	Pods /plant	Seeds /pod	Seeds/ plant	100 seed weight (g)	Biological yield / plant	Harvest index (%)	Correlation with seed yield
Days to 50% flowering	**-0.045**	0.037	-0.001	0.002	0.000	0.012	-0.005	0.110	-0.083	0.005	0.032
Days to maturity	-0.021	**0.078**	-0.002	0.006	0.000	-0.001	0.000	-0.107	0.139	0.003	0.094
Plant height (cm)	0.001	-0.007	**0.026**	0.011	0.000	-0.007	0.001	-0.027	0.010	0.004	0.011
Branches per plant	-0.003	0.015	0.009	**0.033**	0.000	0.003	-0.003	-0.091	-0.006	-0.005	-0.048
Pods per plant	0.005	0.009	0.000	-0.004	**-0.002**	-0.022	0.014	-0.038	0.283	0.002	0.247
Seeds per pod	0.007	0.001	0.002	-0.001	-0.001	**-0.077**	0.012	-0.211	0.117	-0.006	-0.157
Seeds per plant	0.008	-0.001	0.001	-0.003	-0.001	-0.033	**0.027**	-0.194	0.160	-0.001	-0.038
100 seed weight (g)	-0.006	-0.010	-0.001	-0.004	0.000	0.019	-0.006	**0.855**	-0.417	0.011	0.443
Biological yield /plant	0.004	0.012	0.000	0.000	-0.001	-0.010	0.005	-0.383	**0.929**	0.001	0.567
Harvest index (%)	-0.004	0.005	0.002	-0.003	0.000	0.010	-0.001	0.203	0.211	**0.048**	**0.470**

However, its negative indirect effect was noticed through pods per plant and harvest index (-0.001) followed by seed per pod (-0.010) and 100 seed weight (-0.383).Harvest index had shown positive effect (0.211*) on biological yield per plant followed by 100 seed weight (0.203). Although, it had negative effect through seeds per plant (-0.001) followed by primary branches per plant (-0.003).

The studies revealed that major yield contributing traits viz. days to 50% flowering, days to maturity, seeds per pod, seeds per plant, pods per plant, 100 seed weight, biological yield per plant and harvest index were identified from present investigation. Hence direct selection on these above traits might be focused to improve seed yield in soybean.

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