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enetic variability, character association and path coefficient analysis soybean

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Abstract: Fifty genotypes of soybean (*Glycine max* (L.) Merrill.) with diverse origin were studied for their genetic variability, character association and path analysis. The difference between the genotypes were highly significant for all the 10 characters studied. Among the characters, number of pods, seed yield, plant height and drymatter production showed high genotypic coefficient of variation. Correlation studies indicated that seed yield per plant showed significant positive correlation with drymatter production, number of branches, days to flowering, days to maturity and plant height. Path coefficient analysis showed that, among all the traits studied, dry matter production contributed most directly to seed yield.

Key words : Soybean, Variability, Path analysis.

roduction

Soybean (*Glycine max* (L.) Merrill.) an portant oilseed crop belonging to family guminoceae, is grown as food crop. It is esently the worlds most important oilseed op in terms of total production and international ade. The development of superior variety depends n the magnitude of genetic variability in the asic material and the extent of heritability f desirable characters. Yield is a polygenically ontrolled complex character and is determined y number of character components, which are so quantitatively inherited. The knowledge the association between yield and its components nd among components themselves is of immense actical value in crop improvement through lection. Path coefficient analysis (Wright, 1921) ings out the direct and indirect effects of mponents traits on yield. The present investigation as carried out with 50 soybean germplasm ollection of diverse origin to explore the extent f genetic variability, association of certain naracters, their direct contribution to yield nd indirect effects through other characters n yield.

aterials and Methods

Fifty geographically diverse genotypes of ybean collected from different states of India and different countries were raised in a Randomised Block Design with four replications during *kharif*, 1997 at Agricultural Research Station, Tamil Nadu Agricultural University, Pattukkottai. Each genotype was raised in a single row of 4m length by adopting a spacing of 30x10 cm. In each row, five randomly selected plants were observed for days to flowering, days to maturity, plant height, number of branches, number of pods, 100 seed weight, protein content, oil content, dry matter production and seed yield per plant. The mean value of five plants represented each genotype. Standard statistical procedure, were used for the analysis of variance, genotypic and phenotypic coefficients of variation (Burton, 1952), heritability (Hanson *et al.* 1956) and genetic advance (Johnson *et al.* 1955). The genotypic and phenotypic correlation coefficients were computed using genotypic and phenotypic variances and co-variances (Al. Jibouri *et al.* 1958). The path co-efficient analysis was done according to the method by Dewey and Lu (1959).

Results and Discussion

Genetic variability

Data on mean, variability, heritability and genetic advance as percentage of mean are persented

Table 1. Estimate of mean, components of variance, heritability (broad sense) and expected genetic advance in respect of ten characters in soybean

Characters	Range		Mean	Variance		Coefficients of variation		Heritability %	Genetic advance (GA)	Expected genetic advance (% of mean)
	Minimum	Maximum		Phenotypic	Genotypic	Phenotypic (PCV)	Genotypic (GCV)			
Days to flowering	36.00	48.00	42.60	7.44	7.18	6.4	6.3	96.5	5.4	12.7
Days to maturity	72.00	95.00	87.80	35.71	10.51	6.8	3.7	29.4	3.6	4.1
Plant height (cm)	26.20	55.70	44.60	52.87	41.82	16.3	14.5	79.1	11.9	26.7
No.branches	3.80	5.70	4.90	0.47	0.10	14.1	6.4	20.6	0.3	6.1
No.of pods	33.03	91.00	63.00	262.03	197.17	25.7	22.3	75.2	25.1	39.8
100 seed wt.(g)	11.20	18.00	14.50	2.13	1.83	10.1	9.4	85.8	2.6	17.9
Protein content (%)	35.50	41.60	38.00	2.39	2.08	4.1	3.8	86.9	2.8	7.4
Oil content (%)	17.70	21.30	19.90	0.96	0.77	4.9	4.4	80.5	1.6	8.0
DMP (g)	15.00	32.20	25.10	24.90	12.20	19.9	13.9	49.0	5.0	19.9
Seed yield (g)	7.00	15.60	11.50	5.52	3.90	20.4	17.1	70.7	3.4	29.6

in Table 1. The analysis of variance revea significant differences among genotypes for the ten characters studied. The characters number of pods per plant, seed yield, pl height and dry matter production showed hi PCV and GCV estimates. This suggests th the selection based on these characters wou facilitate successful isolation of desirable typ Similar findings were reported for characte like plant height, number of pods per pla and seed yield (Harer and Deshmukh 199 Jagtap and Mehetre, 1994).

High heritability estimates were observ for days to flowering, protein content, 10 seed weight, oil content, plant height, numb of pods and seed yield. These results indica that these characters were highly heritable a hence were less affected by the environme The plant breeder, therefore, may make selection safely on the basis of phenotypic express of these characters in the individual plant. Hi heritability estimates have been reported f days to flowering, 100 seed weight, plant heig and number of pods by Harer and Deshmu (1992) and Jagtap and Mehetre (1994).

Heritability in conjunction with geneti advance would give a more reliable index c selection value (Johnson *et al.* 1995). In th present study, the highly heritable character like number of pods per plant, seed yield an plant height had high genetic advance as per cent of mean indicating that these characters were under the influence of additive gene action. Days to flowering and 100 seed weight had high heritability coupled with moderate genetic advance, while high heritability with low genetic advance were recorded for protein and oil content rendering them unsuitable for improvement through selection. Low heritability combined with low genetic advance as percentage of mean was noted for number of branches and days to maturity. It indicates that the scope for improving this trait through selection is very much limited and this may be attributed to the non-additive gene action (Johnson *et al.* 1955).

Character		Days to maturity	Plant height	No. of branches	No. of pods	100-seed weight	Protein content	Oil content	Total dry matter production	Seed yield
Days to flowering	G	0.575**	0.439**	0.675**	0.472**	-0.285**	-0.116	0.203	0391**	0.389**
	P	0.309*	0.382**	0.303*	0.401**	-0.261	-0.106	0.171	0.270*	0.313*
	E	0.016	-0.017	0.011	-0.017	-0.021	-0.008	-0.090	0.009	-0.080
Days to maturity	G		0.568**	0.298*	0.519**	-0.313*	-0.065	0.135	0.538**	0.348*
	P		0.224	0.084	0.215	-0.157	-0.058	0.044	0.152	0.118
	E		-0.130	0.014	-0.070	-0.002	-0.084	-0.058	-0.088	-0.090
Plant height	G			0.536**	0.553**	-0.196	-0.086	0.111	0.502**	0.344*
	P			0.217	0.461**	-0.161	-0.063	0.091	0.331*	0.266*
	E			0.002	0.152	0.007	0.053	0.015	0.056	0.035
No. of branches	G				0.807**	0.359**	0.179	-0.192	0.684**	0.653*'
	P				0.427**	0.160	0.058	-0.085	0.477**	0.359*'
	E				0.246	0.025	-0.054	-0.018	0.408**	0.228
No. of pods	G					-0.143	-0.106	0.092	0.906**	0.794**
	P					-0.129	-0.092	0.081	0.706**	0.709**
	E					-0.075	-0.031	0.044	0.438**	0.481**
100 seed weight	G						0.139	-0.190	0.008	-0.045
	P						0.123	-0.154	0.063	0.001
	E						0.025	0.025	0.216	0.179
Protein content	G							-0.963**	-0.025	-0.018
	P							-0.814**	-0.010	0.001
	E							-0.052	0.025	0.077
Oil content	G								0.007	-0.010
	P								-0.012	-0.019
	E								-0.052	-0.046
Dry matter production	G									0.953**
	P									0.761**
	E									0.517**

* Significant at 5% level; ** Significant at 1% level

Table 3. Path coefficient analysis of yield components on seed yield at genotypic level in soybean

Characters	Days to flowering	Days to maturity	Plant height	No. of branches	No. of pods	100-seed weight	Protein content	Oil content	Total dry matter production	Correla-tion with seed yield
Days to flowering	0.433	-0.255	0.008	-0.215	-0.106	0.005	0.020	-0.051	0.567	0.389**
Days to maturity	0.249	-0.443	-0.010	-0.095	-0.117	0.006	0.011	-0.034	0.781	0.348*
Plant height	0.190	-0.251	-0.018	-0.171	-0.124	0.004	0.015	-0.028	0.729	0.344*
No. of branches	0.292	-0.132	-0.010	-0.319	-0.181	-0.007	-0.030	0.049	0.992	0.653**
No. of pods	0.205	-0.230	-0.10	-0.258	-0.225	0.003	0.018	-0.023	1.314	0.794**
100 seed weight	-0.123	0.139	0.004	-0.115	0.032	-0.018	-0.023	0.048	0.012	-0.045
Protein content	-0.050	0.029	0.002	-0.057	0.024	-0.003	-0.169	0.243	-0.037	-0.018
Oil content	0.088	-0.060	-0.002	0.061	-0.021	0.003	0.162	-0.253	0.010	-0.010
Dry matter production	0.169	-0.238	-0.009	-0.218	-0.204	0.000	0.004	-0.002	1.450	0.953**

Residual effect - 0.0094 * Significant at 5% level ** ** Significant at 1% level
Diagonal values indicated direct effect

Correlation

The genotypic and phenotypic correlatio coefficients between yield and yield attribute are given in Table 2. It shows that days t flowering, plant height, number of branche number of pods and dry matter productio exhibited significant and positive correlatio with seed yield both at genotypic and phenotypi level. The degree of association was highe between dry matter production and seed yiel It was followed by number of pods and numbe of branches. Mahto *et al.* 1994, Jagtap an Chaudhary, 1993, Kumar and Nadarajan, 199 and Harer and Deshmukh, 1992; also observe similar strong correlation for number of pod number of branches and plant height. Hig positive correlation of number of pods wi seed yield may be attributed to the increas sink strength (Nakaseko, 1984). Diaz carrasc *et al.* (1985) also suggested that yield coul be raised by selecting for lateness, tallness an more pods/plant, which is evident in the prese study.

The traits, days to 50% flowering, day to maturity, plant height, number of branches number of pods and dry matter productio had highly significant and positive correlation both at genotypic and phenotypic levels amon themselves. All these traits also had positiv relationship with seed yield indicating certai inherent relationship with seed yield. Selectio for these characters simultaneously would brin improvement in soybean yield. Mahto *et al* (1994) Jagtap and Chaudhary (1993), Kuma and Nadarajan (1992) reported positive significan association among number of pods, numbe of branches, plant height, days to flowerin and days to maturity. Both the quality characters oil and protein content, were negatively correlate with each other and showed no significant associatio with seed yield. The negative correlation betwee oil and protein content also observed by Hare and Deshmukh (1992).

Path analysis

As simple correlation does not provid the true contribution of the characters toward ɜ yield, these genotypic correlations were ɹrtitioned into direct and indirect effects ɾoughout path coefficient analysis.

Path analysis (Table 3) revealed that dry ɜtter production had the highest positive direct fect followed by the days to flowering. The ɾect positive effect of days to flowering on ɜ seed yield was reported by Harer and Deshmukh 992) and Rajasekharan *et al.* (1980). The maining seven characters showed only negative ɾect effects on the seed yield. The direct fects on days to maturity, plant height, number branches and number of pods were negative ɪ their positive correlation with seed yield ɪld be due to high indirect effects through ɣ matter production. It would be logical to ɪect that a genotype, which has a longer ɡetative period will have a greater ability produce more biomass and consequently more ,ed yield. This sort of relationship is evident ɔm the present study.

This investigation thus revealed that it ɾould be rewarding to lay emphasis on more ɪy matter production, pods and branches per ɪant, more height and lateness in selection ɾogramme of soybean

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