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Utilization of Diverse Germplasm for Soybean Yield Improvement

[1]Muhammad Faisal Anwar Malik, [2]Muhammad Ashraf,
[1]Afsari Sharif Qureshi and [3]Abdul Ghafoor
[1]Department of Biological Sciences, QAU,
[2]Oilseeds Programme, NARC,
[3]Plant Genetics Resources Programme, NARC, Islamabad, Pakistan

Abstract: Seventeen soybean varieties were evaluated for yield components at National Agricultural Research Centre, Islamabad during July to October 2002. Data were recorded for traits viz. leaf area, chlorophyll content, 1st pod height, days to 50% flowering, days to flowering completion, days to pod initiation, days to 50% maturity, plant height, number of pods per plant, number of branches per plant, number of unfilled pods, number of shattered pods, 100 seed weight, grain yield, oil content, protein content. Data were analyzed for analysis of variance, heritability, correlation coefficient and path analysis. Results of analysis of variance revealed that there were highly significant differences among genotypes for all the characters. High heritability was recorded in 100 grain weight, days to maturity, days to flowering completion, days to pod initiation, leaf area, days to 50% flowering, oil contents, no. of shattered pods/plants and grain yield/plant, plant height and protein contents respectively indicating the additive type of gene action. On the basis of heritability selection for these traits will provide greatest improvement in soybean. Correlation coefficient of yield was significant and positive with leaf area, pods per plant and oil contents. Therefore, increase in these traits will ultimately increase the grain yield. Path coefficient analysis revealed that days to pod initiation had maximum direct contribution to yield followed. Therefore, it is suggested that this characters can be considered as selection criteria in improving the bean yield of soybean genotypes

Key words: *Glysine max* (L.), genetic variation, correlation, path analysis, agronomic traits

INTRODUCTION

The profitable yield can be obtained through genetic improvement for high yield potential. The examination of genetic diversity is important for plant breeder in general and particularly in a new introduced crop like soybean, which is not grown commercially in Pakistan. Introduced genotypes are an important source to help us meet our national food/oil demand. In Pakistan, soybean is one of the non-conventional oilseed crops which can be successfully grown in the country during both spring as well as the autumn seasons. Nutritional value of soybean lies in its protein (40-42%) and oil contents (18-22%) and is free from cholesterol, so it is highly desirable in the human diet.

Introgression of diverse germplasm into the current soybean genetic base may increase genetic variability and lead to greater gains from selection (Thompson and Nelson, 1998). Annual wild soybeans (*Glycine soja*), the ancestors of cultivated soybeans (*G. max*), are important sources of major genes for resistance to pests, diseases and environmental stresses. The study of their genetic diversity is invaluable for efficient utilization, conservation and management of germplasm collections (Dong *et al*., 2001). Khanghah and Sohani (1999), Muhammad and Shah (2003) showed significant differences among varieties in terms of traits like pods/plant, seeds/plant, plant height, days to flowering, days to pod initiation, 100 seed weight, grain yield/plant and seeds/pod, indicating the existence of genetic variation among varieties. Choudhry *et al.* (1999) also revealed that all cultivars varied significantly in yield components. Jagdish *et al.* (2000) and Jain and Ramgiri (2000) reported that seed yield per plant, biological yield, pods per plant and plant height showed high heritability with high genetic advance as a percentage of mean. Rajanna *et al.* (2000) showed significant and positive correlation of number of pods per plant, number of clusters per plant and 100 seed weight with seed yield. Similar results were found by Amanullah and Hatam (2001) who observed significant variations in all the parameters studied and showed significantly positive correlation of plant height, branches per plant, pods per plant and dry matter with grain yield. The correlation between grain

Corresponding Author: Muhammad Faisal Anwar Malik, Department of Biological Sciences, QAU, Islamabad, Pakistan

yield and 100 seed weigh was, however, significantly negative. Iqbal *et al.* (2003) showed that pods per plant had maximum positive direct effect on yield per plant followed by 100 seed weight and seeds per pod.

Genetic improvements could be accelerated if physiological attributes were used as selection criteria. Present study is one of such efforts in which soybean germplasm was used to study the genetic variability and to evaluate the performance of different genotypes. Moreover, The study of direct and indirect effects of yield and its components provides the basis for increased bean yield and selection for closely associated traits. This information would ultimately lead to the determination of suitable plant types available for further studies in soybean.

MATERIALS AND METHODS

The study was carried out during summer season (July to Oct. 2002) at experimental farm of Oilseed Programme, NARC, Islamabad. Experimental material consisting of seventeen soybean genotypes (Table 1) was obtained from the Institute of Agro-biotechnology and Genetic Resources (IABGR) of National Agricultural Research Center (NARC), Islamabad. The experimental design was randomized completely block design with 3 replications; each plot consisted of a single row of 5 m length with a row to row distance of 60 cm maintaining 20-24 plants m^{-1} in length. The crop was grown under normal conditions. Sowing was done with the help of hand drill. Five selected plants were used to take the data from each plot of each replication. Data were recorded for leaf area, chlorophyll content, 1st pod height, days to 50% flowering, days to flowering completion, days to pod initiation, days to 50% maturity, plant height, number of pods per plant, number of branches per plant, number of unfilled pods, number of shattered pods, 100 seed weight, grain yield, oil content and protein content.

RESULTS

The mean squares of various traits (Table 1) indicated that there were significant differences among genotypes for all the characters under study. High range of variation was observed in leaf area, plant height, 50% flowering, days to 50% maturity, plant height, pods/plant, branches/plant, 100 seed weight and grain yield/plant. This high variation indicated that improvement in soybean could be successful by simple selection for these characters. The other characters with low variations needed to be improved by acquiring germplasm from other sources or using breeding techniques. Evaluation and classification of broad base germplasm needs to be built up by making extensive local collection and obtaining germplasm from abroad to develop a sound breeding program (Ghafoor *et al.*, 1992). The partitioning of variance (Table 1) revealed that high heritability was recorded in 100 grain weight, days to maturity, days to

Table 1: Means of 16 characters studied in 17 lines of soybean grown during July-Oct. 2001

Genotype	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16
95039-A	43	59.07	8.6	54	68	62	108	61.87	132	6	3	1	5.87	11.49	16.26	35.87
95038-A	32	41.43	10.6	54	68	62	107	55.8	113	7	8	1	5.67	11.89	16.95	34.27
95037-A	39	43.53	9.2	54	70	62	109	67.13	133	6	5	1	4.47	8.66	16.05	36
95035-A	29	38.23	8.47	53	69	61	105	60.4	128	8	12	2	4.67	7.85	16.4	30.8
95034-A	23	40.37	10.33	51	67	59	93	77.33	120	7	8	4	4.77	8.12	14.92	32.63
95031	30.33	45.97	12.47	41	57	49	89	45.2	44	4	3	13	15.93	7.62	19.48	32.17
95034-B	32	47.57	11.33	49	65	57	91	80.4	104	7	5	11	4.93	9.34	15.67	35.47
95035-B	55.33	45.33	10.67	52	68	60	103	62.73	101	7	7	2	5.93	6.98	15.46	36.43
95033	51.67	42.87	9.4	51	67	59	102	64.07	90	6	5	2	5.33	6.56	15.27	36.57
95037-B	56	42.37	9.93	53	69	61	100	68.33	79	6	5	2	4.83	7.83	15.16	36.9
95038-B	59.33	43.2	7.47	51	67	59	103	65.2	102	7	4	2	5.33	11.1	16.47	35.3
95039-B	65.33	45.37	7.93	30	46	38	88	64.47	108	5	5	13	13.43	18.16	18.46	38.6
95078	58.33	44.17	10.2	32	48	40	90	37.2	44	2	1	6	21.03	14.45	20.41	31
95049	54.33	46.07	11.6	55	71	63	102	70	90	6	4	2	1.83	8.58	16.07	35.73
AGS-5	133	46.2	20.27	51	67	59	101	75.93	89	5	3	1	14.5	21.24	21.12	39.27
AGS-194	97.67	49.47	10.93	49	65	57	87	62.2	203	8	7	1	14	57.94	19.92	39.73
AGS-19	34	42.73	14.33	40	56	48	89	61.4	60	4	1	30	12.97	7.29	19.23	41.3
MS(Var)	2279.831	62.025	26.502	181.265	175.441	182.632	177.169	341.129	4268.018	6.039	21.75	170.843	89.988	448.222	12.581	26.587
MS(Rep)	8.018	25.84	3.258	29.199	5.074	2.248	144.369	1.824	660.048	0.412	1.588	10.961	1.652	0.42	0.061	0.363
MS(Error)	13.603	24.735	3.826	0.934	0.929	0.932	0.331	46.789	335.476	1.245	3.651	7.461	0.004	6.514	0.379	0.904
F.Ratio(V)	167.598**	2.508*	6.927**	194.12**	188.92**	196.042**	535.04**	7.291**	12.722**	4.85**	5.958**	22.899**	21152.27**	68.813**	33.159**	29.421**
F.Ratio(R)	0.589ns	1.045ns	0.852ns	31.27**	5.464**	2.413ns	435.99**	0.039ns	1.967ns	0.331ns	0.435ns	1.469ns	388.363**	0.065ns	0.161ns	.402ns
ST.Error	2.129	2.871	1.129	0.558	0.556	0.557	0.332	3.949	10.575	0.644	1.103	1.577	0.038	1.473	0.356	0.549
CD1	6.086	8.207	3.228	1.595	1.59	1.593	0.95	11.287	30.224	1.841	3.153	4.507	0.108	4.211	1.016	1.569
CD2	8.143	10.98	4.318	2.133	2.128	2.131	1.27	15.102	40.438	2.464	4.218	6.03	0.144	5.635	1.36	2.099
G.Var.	755.409	12.43	7.559	60.111	58.171	60.567	58.946	98.113	1310.847	1.598	6.033	54.461	29.994	147.236	4.067	8.561
P.Var	769.012	37.165	11.384	61.044	59.099	61.498	59.277	144.902	1646.323	2.843	9.684	61.922	29.999	153.75	4.447	9.465
GCOV	52.303	7.846	25.438	16.063	11.914	13.834	7.819	15.596	35.373	21.49	49.125	131.597	63.989	91.64	11.69	8.181
PCOV	52.772	13.566	31.219	16.187	12.008	13.94	7.841	18.954	39.642	28.665	62.238	140.322	63.994	93.645	12.223	8.601
COH	0.982	0.334	0.664	0.985	0.984	0.985	0.994	0.677	0.8	0.562	0.623	0.88	1	0.958	0.915	0.905

X1 = Leaf Area (cm^2), X2 = Chlorophyll content, X3 = 1st Pod height (cm), X4 = Days to 50% flowering, X5 = Days to flowering completion, X6 = Days to pod initiation, X7 = Days to maturity, X8 = Plant height (cm), X9 = No. of pods/plant, X10 = No. of branches/plant, X11 = No. of unfilled pods/plant, X12 = No. of shattered pods/plant, X13 = 100 seed weight (g), X14 = Grain yield/plant (g), X15 = Oil content (%), X16 = Protein content (%)

Table 2: Genotypic, phenotypic and environmental correlation coefficients among 16 characters studied in 17 genotypes of soybean grown during July-Oct. 2001

Variables		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X2	rG	0.348														
	rP	0.160														
	rE	-0.363														
X3	rG	0.5815*	0.085													
	rP	0.476	-0.002													
	rE	0.082	-0.090													
X4	rG	-0.046	0.037	0.007												
	rP	-0.048	0.008	-0.010												
	rE	-0.147	-0.129	-0.220												
X5	rG	-0.030	-0.013	0.023	0.9964**											
	rP	-0.031	-0.019	0.004	0.9965**											
	rE	-0.136	-0.116	-0.208	0.9972**											
X6	rG	-0.047	0.036	0.009	1.0000**	0.9965**										
	rP	-0.048	0.009	-0.008	0.9999**	0.9965**										
	rE	-0.136	-0.116	-0.207	0.9968**	0.9994**										
X7	rG	-0.083	0.025	-0.188	0.7532**	0.7282**	0.7525**									
	rP	-0.082	0.004	-0.162	0.7444**	0.7192**	0.7435**									
	rE	-0.026	-0.178	-0.205	0-0.105	-0.131	-0.127									
X8	rG	0.171	0.045	0.133	0.05591*	0.5833*	0.5565*	0.180								
	rP	0.128	-0.024	0.266	0.0449	0.470	0.448	0.139								
	rE	-0.152	-0.097	0.5359*	-0.103	-0.091	-0.091	-0.218								
X9	rG	0.195	0.367	-0.287	0.447	0.436	0.445	0.184	0.422							
	rP	0.167	0.139	-0.269	0.401	0.391	0.399	0.165	0.291							
	rE	-0.091	-0.138	-0.228	0.095	0.078	0.078	0.029	-0.072							
X10	rG	-0.143	-0.208	-0.396	0.7725**	0.7696**	0.7699**	0.432	0.6021*	0.8201**						
	rP	-0.109	-0.045	-0.284	0.5807*	0.5793*	0.5795*	0.321	0.404	0.7041**						
	rE	-0.023	0.084	-0.110	0.073	0.082	0.082	-0.035	0.086	0.5205*						
X11	rG	-0.284	-0.473	-0.442	0.5264*	0.5282*	0.5241*	0.325	0.251	0.6555**	0.9644**					
	rP	-0.203	-0.298	-0.301	0.415	0.418	0.415	0.254	0.228	0.5315*	0.681**					
	rE	0.233	-0.164	-0.047	0.040	0.055	0.055	-0.050	0.187	0.252	0.272					
X12	rG	-0.289	-0.120	0.240	-0.6405**	-0.6324**	-0.6391**	-0.6339**	-0.140	-0.5011*	-0.5064*	-0.5007*				
	rP	-0.276	-0.074	0.195	-0.589*	-0.5831*	-0.5896*	-0.5918*	-0.116	-0.378	-0.348	-0.338				
	rE	-0.157	-0.032	0.055	0.165	0.121	0.121	0.039	-0.039	0.265	0.036	0.151				
X13	rG	0.407	0.153	0.411	-0.8036**	-0.8016**	-0.802**	-0.6559**	-0.6421**	-0.331	-0.8068**	-0.5709*	0.398			
	rP	0.403	0.089	0.333	-0.7974**	-0.7953**	-0.7958**	-0.6534**	-0.5293*	-0.295	-0.6052**	-0.451	0.373			
	rE	-0.038	0.068	-0.191	-0.018	-0.036	-0.034	0.6654**	-0.155	0.076	-0.049	-0.099	-0.041			
X14	rG	0.6342**	0.402	0.166	-0.116	-0.114	-0.116	-0.384	-0.024	0.6534**	0.194	0.094	-0.187	0.414		
	rP	0.6115**	0.241	0.089	-0.114	-0.113	-0.114	-0.375	-0.028	0.6305**	0.201	0.066	-0.164	0.405		
	rE	-0.133	0.077	-0.363	-0.062	-0.082	-0.082	-0.016	-0.079	0.6455**	0.434	-0.051	0.112	0.055		
X15	rG	0.5801*	0.183	0.6298**	-0.6125**	-0.6131**	-0.6112**	-0.5147*	-0.5023*	-0.193	-0.651**	-0.526*	0.342	0.9259**	0.5306*	
	rP	0.5496*	0.129	0.472	-0.5866*	-0.5872*	-0.5854*	-0.4903*	-0.377	-0.159	-0.4907*	-0.392	0.297	0.8865**	0.5048*	
	rE	-0.007	0.118	-0.113	-0.147	-0.150	-0.149	0.027	0.112	0.045	-0.124	0.027	-0.092	0.297	0.138	
X16	rG	0.5376*	0.342	0.429	-0.043	-0.037	-0.044	-0.162	0.451	0.244	0.042	-0.375	0.323	0.091	0.408	0.250
	rP	0.5047*	0.234	0.308	-0.040	-0.035	-0.041	-0.154	0.329	0.177	0.052	-0.287	0.271	0.085	0.376	0.201
	rE	0-0.049	0.181	-0.135	0.010	0.011	0.012	0.002	-0.136	-0.211	0.107	-0.030	-0.159	-0.209	-0.050	-0.294

X1 = Leaf area (cm^2), X2 = Chlorophyll content, X3 = 1st Pod height (cm), X4 = Days to 50% flowering, X5 = Days to flowering completion, X6 = Days to pod initiation, X7 = Days to maturity, X8 = Plant height (cm), X9 = No. of pods/plant, X10 = No. of branches/plant, X11 = No. of unfilled pods/plant, X12 = No. of shattered pods/plant, X13 = 100 Seed weight (g), X14 = Grain yield/plant (g), X15 = Oil content (%), X16 = Protein content (%)

Table 3: Direct (Bold) and indirect effects of 15 characters (Independent variables) on srain yield (Dependent Variable) in 17 lines of soybean

Variables	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
X1	0.786	0.056	-0.157	0.641	-0.012	-0.650	0.062	-0.110	0.075	-0.029	-0.020	-0.056	-0.206	0.221	0.034
X2	0.274	0.162	-0.023	-0.517	-0.005	0.502	-0.019	-0.029	0.141	-0.042	-0.032	-0.023	-0.078	0.070	0.022
X3	0.457	0.014	-0.271	-0.102	0.010	0.120	0.140	-0.086	-0.111	-0.080	-0.030	0.047	-0.208	0.240	0.027
X4	-0.036	0.006	-0.002	-13.925	0.417	13.933	-0.558	-0.360	0.172	0.156	0.036	-0.124	0.407	-0.234	-0.003
X5	-0.023	-0.002	-0.006	-13.876	0.418	13.884	-0.540	-0.376	0.168	0.155	0.036	-0.122	0.406	-0.234	-0.002
X6	-0.037	0.006	-0.002	-13.925	0.417	13.933	-0.558	-0.358	0.171	0.155	0.036	-0.124	0.406	-0.233	-0.003
X7	-0.065	0.004	0.051	-10.489	0.305	10.485	-0.741	-0.116	0.071	0.087	0.022	-0.123	0.332	-0.196	-0.010
X8	0.135	0.007	-0.036	-7.786	0.244	7.754	-0.134	-0.644	0.162	0.121	0.017	-0.027	0.325	-0.192	0.029
X9	0.153	0.060	0.078	-6.224	0.183	6.206	-0.137	-0.272	0.385	0.165	0.045	-0.097	0.168	-0.074	0.015
X10	-0.113	-0.034	0.107	-10.757	0.322	10.727	-0.320	-0.388	0.315	0.202	0.066	-0.098	0.409	-0.248	0.003
X11	-0.224	-0.077	0.120	-7.330	0.221	7.303	-0.241	-0.162	0.252	0.195	0.069	-0.097	0.289	-0.201	-0.024
X12	-0.227	-0.019	-0.065	8.920	-0.265	-8.904	0.470	0.090	-0.193	-0.102	-0.034	0.193	-0.201	0.130	0.020
X13	0.320	0.025	-0.111	11.190	-0.335	-11.174	0.486	0.413	-0.127	-0.163	-0.039	0.077	-0.506	0.353	0.006
X14	0.456	0.030	-0.171	8.530	-0.257	-8.515	0.382	0.323	-0.074	-0.131	-0.036	0.066	-0.469	0.382	0.016
X15	0.423	0.055	-0.116	0.596	-0.016	-0.616	0.120	-0.290	0.094	0.008	-0.026	0.063	-0.046	0.096	0.063

X1 = Leaf area (cm^2), X2 = Chlorophyll content, X3 = 1st Pod height (cm), X4 = Days to 50% flowering, X5 = Days to flowering completion, X6 = Days to pod initiation, X7 = Days to maturity, X8 = Plant height (cm), X9 = No. of pods/plant, X10 = No. of branches/plant, X11 = No. of unfilled pods/plant, X12 = No. of shattered pods/plant, X13 = 100 Seed weight (g), X14 = Oil content (%), X15 = Protein content (%)

flowering completion, days to pod initiation, leaf area, days to 50% flowering, shattered pods/plant, grain yield/plant, oil contents and protein contents respectively indicating the additive type of gene action. Moderate heritability was noted for plant height, pods/plant, branches/plant, unfilled pods/plant, On the basis of heritability, selection for above traits would provide the greatest improvement in soybean.

The results regarding genotypic, phenotypic and environmental coefficients of correlation given in Table 2 showed that the grain yield was positively and significantly correlated with leaf area, pods per plant and oil contents. Positive association of yield with these characters illustrated that selecting for above traits can increase the yield.

Path co-efficient analysis presented in Table 3 revealed that the maximum direct effect was observed for days to pod initiation. Days to pod initiation suggested important selection criteria. Leaf area, chlorophyll content, days to flowering completion, days

to pod initiation, number of branches per plant, number of pods per plant and oil content and protein content also exerted positive direct effects. However, first pod height, days to 50% flowering, days to maturity, plant height, 100 seed weight had negative direct effects on yield. This suggested that selection on the basis of these traits might lead to the loss in terms of bean yield.

DISCUSSION

Germplasm evaluation must be considered the first step in any plant breeding programme and it is commonly based on a simultaneous examination of a large number of populations for several characters of both agronomic and physiological traits. It was observed that some genotypes possessed desirable genes for more than one character and hence these could be utilized directly or included in a hybridization programme for varietal development. Ghafoor *et al.* (2001) has suggested selection on the basis of best performance. The identification of plants with suitable combinations of characters from a population with genetic variability is dependent upon the knowledge of breeder on that population. This knowledge is utilized to decide a selection criterion which is expected to prove effective for yield improvement together with improvement in other traits.

Present investigations revealed that the genotypes under study varied significantly for all the characters under study. These results are confirmed with the findings of Ghatge and Kadu (1993) who showed significant differences for days to maturity, plant height and seed yield. Maestri *et al.* (1998) reported significant differences in oil content and protein content. Muhammad and Shah (2003) showed significant differences among varieties in terms of traits like pods/plant, seeds/plant, plant height, days to flowering, days to pod initiation, 100 seed weight, grain yield/plant and seeds/pod, indicating the existence of genetic variation among varieties. In order to maintain, evaluate and utilize germplasm efficiently, it is important to investigate the extent of genetic diversity it contains (Ghafoor *et al.* 2003). Considerable amount of variation was found among genotypes for days to 50% flowering. Results are contradictory to the findings of Dadson (1976) who evaluated different cultivars of soybean and revealed that most cultivars flowered at the optimum date, between 30-35 days after sowing. The difference in the results might be due to the difference in genetic constitution of breeding material. Some genotypes produced smaller seeds with relatively lighter weight. These results are somewhat contradictory to the findings of Maestri *et al.* (1998) who conducted trials to compare different genotypes of soybean and reported that seed size varied between 13.9-21.0 g/100 seeds. The results are different because of the type of genotypes which produced lighter seeds. These lines of low 100 seed weight may be used as fodder purpose or in breeding program to improve this character.

High estimates of heritability were recorded in 100 grain weight, days to maturity, days to flowering completion, days to pod initiation, leaf area, days to 50% flowering, shattered pods/plant, grain yield/plant, oil contents and protein contents respectively indicating the additive type of gene action. On the basis of heritability, selection for above traits would provide the greatest improvement in soybean.

These results are comparable to the results of and Jain and Ramgiry (2000) who reported that plant height, pods per plant and 100 seed weight had high estimates of heritability. Ghatge and Kadu (1993) and Rasaily *et al.* (1986) also showed that heritability was high for leaf area, days to 50% flowering, days to maturity, plant height and seed yield. Zhu (1992) revealed that heritability for 100 seed weight and plant height was high.

The results regarding genotypic, phenotypic and environmental coefficients of correlation showed that the genotypic correlations were higher than the phenotypic and environmental ones for most of the characters exhibiting high degrees of genetic association among traits under consideration. The environmental correlation coefficients were not very important in most of the cases indicating low environmental influence in the experiment. Chand (1999) performed experiments on different varieties of soybean and revealed that the genotypic correlation coefficients for all characters studied were higher than the phenotypic and environmental correlation coefficients. Number of pods per plant and leaf area are an important characteristic which finally affects yield of soybean. It is clear that more number of pods per plant and higher leaf area will produce higher yield per plant. The potential of genotypes may be utilized as the oil content is positively and significantly correlated with yield and both characters could be combined in the same genotype. The results are in line with those of Rajanna *et al.* (2000). Positive association of yield with leaf area, pods per plant and oil contents illustrated that selection on the basis of these traits can increase the yield. The results are in line with those of Manzoor and Kaleri (1971), Khurana and Sandhu (1972), Amaranath *et al.* (1990), Khanghah and Sohani (1999), Chand (1999) and Rajanna *et al.* (2000).

Path co-efficient analysis revealed that days to pod initiation exerted highest positive direct effect on grain yield followed by leaf area and days to flowering completion. Therefore it is an important character contributing maximum to yield and emphasis may be given during selection. Harer and Deshmukh (1992) presented similar results and suggested greater emphasis on longer duration during selection. However, the results are contradictory to the findings of Srinives *et al.* (1986)

who carried out experiments on soybean and reported that direct effect of leaflet index on yield was small and negative. The contradiction to the results might be due to the difference in the genetic material.

It is concluded that the germplasm exhibited considerable amount of variability for characters like leaf area, plant height, 50% flowering, days to 50% maturity, plant height, pods/plant, branches/plant, 100 seed weight and grain yield/plant. However, there is a need to collect more germplasm to increase the diversity in terms of chlorophyll contents, oil content and protein content. On the basis of correlation and path analysis, it is clear that selection of genotypes on the basis of leaf area, pods per plant, days to flowering completion and oil content can be helpful to increase the yield.

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