STUDY ON INTER RELATION AND PATH COEFFICIENT FOR YIELD AND ITS ATTRIBUTING CHARACTERS IN SOYABEAN [*GLYCINE MAX* (L.)]

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Abstract: Twenty promising breeding lines of soybean were evaluated for correlation and path coefficient for eighteen economically important attributes. The mean squares were significantly for all the characters. Based on mean performance, six genotypes viz. ISS-522, ISS-524, ISS-631, ISS-715, ISS-734 and ISS-889 were significantly superior in yield and other major yield contributing characters. Seed yield showed significant positive correlations with total dry matter weight and harvest index. And, these characters were also positively associated with each other. Protein and oil contents showed significant and negative association with each other. While, 100-seed weight had positive association with oil content but negative with protein content, path coefficient analysis indicating major role of pods/plant, total dry matter, primary branches/plant, seed yield efficiency and 100-seed weight both directly and indirectly influenced seed yield. Therefore, main emphasis should be given on these traits during phenotypic selection for the developing high yielding genotypes of soybean.

Key words: Correlation, Path analysis, Direct & indirect effect.

INTRODUCTION

Soybean is basically a leguminous crop and is gaining importance as an oilseed crop in India. Soybean, a non-conventional crop is emerging as an important crop in different state of country. Existence of adequate genetic variability is a pre-requisite for the genetic improvement and exploitation of yield in soybean by breeding methods. Similarly, the correlation and path analysis studies are of great help in formulating efficient scheme of multiple traits selection, as they provide means for direct and indirect selection of component characters. Thus, knowledge of correlation and path coefficient in elite breeding lines of soybean is essential for a breeder to choose best genotypes and to decide the correct breeding methodology for soybean improvement. The present study was undertaken for the genetic improvement on soybean.

MATERIAL AND METHODS

The experiment was conducted at Research Farm of Sardar Vallabh Bhai Patel University of Agriculture & Technology, Meerut, during *Kharif* 2006 in a randomized block design with three replications. Each genotype was sown in 5 rows of 5 meter length. Spacing between rows was 60 cm and between plants was 10 cm. Recommended agronomic practices were followed to raise the good crop. Experimental material comprised of twenty elite breeding lines of soybean assigned with ISS numbers viz. ISS-521, ISS-522, ISS-523, ISS-524, ISS-525, ISS-526, ISS-527, ISS-528, ISS-529, ISS-530, ISS-531, ISS-532, ISS-715, ISS-734, ISS-885, ISS-889, ISS-897, ISS-901, ISS-910 and PS-1142. The Observations were recorded on five randomly selected plants in each genotype per replication for eighteen yield contributing important characters. The character means of the genotypes for each replication were subjected to the statistical analysis. The various parameters of Phenotypic and genotypic correlation coefficients effects (Al-Jibouri, *et al., 1958* and Sharma, *et al*., 1986) and direct and indirect effects were worked out as per formulae.

RESULTS AND DISCUSSION

The yield is a complex character and it depends upon a number of yield contributing traits. In order to persuade a clear-cut view about inter-character associations among different yield contributing characters, it is necessary to interpret correlation among these characters in the crop plants. The yield components may not always be independent in their action but may be inter-linked. The selection practiced for one character may simultaneously bring change in the other related character. Thus, the information of the magnitude and direction of association between the component characters are essential for the improvement in the desirable direction. Genotypic correlations in general were higher than phenotypic correlations (Table 1). Directions of phenotypic and genotypic correlations were almost the same for the most of the character combinations. Whereas, environmental correlations were lowest in magnitude as compared to the genotypic and phenotypic correlations. The genotypic correlation is its true sense may be interpreted as the correlation of breeding value while the environmental correlation includes both environmental and non-additive genetic deviations.

In the present study seed yield/plant was significantly positively correlated with total dry matter/plant, primary branches/plant, pods/plant, seed yield efficiency, 100-seed weight and harvest index. However, these traits were also positively associated with each other. Protein and oil

contents exhibited significant and negative association with each other while, 100-seed weight had positive association with oil content but negative with protein content. Similar results were reported earlier in soybean (Algan, 1992, Singh and Phule, 1999, and Tong, 1986).

Path coefficient is the standardized partial regression coefficients and offers the measure of direct and indirect influence of one variable upon the other. The significance of pods/plant, total dry matter weight/plant, primary branches/plant, seed yield efficiency and 100-seed weight in determining seed yield became obvious through path coefficient analysis. These components had substantial direct effect on seed yield at phenotypic, genotypic as well as at environmental level (Table 2). At phenotypic level, number of pods/plant had substantial indirect effect on seed yield via total dry matter weight. Whereas, dry matter was also indirectly influenced via number of pods/plant in determining the seed yield. Similarly, primary branches had sufficient direct and indirect effect via pods/plant followed by dry matter weight. Seed yield efficiency also had substantial direct effect on seed yield and indirect effect via 100-seed weight and harvest index. However, harvest index did not have much direct effect on seed yield but this trait had substantial indirect effect on seed yield via seed yield efficiency. Whereas, 100-seed weight exhibited significant direct and indirect effect in determining the seed yield via seed yield efficiency. These findings of present investigation are in agreement with other workers (Harer and Deshmukh, 1992 , Jadhav *et al.*, 1995 and Shrivastava and Shukla, 1998).

Thus, on the basis of character associations and path coefficient analysis it can be suggested that, during selection main emphasis should be given on number of pods/plant, total dry matter/plant, number of primary branches/plant, seed yield efficiency and 100-seed weight for the enhancement of genetic for potential seed yield for the soybean.

Table 1 Inter – character association between different character-pairs

Characters		Days to maturity	Plant height	Flower span	N0. of pods/ plant	N0. of seeds/ pod	N0. of primary Branches/ plant	N0. of nodes on main stem	Basal node height (cm)	Basal pod neight (cm)	Total matter wt. (g)	Harvest index	Seed coat wt. Cotyledon wt. ratio (%)	100 – seed wt. (g)	Seed yield efficiency	Seed yield / Plant (g)	Protein contents	Oil contents (%)
Days to flower	G	0.0038	0.0429	0.0336	-0.0465	-0.4151	-0.4858*	0.3280	-0.3519	-0.3810	-0.5593**	-0.3064	0.4700*	-0.2246	-0.3299	-0.5533**	-0.2106	0.0608
	P	0.2046	-0.0073	0.0464	-0.2424	-0.2344	-0.4154	0.1704	-0.1737	-0.0870	0.3497	-0.1298	0.2139	-0.2164	-0.1441	-0.4523	-0.1619	0.1098
Days to maturity	G		-0.0647	0.0839	0.0202	0.1452	-0.2221	0.2561	-0.0559	-0.3582	-0.1639	0.1629	0.5595**	-0.1639	0.0884	-0.5391**	0.2505	0.0012
	P		-0.0381	0.0857	0.0108	0.0258	-0.1675	-0.0143	0.0907	-0.1893	-0.0630	0.0919	0.2318	-0.1672	0.0391	-0.0208	-0.0049	0.0558
Plant height (cm)	G			0.4636*	0.4948*	-0.2798	-0.1511	0.8321**	-0.1478	-0.4785*	0.4791*	-0.5031*	0.2080	-0.4865*	-0.4886*	-0.0244	0.5102*	-0.5399**
	P			0.3668	0.4496*	-0.1713	-0.0978	0.6811**	-0.0484	-0.1906	0.2710	-0.3492	0.1042	-0.4226	-0.2667	-0.0172	0.2914	0.4289
Flower span	G				0.2286	0.1026	-0.2206	0.7793**	-0.1438	-0.3457	0.1654	-0.3632	0.3823	-0.4429	-0.2994	-0.1260	0.5111*	-0.3361
	P				0.1765	0.1766	-0.1782	0.3452	-0.0816	-0.2209	0.0349	0.1256	0.1004	-0.3302	0.0773	0.0704	0.2794	-0.2472
N0. of pods/ Plant	G					0.3564	0.3875	0.4731*	0.07101	-0.4049	0.8890**	0.0886	-0.3628	-0.1097	0.2108	0.6489**	0.0961	-0.2665
	P					0.0062	0.3835	0.2967	0.0302	-0.2770	0.4863*	0.0631	-0.1482	-0.0920	0.1403	0.5987**	0.0517	-0.2117
N0. of seeds/ Pod	G						0.1360	-0.3396	0.5437**	0.6639**	0.0723	0.5019*	0.1220	0.2889	0.4698*	0.3121	-0.3247	0.5655**
	P						0.0795	-0.1290	0.2624	0.3442	-0.0130	0.2330	-0.0016	0.1195	0.1916	0.2110	0.0039	0.2049
N0. of primary branches/plant	G							-0.1941	-0.0324	0.2330	0.6865**	0.1565	-0.6264**	0.4179	0.0981	0.5930**	-0.2725	0.1036
	P							0.0306	-0.0593	0.0163	0.5655**	0.1639	-0.2832	0.3437	0.1529	0.6031**	-0.1362	0.0682
N0. of nodes on main stem	G								-0.4104	0.7649**	0.0397	-06921**	0.6248**	-0.7350*	-0.2466	0.5682**	-0.6124**	0.7629**
	P								-0.1079	-0.2890	0.3579	0.2008	0.2008	-0.4463*	-0.2011	-0.0498	0.2622	-0.3130
Basal node height (cm)	G									0.7629**	0.2840	-0.1496	-0.1777	0.2524	0.1808	0.3368	-0.2287	0.2678
	P									0.3497	0.0767	-0.1486	-0.0582	0.1866	0.1745	0.2555	-0.2044	0.1827
Basal pod height (cm)	G										0.3996	-0.2098	-0.4589*	0.7662**	0.1931	0.2072	-0.7339**	0.7040**
	P										-0.1942	0.0487	-0.0712	0.3561	0.0238	0.0569	-0.2225	0.3708
Total dry matter (g)	G											-0.3867	-0.9867**	0.5604**	-0.2953	0.8960**	0.1320	-0.3615
	P											-0.0317	-0.2530	0.2443	0.0656	0.6144**	0.1461	-0.1928
Harvest index	G												0.2322	0.3556	0.9896**	0.5518**	-0.4931*	0.5721**
	P												-0.1114	0.3456	0.9626**	0.5069	-0.2565	0.2893
Seed coat wt. coty. Wt. ratio (%)	G													-0.8379*	0.3556	-0.6243**	-0.0132	0.0821
	P													-0.4581*	0.3456	-0.3208	-0.0275	0.0865
100- seed wt. (g)	G														-0.8379**	0.6174**	-0.5252**	0.4619*
	P														-0.4581*	0.5114**	-0.2508	0.3422
Seed yield efficiency	G															0.6450**	-0.4484*	0.5217**
	P															0.5636**	-0.2505	0.2493
Protein contents (%)	G																-0.2417	0.1156
	P																-0.077	0.0420
																		-0.9801**
																		-0.8082**

G = Genotypic correlation: P = Phenotypic correlation * ** Significant at 5% and 1% level of probability respectively

Table 2 Path coefficient analysis showing the direct and indirect effect on seventeen characters on seed yield.

Characters	Correlation (Phenotypic)	Direct effect	Days to flower	Days to maturity	Plant height (cm)	Flower span	N0. of pods/ plant	N0. of seeds/ pod	N0. of primary Branches/	N0. of nodes on main stem	Basal node height (cm)	Basal pod neight (cm)	Total matter wt. (g)	Harvest index	Seed coat wt. Cotyledon wt. ratio	100 – seed wt. (g)	Seed yield efficiency	Protein contents (%)	Oil contents (%)
Days to flower	-0.4523*	0.0762	-	0.0128	0.0003	0.0007	-0.1033	-0.0053	-0.0616	-0.0048	-0.0131	-0.0092	-0.0801	-0.0062	0.0130	-0.0625	-0.0437	-0.0036	-0.0091
Days to maturity	-0.0208	0.0625	-0.0155	-	0.0018	0.0014	0.0046	0.0005	-0.0248	0.004	0.0068	-0.0201	-0.0157	0.0043	0.0141	-0.0480	0.0118	-0.0001	-0.0046
Plant height (cm)	-0.0172	-0.0482	0.0005	-0.0023	-	0.0062	0.1917	0.0038	-0.0145	-0.0195	-0.0036	-0.0202	0.0678	-0.0167	0.0063	-0.1221	-0.0810	0.0066	0.0358
Flower span	0.0704	0.0170	-0.0035	0.0053	-0.0177	-	0.0735	0.0040	-0.0264	-0.0099	-0.0061	-0.0234	0.0087	-0.0060	0.0061	0.0954	-0.0235	0.0063	0.0206
N0. of pods/ Plant	0.5987**	0.4263	0.0184	0.0006	-0.0217	0.0029	-	0.0001	0.0569	-0.0085	0.0022	-0.0294	0.1217	0.0030	-0.0090	-0.0265	0.0426	0.0011	0.0176
N0. of seeds/ Pod	0.2110	0.0226	0.0187	0.0016	0.0082	0.0030	0.0026	-	0.0118	0.0037	0.0198	0.0366	-0.0032	0.0111	-0.0007	0.0345	0.0582	0.0001	-0.0171
N0. of primary branches/plant	0.6021**	0.1484	0.0317	-0.0104	0.0047	-0.0030	0.1635	0.0018	-	-0.0008	-0.0044	0.0017	0.1415	0.0078	-0.0173	0.0993	0.0464	-0.0030	-0.0057
N0. of nodes on main stem	-0.0498	-0.0280	-0.0129	-0.0008	-0.0328	0.0058	0.1265	-0.0029	0.0045	-	0.0081	-0.0307	0.0896	-0.0134	0.0122	-0.1290	-0.0610	0.0059	0.0261
Basal node height (cm)	0.2555	0.0755	0.0132	0.0056	0.0023	-0.0013	0.0129	0.0059	-0.0088	0.0030	-	0.0371	0.0192	0.0071	-0.0035	0.0539	0.0530	-0.0046	0.0152
Basal pod height (cm)	0.0569	0.1063	0.0066	-0.0118	0.0092	-0.0037	-0.1181	0.0077	0.0024	0.0082	0.0264	-	-0.0486	0.0023	-0.0043	0.1029	0.0072	-0.0050	-0.0309
Total dry matter (g)	0.6144**	0.2502	0.0244	-0.0039	-0.0130	0.0005	0.2073	-0.0002	0.0839	-0.0102	0.0058	-0.0206	-	0.0015	-0.0154	0.0706	0.0171	0.0033	0.0161
Harvest index	0.5065*	0.0478	0.0099	0.0057	0.0168	-0.0021	0.0269	0.0052	0.0243	0.0080	0.0112	0.0051	-0.0079	-	-0.0068	0.099	0.2924	-0.0058	0.0241
Seed coat wt. coty.Wt.ratio(%)	-0.3208	0.0611	-0.0163	0.0145	-0.0050	0.0017	-0.0632	-0.0002	-0.0420	-0.0057	-0.0044	-0.0075	-0.0633	-0.0055	-	0.1324	-0.0445	0.0006	-0.0072
100- seed wt. (g)	0.5114*	0.2890	0.0164	-0.0104	0.0204	-0.0056	-0.0392	0.0027	0.0510	0.0128	0.0141	0.0378	0.0611	0.0165	-0.0278	-	0.1069	-0.0056	0.0285
Seed yield efficiency	0.5636**	0.3038	0.0109	0.0024	0.0128	-0.0013	0.0598	0.0043	0.0227	0.0057	0.0131	0.0025	0.0141	0.0460	-0.0089	0.1017	-	-0.0056	-0.0208
Protein contents (%)	-0.0777	0.0226	0.0123	-0.0003	-0.0140	0.0047	0.0220	0.0001	-0.0202	-0.0075	-0.0154	-0.0236	0.0365	-0.0120	-0.0016	-0.0724	-0.0761	-	0.075

Residual factor = 0.1942 *** Significant at 5% and 1% level of probability respectively

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