

**Studies on F<sub>1</sub> and F<sub>2</sub> generations of soybean for correlation and path coefficient in Tarai region of Uttarakhand**

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**Abstract**

Forty three soybean genotypes (23 crosses, nineteen parents and one check) were evaluated at G. B. P. U. A. T. Pantnagar, Uttarakhand, in 2013 and 2014 using randomized complete block design with 2 replications for F<sub>1</sub> and F<sub>2</sub> generation, respectively. The objectives of the study were to investigate the correlations among twelve characters of soybean and to verify direct and indirect effects which will be used for the selection of seed yield in early generations. The data regarding twelve characters *viz.*, days to fifty per cent flowering, days to maturity, plant height, number of primary branches per plant, number of nodes per plant, number of pods per cluster, number of pods per plant, number of seeds per pod, dry matter weight per plant, hundred seed weight, harvest index and yield per plant were evaluated for phenotypic- genotypic correlations and path coefficient. Yield per plant showed highly significant positive phenotypic and genotypic correlations for number of nodes per plant, primary branches per plant, number of pods per plant, dry matter weight per plant and harvest index in F<sub>1</sub> and F<sub>2</sub>. Whereas, in F<sub>1</sub> yield showed significant and positive values of genotypic and phenotypic correlations with number of pods per cluster, seeds per pod and hundred seed weight also. A critical perusal of path-coefficient analysis at the level of phenotypic correlation coefficient, revealed that dry matter weight per plant had the highest direct effect on seed yield per plant (0.075) The highest negative direct effect was that of plant height (-0.008) in F<sub>1</sub>. In contrast to F<sub>1</sub>, in F<sub>2</sub> harvest index had the highest direct effect on yield per plant both at phenotypic (0.98) and genotypic (0.96) levels.

Keywords - Soybean, Correlation, Path coefficient, Yield

## INTRODUCTION

Soybean (*Glycine max* L. Merrill) is one of the oldest crops grown in the world. The plant is classed more as an oil seed crop than a pulse with its 40 per cent protein and 20 per cent oil. It is also known as an excellent source of good quality unsaturated fatty acids (about 85%) and is very high in the essential fatty acids such as oleic acid (23%) linoleic acid (53%) and linolenic acid (7%) (Fehr *et al.*, 1992). Soybean is a major *kharif* season oilseed crop in India. The basic objective of any breeding programme is to increase the yield per unit area to meet the demand of increasing populations. Yield is the ultimate product of action and interaction of number of yield components, with low heritability that makes the response to selection for yield per se low (Burton 1987). Quantitative characters are governed by a large number of genes having small effects and are greatly influenced by environment, the effect of small individual genes cannot be estimated and only cumulative effect of the genes can be estimated for any of the attributes. Genetic correlations should be more useful than phenotypic correlations as it contains the additive portion of gene expression for that particular trait that can be used as base of selection for seed yield as the environmental effects are excluded. Furthermore, correlations between seed yield and related characters could be partitioned through path analysis into direct and indirect effects to identify characters most responsible for the increase of seed yield (Dewey and Lu 1959). The present investigation was done to know the inter character correlation and their direct as well as indirect effects in  $F_1$  and  $F_2$  generations on yield per plant.

## MATERIALS AND METHODS:

The study was carried out during *Kharif* 2013 and 2014 at Norman E. Borlaug Crop Research Center, Govind Ballabh Pant University of Agriculture and Technology Pantnagar from the population of 43 soybean genotypes comprised of 23 crosses, nineteen parents and one check (Table 1). In 2013-14,  $F_1$ 's were planted in single row along with parents and check in 3 rows of 1.5 meter with row to row distance of 45cm. Parents were planted to both sides of all the crosses,  $F_1$  plants were guarded by PS 1347, a narrow leaflet variety to provide better competition. In 2014-2015, 10 rows of 4 meter with 45 cm row to row spacing for each  $F_2$  cross and three rows of parents and check were planted. The observations were recorded for all the

plants of  $F_1$  crosses and five sample plants of the parents and check, In  $F_2$  generations data was taken from 25 randomly selected competitive plants of crosses and five sample plants of the parents and check for plant height, number of primary branches per plant, number of nodes per plant, number of pods per cluster, number of pods per plant, number of seeds per pod, dry matter weight per plant, hundred seed weight, harvest index and yield per plant. On the whole plot basis the observations were recorded for days to 50 per cent flowering and days to maturity. The correlation coefficients at phenotypic and genotypic level between all possible pairs of characters were estimated according to Searle (1961). Phenotypic correlation coefficients were further partitioned into direct and indirect effects with the help of path coefficient analysis as Wright (1921) and applied in plant breeding by Dewey and Lu (1959).

## **RESULTS AND DISCUSSION:**

In general, phenotypic correlations were smaller than genotypic correlations. Phenotypic and genotypic correlations between character pairs for all the characters are presented in Tables 2 and 3, respectively. Diagrammatic representation of phenotypic correlations in  $F_1$  and  $F_2$  is given in figure 1 and 2 respectively.

Days to fifty per cent flowering showed significant positive correlation with days to maturity, plant height, primary branches per plant, number of pods per plant, number of pods per cluster, dry matter weight per plant and yield per plant at phenotypic and genotypic levels in  $F_1$ . In  $F_2$ , days to fifty per cent flowering had significant positive correlation with days to maturity and number of pods at both at phenotypic and genotypic levels. Days to maturity had significant positive correlation with plant height at both the levels in  $F_1$  and  $F_2$ . There were positive and significant phenotypic and genotypic correlations with plant height and number of primary branches per plant at both the levels in  $F_2$ . Number of primary branches per plant showed significant positive values of phenotypic and genotypic correlations with number of pods per plant, number of seeds per pod, dry matter weight per plant and yield per plant.

Highly significant and positive value of phenotypic and genotypic correlations was observed only with yield per plant only. Genotypic association with number of pods and harvest index also showed significant and positive value. Characters like dry matter weight per plant and number of pods per cluster showed positive but non-significant correlation in  $F_2$ .

Number of pods per plant showed significant positive values of phenotypic and genotypic correlations with number of pods per cluster, number of seeds per pod, hundred seed weight, dry matter weight, harvest index and yield per plant in  $F_1$ .

Highly significant and positive value of phenotypic and genotypic correlations was observed with dry matter weight per plant, harvest index and yield per plant in  $F_2$ . Seeds per pod showed non-significant negative values of phenotypic and genotypic correlations with number of pods per plant. Dry matter weight per plant showed highly significant and positive value of phenotypic and genotypic correlations with yield per plant. Negative and highly significant genotypic correlations were observed for harvest index in  $F_1$ . In  $F_2$  harvest index showed highly significant and negative value of phenotypic and genotypic correlation with dry matter weight per plant.

Yield per plant showed highly significant positive phenotypic and genotypic correlations for number of nodes per plant, primary branches per plant, number of pods per plant, dry matter weight per plant and harvest index in  $F_1$  and  $F_2$ . Whereas, in  $F_1$  yield showed significant and positive values of genotypic and phenotypic correlations with number of pods per cluster, seeds per pod and hundred seed weight also.

The path coefficient analysis was carried out by taking seed yield per plant as separate and rest of the characters, as independent variables. Phenotypic and genotypic direct effects in  $F_1$  and  $F_2$  generations of various characters on seed yield are presented in Tables 4, 5, 6 and 7 respectively. Diagrammatic representation of phenotypic path in  $F_1$  and  $F_2$  generation is depicted in Fig 3 and Fig.4 respectively.

A critical perusal of phenotypic path coefficient analysis in  $F_1$  revealed that the dry matter weight had highest positive direct effect (0.752) on yield per plant followed by harvest index (0.424), number of pods per plant (0.076), pods per cluster (0.014), days to maturity (0.012) and hundred seed weight (0.009). At genotypic level dry matter weight (0.963) was most important direct contributor to the yield per plant followed by, harvest index (0.649), number of nodes per plant (0.3254), days to 50 per cent flowering (0.321) and plant height (0.130), whereas number of primary branches per plant (-0.464), hundred seed weight (-0.358), number of seeds per pod (-0.318) and number of pods per cluster exhibited direct but negative effects to yield per plant

In  $F_2$ , harvest Index was the most important positive direct contributor towards the seed yield per plant (0.987) followed by dry matter weight per plant (0.615), days to maturity (0.0351), number of pods per plant (0.026), number of pods per cluster (0.0175) and days to fifty per cent flowering (0.011). The maximum negative direct effect was that of number of nodes per plant (-0.032) followed by plant height (-0.0056) and no of primary branches (-0.0054) at phenotypic level. At genotypic level dry matter weight per plant was the most important positive direct contributor towards the yield per plant at genotypic (0.969) level followed by harvest index (0.593), number of pods per plant (0.064), days to maturity (0.047), number of pod per cluster (0.044), plant height (0.031) and hundred seed weight (0.006).

The positive and significant association of these traits with yield per plant and high direct effect of these traits towards the total yield revealed that there is true relationship between these characters and the direct selection for these component traits will bring an improvement in the yield per plant, the dependent variable.

Since, these characters also exhibited significant and positive correlation with yield per plant and hence improvement in these component characters would result in the improvement of yield per plant. Therefore, during selection maximum emphasis should be given to the improvement of these component characters. Lee *et al.*, (2010) and Li *et al.*, (2013).

In the present study, the estimates of the residual factor in  $F_1$  were 0.153 and 0.137 at phenotypic and genotypic levels, respectively, while in  $F_2$  there were 0.171 and 0.137 at phenotypic and genotypic levels respectively indicating that there are some other minor factors which have not been considered here and need to be included in this analysis to bring the desired improvement in yield.

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**Table 1: List of soybean genotypes with code**

Sl. No.	Genotype	Sl. No.	Genotype
1	DT 21xDOKO	23	PS 1347xDS 9814
2	DT 21xUPSM 534	24	DT 21
3	DT 21xPS 1042	25	DOKO
4	DT 21xPS 1347	26	UPSM 534
5	PS 1347xPS 1042	27	PS 1042
6	JS 335xUPSM 534	28	PS 1347
7	MACS 330xEC 389148	29	JS 335
8	MACS 330xVLS 59	30	MACS 330
9	PS 1347xPS 1241	31	EC 389148
10	PS 1421xJS 335	32	VLS 59
11	UPSM 534xPS 1042	33	NRC 90
12	PS 1042xDS 9814	34	JS 93-05
13	PS 1042xHardee	35	DS 9814
14	PS 1042xTGX 1681-3F	36	Hardee
15	PS 1042xPP 6	37	TGX 1681-3F
16	PS 1042xJS 335	38	PP 6
17	PS 1092xPP 6	39	PS 1092
18	PS 1347xTGX 1681-3F	40	PS 1225
19	PS 1347xPS 1225	41	PS 1421
20	PS 1421xJS 93-05	42	PS 1241
21	PS 1421xNRC 90	43	PS 19
22	PS 1421xPS 1042		

Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of nodes per plant	Number of primary branches per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	100- seed weight (g)	Dry matter weight per plant (g)	Harvest index (%)	Yield per plant (g)
Days to 50% flowering	F <sub>1</sub>	1.000	0.264 *	0.296 **	0.075	0.331 *	0.370 **	0.329 *	0.091	0.195	0.322 *	0.134	0.336*
	F <sub>2</sub>	1.000	0.353**	0.190	0.131	0.102	0.318 *	0.232	0.077	-0.164	0.008	0.194	0.226
Days to maturity	F <sub>1</sub>		1.000	0.257 *	0.078	-0.042	0.106	-0.022	0.336 **	0.131	0.101	0.117	0.145
	F <sub>2</sub>		1.000	0.268 *	0.176	0.287 *	0.086	-0.024	0.012	-0.155	-0.006	0.064	0.090
Plant height (cm)	F <sub>1</sub>			1.000	0.001	-0.074	0.135	-0.245	0.205	0.161	0.058	0.193	0.127
	F <sub>2</sub>			1.000	0.725 **	0.042	0.053	-0.298 *	0.291 **	0.124	-0.025	0.245	0.206
Number of nodes per plant	F <sub>1</sub>				1.000	0.258 *	0.298 *	0.167	0.335 **	0.238	0.303 *	-0.073	0.234
	F <sub>2</sub>				1.000	0.052	0.132	-0.197	0.255 *	0.146	0.065	0.339*	0.347*
Number of primary branches per plant	F <sub>1</sub>					1.000	0.319 *	0.161	0.287 **	0.080	0.446 **	0.053	0.387 **
	F <sub>2</sub>					1.000	0.226	0.134	-0.114	-0.080	0.128	0.193	0.281*
Number of pods per plant	F <sub>1</sub>						1.000	0.320 *	0.313 *	0.413 **	0.876 **	0.258*	0.855 **
	F <sub>2</sub>						1.000	0.106	-0.066	0.064	0.246	0.526**	0.701**
Number of pods per cluster	F <sub>1</sub>							1.000	0.0937	0.072	0.311 *	-0.036	0.259*
	F <sub>2</sub>							1.000	0.0411	-0.167	0.244	-0.091	0.089
Number of seeds per pod	F <sub>1</sub>								1.000	0.306 **	0.413 **	-0.018	0.337 *
	F <sub>2</sub>								1.000	-0.019	-0.101	0.118	0.048
100- seed weight (g)	F <sub>1</sub>									1.000	0.503 **	0.038	0.438**
	F <sub>2</sub>									1.000	0.017	0.040	0.041
Dry matter weight per plant (g)	F <sub>1</sub>										1.000	0.139	0.889 **
	F <sub>2</sub>										1.000	-0.333**	0.297*
Harvest index (%)	F <sub>1</sub>											1.000	0.547 **
	F <sub>2</sub>											1.000	0.784**
Yield per plant (g)	F <sub>1</sub>												1.000
	F <sub>2</sub>												1.000

**Table 2 : Inter-character correlation coefficient between different characters at phenotype level in F<sub>1</sub> and F<sub>2</sub> generation of soybean**



Character		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of nodes per plant	Number of primary branches per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	100- seed weight (g)	Dry matter weight per plant (g)	Harvest index (%)	Yield per plant (g)
Days to 50% flowering	F <sub>1</sub>	1.000	0.297*	0.320*	0.109	0.349**	0.395**	0.365*	0.082	0.201	0.350**	-0.320*	0.435**
	F <sub>2</sub>	1.000	0.360**	0.197	0.125	0.091	0.334*	0.209	0.011	-0.201	0.011	0.211	0.244
Days to maturity	F <sub>1</sub>		1.000	0.279*	0.109	-0.038	0.103	-0.018	0.358**	0.149	0.098	-0.132	0.143
	F <sub>2</sub>		1.000	0.285*	0.194	0.303*	0.088	-0.060	0.036	-0.166	-0.004	0.075	0.108
Plant height (cm)	F <sub>1</sub>			1.000	0.029	-0.086	0.132	-0.275*	0.238	0.160	0.055	-0.274*	0.114
	F <sub>2</sub>			1.000	0.749**	0.051	0.041	-0.321*	0.722**	0.127	-0.032	0.259*	0.216
Number of nodes per plant	F <sub>1</sub>				1.000	0.340*	0.349**	0.184	0.402**	0.251*	0.335*	-0.142	0.397**
	F <sub>2</sub>				1.000	0.067	0.126	-0.201	0.502**	0.149	0.068	0.351**	0.362**
Number of primary branches per plant	F <sub>1</sub>					1.000	0.323*	0.185	0.279*	0.088	0.472**	0.117	0.417**
	F <sub>2</sub>					1.000	0.267*	0.140	-0.087	-0.117	0.119	0.253*	0.329*
Number of pods per plant	F <sub>1</sub>						1.000	0.338*	0.317*	0.439**	0.891**	-0.346**	0.965**
	F <sub>2</sub>						1.000	0.124	-0.045	0.073	0.258*	0.563**	0.761**
Number of pods per cluster	F <sub>1</sub>							1.000	0.062	0.080	0.335**	-0.039	0.345**
	F <sub>2</sub>							1.000	-0.122	-0.222	0.288*	-0.098	0.118
Number of seeds per pod	F <sub>1</sub>								1.000	0.333*	0.460**	0.076	0.408**
	F <sub>2</sub>								1.000	-0.101	-0.147	0.159	0.039
100- seed weight (g)	F <sub>1</sub>									1.000	0.535**	0.031	0.519**
	F <sub>2</sub>									1.000	0.024	0.043	0.057
Dry matter weight per plant (g)	F <sub>1</sub>										1.000	-0.259*	0.963**
	F <sub>2</sub>										1.000	-0.335**	0.295*
Harvest index (%)	F <sub>1</sub>											1.000	0.015
	F <sub>2</sub>											1.000	0.788**
Yield per plant (g)	F <sub>1</sub>												1.000
	F <sub>2</sub>												1.000

Table 3 : Inter-character correlation coefficient between different characters at genotypic level in F soybean

Sl. No.	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of nodes per plant	Number of primary branches per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	100-seed weight (g)	Dry matter weight per plant (g)	Harvest index (%)
1	Days to 50% flowering	<b>-0.0053</b>	-0.0014	-0.0016	-0.0004	-0.0017	-0.0020	-0.0017	-0.0005	-0.0010	-0.0017	-0.0007
2	Days to maturity	0.0033	<b>0.0127</b>	0.0033	0.0010	-0.0005	0.0013	-0.0003	0.0043	0.0017	0.0013	0.0015
3	Plant height (cm)	-0.0025	-0.0022	<b>-0.0086</b>	0.0000	0.0006	-0.0012	0.0021	-0.0018	-0.0014	-0.0005	-0.0017
4	Number of nodes per plant	0.0007	0.0007	0.0000	<b>0.0088</b>	0.0023	0.0026	0.0015	0.0029	0.0021	0.0027	-0.0006
5	Number of primary branches per plant	-0.0001	0.0000	0.0000	-0.0001	<b>-0.0002</b>	-0.0001	0.0000	-0.0001	0.0000	-0.0001	0.0000
6	Number of pods per plant	0.0282	0.0081	0.0103	0.0227	0.0243	<b>0.0760</b>	0.0244	0.0238	0.0314	0.0666	0.0197
7	Number of pods per cluster	0.0046	-0.0003	-0.0034	0.0023	0.0023	0.0045	<b>0.0140</b>	0.0013	0.0010	0.0044	-0.0005
8	Number of seeds per pod	0.0001	0.0005	0.0003	0.0005	0.0004	0.0005	0.0001	<b>0.0015</b>	0.0005	0.0006	0.0000
9	100-seed weight (g)	0.0019	0.0013	0.0016	0.0023	0.0008	0.0040	0.0007	0.0030	<b>0.0097</b>	0.0049	0.0004
10	Dry matter weight per plant (g)	0.2425	0.0762	0.0438	0.2285	0.3362	0.6594	0.2344	0.3110	0.3784	<b>0.7524</b>	0.1047
11	Harvest index (%)	0.0572	0.0500	0.0821	-0.0311	0.0229	0.1100	-0.0153	-0.0078	0.0162	0.0591	<b>0.4249</b>
	<b>Correlation with yield</b>	<b>0.3306</b>	<b>0.1456</b>	<b>0.1278</b>	<b>0.2346</b>	<b>0.3872</b>	<b>0.8552</b>	<b>0.2599</b>	<b>0.3377</b>	<b>0.4386</b>	<b>0.8896</b>	<b>0.5476</b>
	Partial R <sup>2</sup>	-0.0017	0.0018	-0.0011	0.0021	-0.0001	0.0650	0.0036	0.0005	0.0042	0.6693	0.2326

**Table 4: Path coefficient analysis showing the direct and indirect effects of various characters on yield per plant at phenotypic level in F<sub>1</sub> of soybean**

Residual factor: 0.1538

**Table 5: Path coefficient analysis showing the direct and indirect effects of various characters on yield per plant at genotypic level in F<sub>1</sub> of soybean**

Sl. No.	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of nodes per plant	Number of primary branches per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	100- seed weight (g)	Dry matter weight per plant (g)	Harvest index (%)
1	Days to 50% flowering	<b>0.3219</b>	0.0933	0.1033	0.0352	0.1125	0.1274	0.1176	0.0267	0.0647	0.1130	-0.1030
2	Days to maturity	0.0164	<b>0.0566</b>	0.0158	0.0062	-0.0022	0.0058	-0.0011	0.0203	0.0084	0.0056	-0.0075
3	Plant height (cm)	0.0420	0.0365	<b>0.1309</b>	0.0038	-0.0113	0.0174	-0.0361	0.0312	0.0211	0.0072	-0.0359
4	Number of nodes per plant	0.0356	0.0357	0.0095	<b>0.3254</b>	0.1109	0.1138	0.0600	0.1310	0.0819	0.1883	-0.0462
5	Number of primary branches per plant	-0.1623	0.0177	0.0402	-0.1582	<b>-0.4644</b>	-0.1502	-0.0861	-0.1299	-0.0413	-0.2192	-0.0546
6	Number of pods per plant	-0.0198	-0.0052	-0.0066	-0.0175	-0.0162	<b>-0.0500</b>	-0.0169	-0.0159	-0.0220	-0.0446	0.0173
7	Number of pods per cluster	-0.0581	0.0030	0.0439	-0.0293	-0.0295	-0.0538	<b>-0.1591</b>	-0.0100	-0.0128	-0.0534	0.0062
8	Number of seeds per pod	-0.0264	-0.1141	-0.0759	-0.1281	-0.0890	-0.1012	-0.0200	<b>-0.3182</b>	-0.1061	-0.1466	-0.0244
9	100-seed weight (g)	-0.0720	-0.0535	-0.0577	-0.0902	-0.0319	-0.1575	-0.0290	-0.1195	<b>-0.3585</b>	-0.1919	-0.0113
10	Dry matter weight per plant (g)	0.5662	0.1593	0.0889	0.5420	0.7617	1.4385	0.5413	0.7432	0.8637	<b>1.5345</b>	-0.3739
11	Harvest index (%)	-0.2077	-0.0857	-0.1779	-0.0922	0.0764	-0.2251	-0.0254	0.0499	0.0205	-0.1504	<b>0.6492</b>
	<b>Correlation with yield</b>	<b>0.4358</b>	<b>0.1436</b>	<b>0.1143</b>	<b>0.3970</b>	<b>0.4170</b>	<b>0.9652</b>	<b>0.3452</b>	<b>0.4086</b>	<b>0.5195</b>	<b>0.9630</b>	<b>0.0159</b>

Partial R <sup>2</sup>	0.1403	0.0081	0.0150	0.1292	-0.1937	-0.0483	-0.0549	-0.1300	-0.1863	1.6819	0.0103
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Residual factor: 0.157

**Table 6: Path coefficient analysis showing the direct and indirect effects of various characters on yield per plant at phenotypic level in F<sub>2</sub> of soybean**

Sl. No.	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of nodes per plant	Number of primary branches per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	100- seed weight (g)	Dry matter weight per plant (g)	Harvest index (%)
1	Days to 50% flowering	<b>0.0111</b>	0.0039	0.0021	0.0015	0.0011	0.0035	0.0026	0.0009	-0.0018	0.0001	0.0022
2	Days to maturity	0.0124	<b>0.0351</b>	0.0094	0.0062	0.0101	0.0030	-0.0009	0.0004	-0.0055	-0.0002	0.0022
3	Plant height (cm)	-0.0011	-0.0015	<b>-0.0056</b>	-0.0041	-0.0002	-0.0003	0.0017	-0.0016	-0.0007	0.0001	-0.0014
4	Number of nodes per plant	-0.0042	-0.0057	-0.0234	<b>-0.0322</b>	-0.0017	-0.0043	0.0064	-0.0083	-0.0047	-0.0021	-0.0109
5	Number of primary branches per plant	-0.0006	-0.0015	-0.0002	-0.0003	<b>-0.0054</b>	-0.0012	-0.0007	0.0006	0.0004	-0.0007	-0.0010
6	Number of pods per plant	0.0083	0.0023	0.0014	0.0035	0.0059	<b>0.0260</b>	0.0028	-0.0017	0.0017	0.0064	0.0137
7	Number of pods per cluster	0.0041	-0.0004	-0.0052	-0.0035	0.0024	0.0019	<b>0.0175</b>	0.0007	-0.0029	0.0043	-0.0016
8	Number of seeds per pod	0.0002	0.0000	0.0009	0.0008	-0.0003	-0.0002	0.0001	<b>0.0029</b>	-0.0001	-0.0003	0.0003
9	100- seed weight (g)	-0.0008	-0.0007	0.0006	0.0007	-0.0004	0.0003	-0.0008	-0.0001	<b>0.0047</b>	0.0001	0.0002
10	Dry matter weight per plant (g)	0.0055	-0.0040	-0.0158	0.0403	0.0794	0.1526	0.1515	-0.0629	0.0109	<b>0.6195</b>	-0.2068

11	Harvest index (%)	0.1918	0.0632	0.2419	0.3350	0.1909	0.5201	-0.0902	0.1171	0.0398	-0.3296	<b>0.9873</b>
	<b>Correlation with yield</b>	<b>0.2267</b>	<b>0.0906</b>	<b>0.2060</b>	<b>0.3477</b>	<b>0.2818</b>	<b>0.7014</b>	<b>0.0899</b>	<b>0.0481</b>	<b>0.0419</b>	<b>0.2976</b>	<b>0.7842</b>
	Partial R <sup>2</sup>	0.0025	0.0032	-0.0012	-0.0112	-0.0015	0.0183	0.0016	0.0001	0.0002	0.1844	0.7742

Residual factor: **0.1716**

**Table 7: Path coefficient analysis showing the direct and indirect effects of various characters on yield per plant at phenotypic level in F<sub>2</sub> of soybean**

Sl. No.	Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of nodes per plant	Number of primary branches per plant	Number of pods per plant	Number of pods per cluster	Number of seeds per pod	100- seed weight (g)	Dry matter weight per plant g)	Harvest index (%)
1	Days to 50% flowering	<b>-0.0129</b>	-0.0047	-0.0026	-0.0016	-0.0012	-0.0044	-0.0027	-0.0001	0.0026	-0.0002	-0.0027
2	Days to maturity	0.0172	<b>0.0476</b>	0.0136	0.0092	0.0144	0.0042	-0.0029	0.0017	-0.0079	-0.0002	0.0036
3	Plant height (cm)	0.0062	0.0090	<b>0.0315</b>	0.0236	0.0016	0.0013	-0.0101	0.0227	0.0040	-0.0010	0.0082
4	Number of nodes per plant	-0.0044	-0.0068	-0.0260	<b>-0.0348</b>	-0.0024	-0.0044	0.0070	-0.0175	-0.0052	-0.0024	-0.0122
5	Number of primary branches per plant	-0.0024	-0.0078	-0.0013	-0.0017	<b>-0.0257</b>	-0.0069	-0.0036	0.0022	0.0030	-0.0031	-0.0065
6	Number of pods per plant	0.0218	0.0057	0.0027	0.0082	0.0174	<b>0.0648</b>	0.0081	-0.0029	0.0047	0.0167	0.0365
7	Number of pods per cluster	0.0094	-0.0027	-0.0144	-0.0090	0.0063	0.0056	<b>0.0449</b>	-0.0055	-0.0100	0.0130	-0.0044
8	Number of seeds per pod	-0.0003	-0.0010	-0.0202	-0.0140	0.0024	0.0013	0.0034	<b>-0.0280</b>	0.0029	0.0041	-0.0045

9	100-seed weight (g)	-0.0013	-0.0011	0.0008	0.0010	-0.0008	0.0005	-0.0014	-0.0007	<b>0.0064</b>	0.0002	0.0003
10	Dry matter weight per plant (g)	0.0069	-0.0025	-0.0193	0.0405	0.0711	0.1533	0.1714	-0.0875	0.0148	<b>0.5935</b>	-0.1994
11	Harvest index (%)	0.2046	0.0730	0.2518	0.3412	0.2460	0.5459	-0.0958	0.1546	0.0421	-0.3257	<b>0.9696</b>
	<b>Correlation with yield</b>	<b>0.2449</b>	<b>0.1088</b>	<b>0.2165</b>	<b>0.3625</b>	<b>0.3292</b>	<b>0.7613</b>	<b>0.1182</b>	<b>0.0392</b>	<b>0.0574</b>	<b>0.2950</b>	<b>0.7884</b>
	Partial R <sup>2</sup>	-0.0032	0.0052	0.0068	-0.0126	-0.0085	0.0494	0.0053	-0.0011	0.0004	0.1751	0.7644

Residual factor: 0.1374

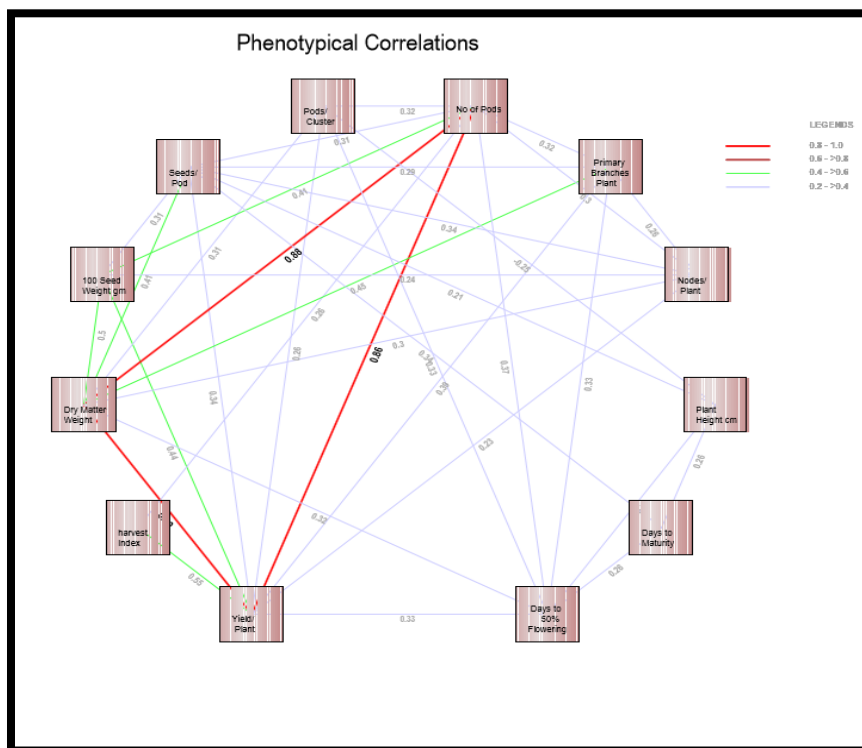
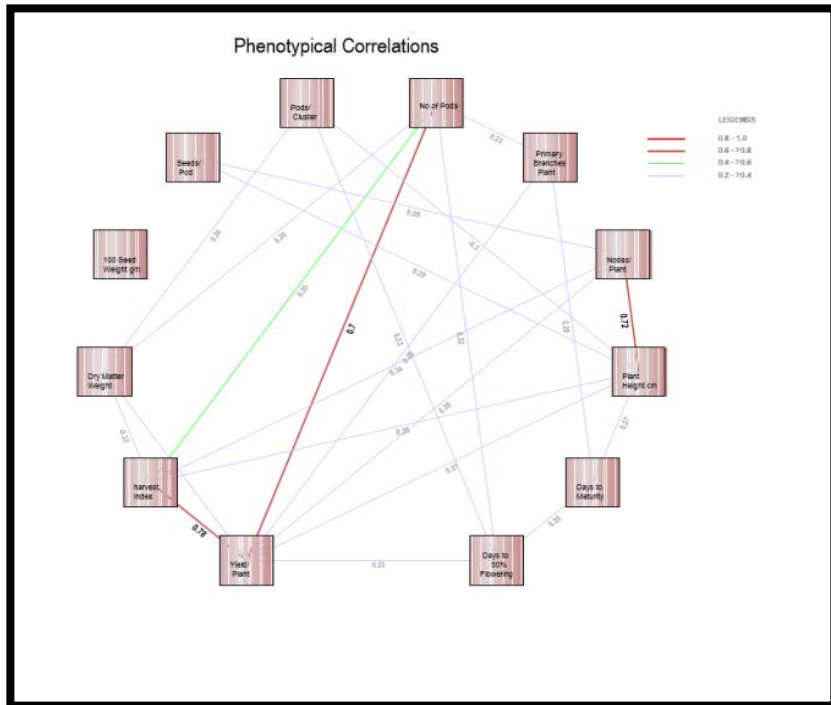


Fig 1: Diagrammatic representation of phenotypic correlation among yield and its components in F<sub>1</sub> generation of soybean



**Fig 2:** Diagrammatic representation of phenotypic correlation among yield and its components in F<sub>2</sub> generation of soybean

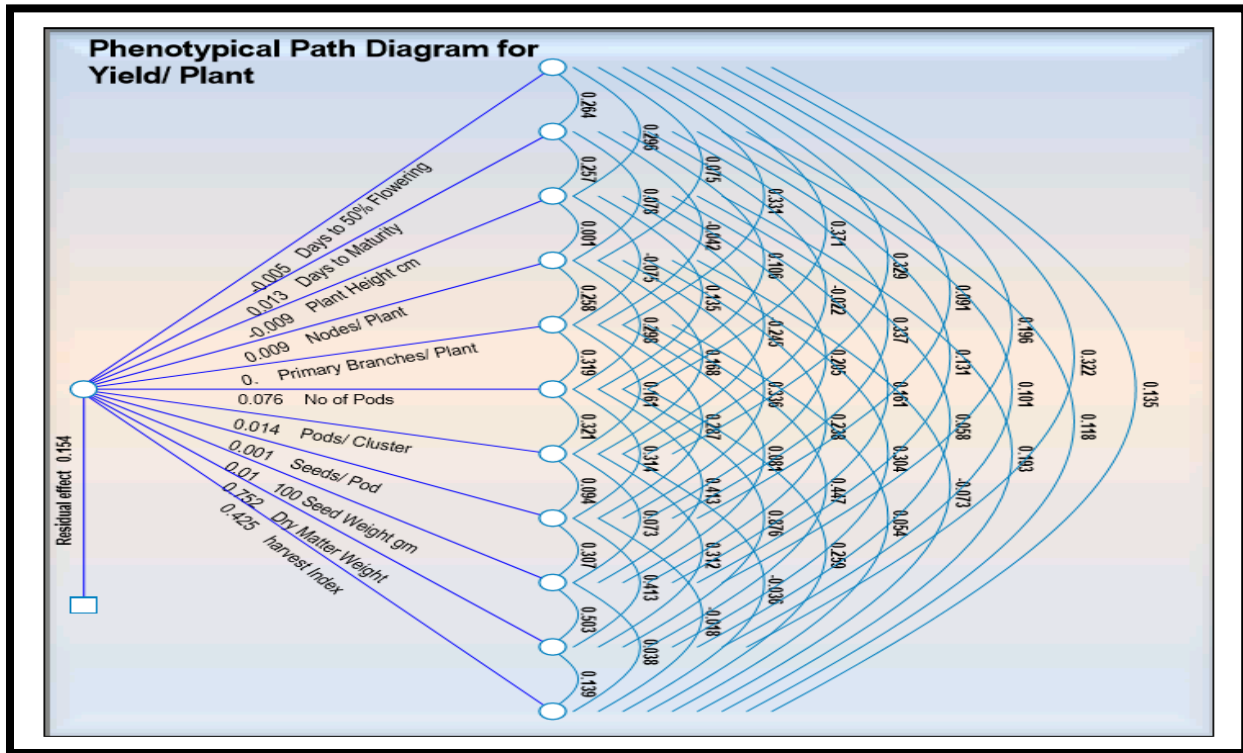


Fig 3: Diagrammatic representation of phenotypic path in F<sub>1</sub> generation of soybean

