http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Science 6 (12): 1085-1087, 2003
ISSN 1028-8880

Path Coefficient Analysis in Different Genotypes of Soybean (*Glycine max* (L) Merril)

Shahid Iqbal, Tariq Mahmood, Tahira, Muhammad Ali, Muhammad Anwar and Muhammad Sarwar
Ayub Agricultural Research Institute, Faisalabad, Pakistan

Abstract: Interrelationships between yield and its components were determined by genotypic correlation and path coefficient analysis in ten soybean varieties. The results indicated that seed yield plant^{-1} was positively and significantly associated with all parameters studied. The results also showed that pods plant^{-1} has maximum positive direct effect on yield plant^{-1}. It was followed by 100 seed weight and seeds pod^{-1}. Plant height had negative direct effect on yield plant^{-1}. It was concluded that pods plant^{-1}, seeds pod-' and 100 seed weight were the main yield components.

Key words: Glycine max, correlation, path coefficient, yield components, yield Path coefficient analysis in Soybean

Introduction

Soybean is considered a miracle crop due to its extraordinary qualities. Soybean seed contain. 20-24% oil, 40-441% protein alongwith ample mineral elements. The seed remains after solvent extraction are ground to make high protein meal which is used largely as a supplement to cereal seeds in feed for poultry, dairy and beef animals. Being a legume, it enriches the soil as it works as a mini fertilizer factory by fixing atmospheric, nitrogen through rhizobium activity into available form of nitrogen. Soybean is a universal food, fodder and industrial crop. It is reported that more then 400 different products are prepared from it. Commercial cultivation of soybean in Pakistan started in early 1970, s. Variety improvement work has been in progress in Pakistan too.

The correlation studies were initiated with the rime objective of observing the mutual relationship of different morphological characters and also the type and extent of their contribution to yield. Several workers have attempted to determine linkage between the characters on which the selections for high yields can be made. Khan *et al.* (2000) reported that the heritability value ranged from 29.371% for seeds pod^{-1} to 98.91% maturity they also found that seed yield was positively and significantly correlated with all character except pod height. Path coefficient analysis revealed that pods plant^{-1} had the direct effect on seed yield followed by 100 seed weight. Pod plant^{-1} affected seed yield negatively via indirect effects of plant height, pod height and seeds pod^{-1}. Singh and Yadava (2000) reported that seed yield plant^{-1} showed significant positive association with days to maturity, plant height, pods plant^{-1}, seeds pod^{-1} and 100 seed weight. They also concluded that pods plant^{-1} contributed directly towards seed yield. Shrivastava *et al.* (2001) from path coefficient analysis observed highest positive direct effect on seed yield with number of branches plant^{-1} followed by days to 50% flowering and days to maturity, plant height, 100 seed weight, biological yield and harvest index. They also showed that plant height had a negative effect on yield.

Ball *et al.* (2001) from path coefficient analysis revealed that pod number plant^{-1} and seeds pod^{-1} had positive direct effect on yield while mass seed^{-1} had a negligible effect. Siahsar and Rezai (1999) derived information that in soybean number of pod plant^{-1} had the greatest phenotypic and genotypic correlation with seed yield. The results of regression analysis indicated that the maximum variation in seed yield could be attributed to pods plant^{-1}, seed pod^{-1} and 100 seed weight. Path analysis also revealed the importance of the direct effects of these three characters on see yield and affirmed the importance of pods plant^{-1}.

Khanghah and Sohani (1999) studied that pods plant^{-1}, seeds plant^{-1} and 100 seed weight had the highest amount of correlation with seed yield. Path analysis showed that seeds plant^{-1} had the highest direct effect on seed yield. They also concluded that seeds plant^{-1} followed by pods plant^{-1} and 100 seed weight can be used directly or indirectly as selection criteria for identification of high yielding genotypes in segregating generations.

Singh *et al.* (2000) reported positive correlation of pods plant^{-1} seed pod^{-1} and harvest index with seed yield. Archana. *et al.* (1999) studied path coefficient analysis in soybean and concluded that number of pods had huge direct effect over yield. Indirect effect of leaf area and plant height via number of pods was also high.

Isler and Caliskan (1998) observed that seed yield plant^{-1}, first pod height, branch number and plant height had the greatest correlations with seed yield per decare and they

also concluded that these characters could be used as selection criteria in soybean breeding for yield.

Materials and Methods

The experiment was conducted at Oilseeds Research Institute, Faisalabad. Experimental material comprised ten varieties of soybean; MS-1, MS-2, MS-3, MS-4, MS-5, MS-6, MS-7, MS-8, Ford and 95-1.These genotypes were sown in a Randomized Completed Block Design (RCBD) with three replications under normal irrigated conditions on August 13, 2001. Each plot consisted of 4 rows each of 6.3 m length, for each entry. Seeds were planted with help of a Rabi drill and the distance between row to row was kept 30 cm. Normal agronomic and cultural practices were applied to the experiment throughout the growing season. At maturity 10 random plants from each entry within replication were taken to record data for plant height (cm), pods plant^{-1}, seeds pod^{-1}, 100 seed weight and yield plant^{-1}.

The data were subjected to standard statistical technique for analysis of variance to establish the level of significance among genotypes according to Steel and Torrie (1980). Genotypic coefficient of -variability (GCV), phenotypic coefficient of variability (PCV), heritability estimates in broad sense (h), genetic advance (GA) as percent of means, genotypic (rg) and phenotypic (rp) correlation coefficient were determined as desired by Singh and Chaudhry (1979) whereas path coefficient analysis was made according to Dewey and Lu (1959).

Results and Discussion

The differences between GCV and PCV were very low for all characters studied which showed that the environmental effects in the development of these parameters are minimum (Table 1) The range of mean values for all the traits was high and treatment mean squares, (TMS) were significant except the seeds pod^{-1}. GCV was the highest in case of yield plant^{-1}, followed by plant height, pods plant^{-1} 100 seed weight and seeds pod^{-1}. Heritability was also higher than 60% for all parameters (except seeds pod^{-1}) showing heritable variation among genotypes. Heritability for 100 seed weight and pods plant^{-1} was comparatively higher than other traits studied. Genetic advance (G.A.) as percentage of mean for yield plant^{-1}, plant height and pods plant^{-1} was higher showing that these parameters were under the control of additive genes. This is in confirmation with the results as stated by Khan *et al.* (2000).

It is evident from Table 2 that the genotypic correlation coefficients were larger in values as compared to their respective phenotypic correlation coefficient. This indicates greater contribution of genetic factor in the development of the associations.

Table 1: Range, TMS, GCV, PCV, h2 and GA as percent of mean

Parameters	Range	TMS	GCV	PCV	h^2	GA(% of mean)
Plant height(cm)	22.67-44.33	235.367**	22.792	28.423	64.3	31.06
Pod plant^{-1}	14.00-25.67	34.996**	16.624	17.219	93.2	26.48
Seed Pod^{-1}	2.23-2.60	00.035	01.419	07.871	-3.2	-0.43
100 Seed wt.(g)	9.19-12.29	02.641	08.637	08.661	99.4	14.62
Yield Plant^{-1}	3.91-7.95	04.979**	22.814	25.199	82.0	35.11

Highly Significant, TMS= Treatment mean squares
GCV= Genotypic coefficient of variability
PCV= Phenotypic coefficient of variability, h^2= Heritability

Table 2: Genotypic and phenotypic correlation of various seed yield components with yield in soybean

Parameters		Pods Plant^{-1}	Seeds Pod^{-1}	100 Seeds wt.(g)	Yield Plant
Plant height (cm)	rg	0.8623**	2.8083**	0.2534 NS	0.9260**
	rp	0.6667*	0.1391NS	0.1906 NS	0.5851 NS
Pods Plant -1	rg		1.1997**	0.2713 NS	0.9376**
	rp		0.3033 NS	0.2595 NS	0.8972**
Seeds Pod^{-1}	rg			-0.1220 NS	0.7320*
	rp			-0.0240 NS	0.5070*
100 Seeds	rg				0.6080NS
wt.(g)	rp				0.5468 NS

NS= Non-Significant, *= Significant and **= Highly Significant

Plant height as presented in Table 2 showed positive and highly significant association with pod plant^{-1} at genotypic level while positive and significant at phenotypic level. This indicates that genetic improvement for one character will also improve the other characters. The estimate of genotypic correlation between plant height and seed pod^{-1} and plant height and yield plant^{-1} were found to be positive and highly significant while at genotypic level association was positive and non significant correlation between plant height and 100 seed-weigh was observed positive and nonsignificant at both genotypic and phenotypic level. The results revealed that pods plant^{-1} was highly significant and positively correlated with seeds pod^{-1} at genotypic level and non-significant at phenotypic level.

Correlation between pods plant^{-1} and 100 seed weight was positive and non significant both at genotypic and phenotypic level. Table 2 showed that correlation between pods plant^{-1} and yield plant^{-1} was positive and highly significant both at genotypic and phenotypic levels. A negative and non significant correlation was observed between seeds pod^{-1} and 100 seed weight. This gave a clear indication that improvement for one character will result in the partial decrease of the other character. A positive and significant correlation was observed between seeds pod^{-1} and yield plant^{-1} both at genotypic and phenotypic level. The association of 100 seed weight with yield plant^{-1} was found to be non-significant both at genotypic and phenotypic level. These results confirmed the earlier findings of Isler and Caliskan (1998), Singh *et al.* (2000), Khanghah and Sohani (1999), Singh and Yadava (2000).

Table 3: Direct and Indirect effects of agronomic characters on seed yield

Parameters	Plant height (cm)	Pods Plant^{-1}	Seeds Pod^{-1}	100 Seeds wt. (g)	Yield plant
Plant height (cm)	-0.0967	0.7038	0.2124	0.1065	0.926**
Pods Plant^{-1}	-0.0834	0.8162	0.0908	0.114	0.9376**
Seeds Pod^{-1}	-0.2716	0.9792	0.0756	-0.0513	0.7319**
100 Seeds wt. (g)	-0.0245	0.2214	-0.0092	0.4203	0.6080**

The data presented in Table 3 revealed that direct effect of plant height on yield plant^{-1} was negative (-0.0967). Indirect effects via pods plant^{-1} (0.7038), Seeds pod^{-1} (0.2124) and 100 seed weight (0.1065) were positive. Direct effect of pods plant^{-1} on yield plant^{-1} expressed in Table 3 was positive; hence selection for yield improvement can be done on the basis of pods plant^{-1}. Indirect effects via seeds pod^{-1} (0.0908) and 100 seed weight (0. 114) were positive, while indirect effect via plant height (-0.0834) was negative.

Path coefficient analysis Table 3 indicated that seeds pod^{-1} had a positive direct effect on seed yield plant^{-1}.Similarly positive value was obtained from the indirect effects through pods plant^{-1}. Plant height and 100 seed weight had negative indirect effects on seed yield with computed values of -0.02716 and -0.0513 respectively.

It is evident from Table 3 that direct effect of 100 seed weight on yield plant^{-1} was positive (0.4203). The indirect effects via plant height and seeds pod^{-1} were, however, negative, the values being -0.0245 and -0.0092 respectively. The indirect effect via pods plant^{-1} was positive with path coefficient value of 0.2214. These results confirmed the findings of Khan *et al.* (2000), Ball *et al.* (2001), Singh and Yadava (2000) and Shrivastava *et al.* (2001). From the results of this study it is concluded that effective selection for superior genotype is possible considering pods plant^{-1}, 100 seed weight and seeds pod^{-1}.

References

Archana, M.N., B.D. Narkhede, R.B. Gite, Ghorade and S.R. Golhar, 1999. Path coefficient analysis in soybean (*Glycine max* L. Merrill). J. Soils and crop, 9: 250-251.

Ball, R.A., R.W. McNew, E.D. Vories, J.C. Keisling and L.C. Purcell, 2001. Path analysis of population density effects on short-season soybean yield. Agron. J., 93: 187-195.

Dewey, J.R. and K.H. Lu, 1959. A correlation and path co-efficient analysis of components of crested wheat seed production. J. Agron., 51: 515-518.

Isler, N. and M.E. Caliskan, 1998. Correlation and path coefficient analysis for yield and some yield components of soybean (*Glycine max* L. Merr.) grown in south eastern Anatolia. Turkish J. Agri. and Forestry, 22: 1-15.

Khan, A., M. Hatam and A. Khan, 2000. Heritability and interrelationship among yield determining components of soybean varieties. Pakistan J. Agri. Res., 116: 5-8.

Khanghah, H.Z. and A.R. Sohani, 1999. Genetic evaluation of some important. agronomic traits related to seed yield by Multivariate of soybean analysis methods. Iranian J. Agri. Sci., 30: 807-816.

Singh, K., S. Singh and D.S. Kier, 2000. Correlation and regression studies among various growth and yield parameters of Soybean (*Glycine max* L. Merrill) under Punjab conditions. Crop Res., (Hisar), 19: 287-297.

Shrivastava, M.K., R.S. Shukla and P.K. Jain, 2001. Path coefficient analysis in diverse genotype of soybean (*Glycine max* L.).Advances in Plant Sci., 4: 47-51.

Siahsar, B. and A. Rezai, 1999. Correlation and path coefficient analysis of morphological and phonological traits Associated with yield in soybean (*Glycine max* L. Merr.). Iranian J. Agri. Sci., 30: 685-696.

Singh, J. and H.S. Yadava, 2000. Factors determining seed yield in early generation of soybean. Crop Res. Hisar, 20: 239-243.

Singh, R.K. and B.D. Chaudhry, 1979. Biometrical methods in quantitative genetic analysis. Kelyan publishers, Ludhiana, New Dehli, India, pp: 303.

Steel, R.G.D. and J.H. Torrie, 1980. Principals and procedure of statistics. 2nd Ed. Mc Graw Hill Book, Co. Inc. London, pp: 560.