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Correlation And Path Analysis Studies Among Soybean Genotypes Under Foothill Conditions Of Nagaland

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Abstract:

An experiment was laid out in randomized block design with three replications during *kharif*, 2015 at the experimental farm of School of Agricultural Sciences and Rural Development, Medziphema campus, Nagaland University to study character association and path analysis among twelve genotypes of soybean under foot hill condition of Nagaland. Studies were done on nine characters *viz*., days to 50 percent flowering, plant height, number of primary branches, number of secondary branches, number of pods per plant, number of seeds per pod, days to 80 percent maturity, 100 seed weight and seed yield per plant. At genotypic level seed yield showed strong positive correlation with days to 50% flowering, number of pods per plant, number of secondary branches per plant, number of primary branches per plant and plant height. In general, magnitude of genotypic correlation was higher than the phenotypic correlation. This suggested a strong genetic association between the traits and the phenotypic expression was suppressed due to environmental influence. The Path analysis showed that number of pods per plant has the highest positive direct effect followed by plant height at genotypic level. Thus, direct selection for number of pods per plant and plant height would likely be effective in increasing yield.

Key words: Correlation, Path coefficient, Soybean

Introduction:

Soybean (*Glycine max* L. Merill. 2n=40) is known as the *"Golden Bean"* of the twentieth century. Soybean possesses a very high nutritional value. It contains about 20 per cent oil and 40 per cent high quality protein. In addition, it contains a good amount of minerals, salts and vitamins and its sprouting grains contain a considerable amount of vitamin C. A large number of Indian and western dishes such as bread, chapatti, milk, sweets, pastries *etc*., can be prepared with soybean. Wheat flour fortified with soybean flour makes good quality and more nutritious chapatti. Soybean oil is used for preparing vanaspati ghee and several other industrial products. Soybean is used for making high protein foods for children. It can be used as fodder, forage can be made into hay, silage etc. Soybeans are very rich in nutritive components. The soy protein has a high biological value and contains all the essential amino acids.

The soybean crop is mainly grown in the states of Madhya Pradesh (also known as soybean bowl of India), Maharashtra and Rajasthan.

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Soybean acreage and production in the country was steadily increasing till late 1990's and lost its momentum in past few years. The area under the crop steadily increased from 22.5 lakh hectares in 1989-90 to 60.02 lakh hectares in 2001-02 but thereafter the area fell sharply in 2002-03 due to poor monsoon conditions. The production of soybean during kharif 2014 was 60.249 lakh tones in Madhya Pradesh, 30.721 lakh tones in Maharastra and 5.639 lakh tones in Rajasthan (SOPA, 2016).

Several ethnic communities of Northeast India have invented the traditional technology of converting protein rich soybeans into flavored fermented food with easy digestibility and bio nutrients. This is exclusively carried out by the ethnic women in Sikkim, Manipur, Meghalaya, Nagaland, Mizoram and Arunachal Pradesh. Worth native knowledge of these women has been documented and six sticky fermented foods have been listed out which includes kinema which is produced exclusively by Nepali women belonging to Limboo and Rai castes of Sikkim, Darjeeling hills, east Nepal and Bhutan, Hawaijar which is a traditional sticky soybean food of Manipur similar to kinema and prepared by Meitei women, tungrymbai, an ethnic fermented soybean food of Khasi in Meghalaya prepared by Khasi women, bekang, a fermented food of Mizoram prepared by Mizo women, aakhone or axone an ethnic sticky fermented soybean food of Nagaland prepared by Sema Naga women and peruyyan an ethnic fermented soybean food prepared by Apatani women in Arunachal Pradesh. The farming community of Nagaland and other states of North Eastern region grow Soybean in small areas to meet out their domestic requirements of Soybean and/or its products. There are bright prospects for popularizing this highly remunerative crop in North Eastern parts of India.

Materials and Methods:

The present investigation was carried out at the experimental farm of Department of Genetics and Plant breeding, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema during *kharif* 2015.The experiment site was located in the foothill of Nagaland having an elevation of 310 m above mean sea level with a geographical location of $25^0$45'43" N latitudes and 93º53'04" E longitude; respectively. The experiment was carried out following Randomized Block Design in three replications with twelve genotypes.

Seeds of twelve genotypes of soybean were collected from different areas of Manipur, Nagaland and Madhya Pradesh. One commercial variety (JS 335) is used as check variety.

The seeds were treated with Bavistin® @ 3g per kg of seed and sown on 29th July, 2015. Two-three seeds per hole were dibbled at 20 cm x 15 cm inter row and inter plant distance. Hand weeding was done in regular intervals after sowing to avoid growth of unwanted plants. All the recommended agronomic practices were followed for raising a good crop. Observations for various quantitative and qualitative characters have been recorded. The data collected on the fourteen characters were statistically analyzed for various genetic parameters. Phenotypic and genotypic correlation coefficients were worked out to study the interrelationship between various pairs of characters as suggested by Al-Jibouri *et al.* (1958). The significance of r values were tested at 5% and 1% from r table using (v-2) degrees of freedom. Here, v is the number of genotypes on which the observation was recorded.

The path coefficient analysis was worked out by the formula applied by Dewey and Lu (1959).

Results & Discussion:

The results obtained regarding character association and direct and indirect effects have been analyzed statistically and presented as follows:

1. Correlation coefficient:

The phenotypic (r_p) and genotypic (r_g) correlation coefficient for nine characters were calculated and their significance was tested at 0.05% and 0.01% levels of significance. The results are presented in table 1 and are discussed as follows:

1.1. Correlation of seed yield with other characters:

At genotypic level seed yield showed positive correlation with 50% flowering (4.038), number of pods per plant (0.913), number of secondary branches per plant (0.858), number of primary branches per plant (0.658) and plant height (0.581). At phenotypic level seed yield per plant showed positive correlation with number of pods per plant (0.869), number of secondary branches per plant (0.822), number of primary branches per plant (0.615) and plant height (0.573).

1.2. Plant height

At genotypic level plant height exhibited positive and significant correlation with Days to 50% flowering (3.736) and number of primary branches per plant (0.813). At phenotypic level plant height exhibited significant positive correlation with number of primary branches per plant (0.729).

1.3. Days to 50% flowering

At genotypic level Days to 50% flowering showed positive correlation with number of secondary branches per plant (3.325), number of primary branches per plant (3.039), number of pods per plant (2.975), days to 80% maturity (2.451) and 100 seed weight (2.058). Days to 50% flowering did not exhibit significant correlation with any trait at phenotypic level.

1.4. Number of primary branches:

Number of primary branches per plant did not exhibit significant correlation with any trait neither at phenotypic nor at genotypic level.

1.5. Number of secondary branches:

At phenotypic level number of secondary branches per plant showed positive correlation with number of pods per plant (0.832). At genotypic level Number of secondary branches per plant showed positive and significant correlation with number of pods per plant (0.885).

1.6. Number of pods per plant:

At phenotypic level number of pods per plant did not show positive and negative significant correlation with other characters under present correlation studies. At genotypic level number of pods per plant exhibited positive correlation with days to 80% maturity (0.557).

1.7. Number of seeds per pod

At genotypic level number of seeds per pod showed positive and significant correlation with 100 seed weight (0.624) and days to 80% maturity (0.587). At phenotypic level number of seeds per pod showed negative and significant correlation with days to 80% maturity (-0.551) as well as positive and significant correlation with 100 seed weight (0.504).

1.8. Days to 80% maturity:

At genotypic level days to 80% maturity showed positive and significant correlation with 100 seed weight (0.544). At phenotypic level days to 80% maturity was not observed to have significant correlation with other characters.

Yield is influenced directly and indirectly by set of other characters as well as environment. Therefore it is essential to know the nature and magnitude of association between characters or combinations of characters for better exploitation of yield in breeding programmes. Correlation studies provide better understanding of yield components which helps in plant breeder during selection (Johnson *et al*. 1955). In the present study, correlation between nine characters was studied in all possible combinations at phenotypic and genotypic level.

At genotypic level seed yield showed positive correlation with 50% flowering, number of pods per plant, number of secondary branches per plant, number of primary branches per plant and plant height. Similar observation were reported by Mukhekar *et al.* (2004), Yadav *et al.* (2009, Burli *et al.* (2010), Patil *et al.* (2011).

In general, magnitude of genotypic correlation tended to be higher than the phenotypic correlation. This suggested a strong genetic association between the traits and the phenotypic expression was suppressed due to environmental influence. Similar results were reported by Jain *et al.* (2000) and Gaikwad *et al.* (2007).

At phenotypic level seed yield per plant showed positive correlation with number of pods per plant, number of secondary branches per plant, number of primary branches per plant and plant height.

2. Path coefficient analysis

Path coefficient analysis was carried out to study the direct and indirect effects of different yield contributing characters on yield. The result of various causes influencing yield are presented in table 2 and presented below:

2.1. Direct effect

Maximum positive direct effect on yield was contributed by Number of pods per plant (2.246) followed by plant height (1.045).

High order of negative direct effect was observed in days to 80% maturity (-1.142) followed by number of secondary branches per plant (-0.729) and number of seeds per pod (-0.538).

2.2. Indirect effect

The character plant height exhibited positive indirect effect on seed yield of soybean via number of pods per plant (0.664). Also, Plant height exhibited maximum negative indirect effect on seed yield via days to 80% maturity (-0.343) followed by number of secondary branches per plant (-0.276) and days to 50% flowering (-0.196) at genotypic level.

Days to 50% flowering exerted maximum positive indirect effect on seed yield via number of pods per plant (6.681) followed by Plant height (3.905). Days to 50% flowering also exerted maximum negative indirect effect on seed yield via days to 80% maturity (-2.8) followed by number of secondary branches per plant (-2.425).

Number of primary branches per plant revealed maximum positive indirect effect on seed yield via number of pods per plant (0.871) followed by Plant height (0.85). Also, number of primary branches per plant revealed maximum negative indirect effect on seed yield via days to 80% maturity (-0.261) followed by number of secondary branches per plant (-0.213).

Number of secondary branches per plant exhibited maximum positive indirect effect on seed yield *via* number of pods per plant (1.987) followed by Plant height (0.396). Number of secondary branches per plant also exhibited maximum negative indirect effect on seed yield via days to 80% maturity (-0.529) followed by days to 50% flowering (-0.174).

Number of pods per plant exerted positive indirect effect on seed yield via Plant height (0.309). Number of pods per plant also exerted maximum negative indirect effect on seed yield via number of secondary branches per plant (-0.645), days to 80% maturity (-0.636) and days to 50% flowering (-0.156).

Number of seeds per pod revealed maximum positive indirect effect on seed yield via days to 80% maturity (0.67) followed by number of pods per plant (0.222). Number of seeds per pod also revealed maximum negative indirect effect on seed yield via 100 seed weight (-0.198) followed by number of primary branches per plant (-0.055).

Days to 80% maturity exhibited maximum positive indirect effect on seed yield via Number of pods per plant (1.251) followed by number of seeds per pod (0.316) and Plant height (0.314). Days to 80% flowering also exhibited maximum negative indirect effect on seed yield via number of secondary branches per plant (-0.338) followed by days to 50% flowering (-0.129).

100 seed weight revealed maximum positive indirect effect on seed yield via days to 80% maturity (0.621) followed by number of pods per plant (0.429). 100 seed weight also revealed maximum negative indirect effect on seed yield via number of seeds per pod (-0.336) followed by number of secondary branches per plant (-0.174).

Path analysis was carried out to reveal the direct and indirect effects. The Path analysis showed that number of pods per plant has the highest positive direct effect followed by plant height at genotypic level. Similar observations were reported by Yadav *et al.* (2009) and Gaikwad *et al.* (2007).

Number of pods per plant and plant height exerted positive direct effect as well as exhibited significant positive correlation with yield indicating a true relationship among the traits. Thus, direct selection for number of pods per plant and plant height would likely be effective in increasing yield.

3. Residual effect

The estimated residual factor was **0.162.** The residual effect was moderate (0.162) indicating that the traits under study are sufficient to account for variability.

Table 1. Genotypic and Phenotypic correlation among nine characters in soybean

Characters		50% flowering	No. of primary branches per plant	No. of secondary branches per plant	No. of pods per plant	No. of seeds per pod	Days to 80% maturity	100 seed weight (g)	Seed yield per plant (g)
Plant height (cm)	**G**	0.736**	0.813**	0.378	0.296	0.018	0.300	0.360	0.581*
	P	0.444	0.729**	0.362	0.269	0.030	0.245	0.342	0.573*
Days to 50% flowering	**G**		0.339	0.325	0.975**	-0.169	0.451	0.358	0.038
	P		0.206	0.363	0.206	-0.172	0.213	0.193	0.367
No. of primary branches per plant	**G**			0.293	0.388	0.233	0.229	0.217	0.658**
	P			0.249	0.367	0.219	0.156	0.218	0.615*
No. of secondary branches per plant	**G**				0.885**	-0.095	0.463	0.239	0.858**
	P				0.832**	-0.089	0.424	0.234	0.822**
No. of pods per plant	**G**					0.099	0.557*	0.191	0.913**
	P					0.106	0.439	0.192	0.869**
No. of seeds per pod	**G**						0.587*	0.624*	0.199
	P						-0.551*	0.504*	0.151
Days to 80% maturity	**G**							0.544*	0.391
	P							-0.442	0.320
100 seed weight (g)	**G**								0.441
	P								0.427

Table 2. Direct (diagonal) and indirect effect of yield components on seed yield at genotypic level in soybean genotypes

Characters	Plant height	Days to 50% flowering	No. of primary branches per plant	No. of secondary branches per plant	No of pods per plant	No. of seeds per pod	Days to 80% maturity	100 seed weight	Genotypic correlation with yield
Plant height	**1.045**	-0.196	-0.19	-0.276	0.664	-0.01	-0.343	-0.114	0.581
Days to 50% flowering	0.905	**-0.052**	-0.711	-0.425	1.681	0.091	-0.800	-0.651	0.038
No. of primary branches per plant	0.85	-0.159	**-0.234**	-0.213	0.871	-0.126	-0.261	-0.069	0.658
No. of secondary branches per plant	0.396	-0.174	-0.069	**-0.729**	1.987	0.051	-0.529	-0.076	0.858
No. of pods per plant	0.309	-0.156	-0.091	-0.645	**2.246**	-0.053	-0.636	-0.061	0.913
No. of seeds per pod	0.018	0.009	-0.055	0.069	0.222	**-0.538**	0.67	-0.198	0.199
Days to 80% maturity	0.314	-0.129	-0.054	-0.338	1.251	0.316	**-1.142**	0.172	0.391
100 seed weight	0.376	-0.108	-0.051	-0.174	0.429	-0.336	0.621	**-0.316**	0.441

References:

1. Al-jibouri N A, Miller P A and Robinson H F. (1958). Genotypic and environmental variances, covariances in upland cotton cross of interspecific origin. *Agron. J.* **50**: 633-637.
2. Burli A V, Dodake S S, Kamble A B and Gare B N. (2010). Genetic variability, heritability and correlation in soybean. *Journal of Maharastra Agricultural Universities*. **35** (2): 331-334.
3. Dewey D R and Lu K H. (1959). A correlation and path coefficient analysis components of crested wheat grass seed production. *Agron. J.* **51**: 515-518.
4. Gaikwad S R, Bangar N D and Chavan B H. (2007). Correlation and path coefficient analysis in soybean. *Journal of Maharastra Agricultural Universities.* **32** (2): 276-277.
5. Jain P K, Ramgiri S R and Singh C B. (2000). Genetic association and path analysis for pod and seed attributes in soybean. *Advances in Plant Science*. **13** (2), 377-381.
6. Mukhekar G D, Bangar N D and Lad D B. (2004). Character association and path coefficient analysis in soybean. *Journal of Maharastra Agricultural Universities*. **29** (3): 256-258.
7. Patil S S, Naik M R, Patil P P and Shinde D A. (2011). Genetic variability, correlation and path analysis in soybean. *Legume Research.* **34** (1): 36-40.
8. SOPA-Soybean Processors Association of India. (2016). Estimates of Soybean production in India – *Kharif* (monsoon) 2015. Based on crop survey conducted by SOPA.
9. Yadav N S, Singh K, Pushpendra, Singh B V, Pandey K. and Gupta M K. (2009). Correlation and Path coefficient study in elite breeding lines of soybean. *Pantnagar Journal of Research.* **7** (2): 155-160.