J. Soils and Crops 30 (2) 321-325, December 2020

ISSN 0971-2836 (p)
ISSN 2582-2756 (e)

CHARACTER ASSOCIATION AND PATH ANALYSIS STUDIES IN SOYBEAN MUTANT PROGENIES

Vaishnavi Deshmukh[1], M. P. Meshram[2], Chaitali Mane[3] and R. N. Deshmukh[4]

ABSTRACT

The experimental material comprised of 20 soybean mutant lines along with 2 checks TAMS-38 and JS-335. The experiment was conducted at shankar nagar, Research field of Agricultural Botany section, College of Agriculture, Nagpur during *kharif* 2019. Mutant lines with checks were evaluated for days to 50% flowering, days to maturity, plant height, number of branches plant^{-1}, number of pods plant^{-1}, 100 seed weight, oil content and seed yield plant^{-1}. The data were analysed for character association i.e. correlation and path analysis. Correlation study revealed that plant height, number of pods plant^{-1}, 100 seed weight had strong positive correlation with seed yield plant^{-1}, while path analysis suggested number of pods plant^{-1} followed by 100 seed weight and plant height recorded magnitudinally highest positive direct effect on seed yield plant^{-1}.

(Keywords:Soybean, correlation, path analysis)

INTRODUCTION

Soybean (*Glycine max* L. Merrill) is a leguminous and self-pollinated crop, having chromosome number 2n = 40. Soybean is also known as "Gold of soil" due to its various qualities such as ease in cultivation, less requirement of fertilizers and labour resulting in high cost-benefit ratio. Soybeans, like most legumes, perform nitrogen fixation by establishing a symbiotic relationship with the bacterium *Bradyrhizobium japonicum* capable of transforming nearly 60-100 kg atmospheric nitrogen into 30-40 kg nitrogen in the soil. *Glycine max* is probably polyploid in its origin although the exact nature of its origin is yet to be understood (Darlington and Janaki Ammal, 1945). It is categorized as an oilseed rather than a pulse, despite being the rich source of protein and used as food and feed by the human as well as livestock across the globe.

This soybean has grown within China used for more than 4000 years (Hymowitz, 1970).Soybean being predominantly self-fertilized, inherent variability in this crop may not be sufficient to develop new varieties possessing different desirable characters.It carries a very high nutritional value which contains about 40% proteins, possessing high level of essential amino acids except methionine and cystine, 20% oil rich in polyunsaturated fatty acids specially omega-6 and omega-3 fatty acids, 6 to 7% total minerals, 5 to 6% crude fibre and 17 to 19% carbohydrates (Chauhan *et al*., 1988). Besides, it has a number of nutraceutical compounds such as tocopherol, iron, vitamin B-complex, lecithin and isoflavones such as daidzein, genistein of glycitin made it one of the most valuable agronomic crops in the world (Khan and Tyagi, 2013). Yield and related characters are controlled by the polygenic system. Under such situation, mutation breeding is now playing an important role in developing new genetic resource and breakage of unwanted linkages.

The induced mutation has generated a vast amount of genetic variability and is now widely used for the development of gene controlling traits and understanding the functions and mechanism of actions of these genes in plants.The cultivar TAMS-38 is taken for the study because this cultivar is recommended as high yielding, better adoptable into the area of Vidarbha but highly susceptible to root rot and moderately susceptible to YMV. This situation heads breeders on to new breeding technologies.

The knowledge of association of plant characters as determined by the correlation coefficient is helpful for selection of desirable characteristics under a breeding programme. Thus, measurement of correlation between characters is a matter of correlation response. The estimate of path coefficient analysis is important for better understanding of the crop. It gives specific measure on the direct and indirect of each component character upon yield.Hence, it is important to have the knowledge of association of yield and yield contributing traits among themselves.

1 and 3 . P.G. Students, Agril. Botany section, College of Agriculture Nagpur, Maharashtra
2 . Asst. Professor, Agril. Botany Section, College of Agriculture, Nagpur
3 . Head, Dept. of Botany NAC&S College Parne,Maharashtra

MATERIALS AND METHODS

The experiment was conducted at Shankar nagar, Research field of Agril. Botany section, College of Agriculture, Nagpur during *kharif* 2019. In *kharif* 2019-20 all the harvested seed from each (20) mutants of M_6 generation along with 2 checks (TAMS-38 and JS-335) were sown to raise M_7 generation using Randomized Block Design replicated thrice. All the recommended cultural practices were followed to raise a good crop.(Table1).

The data on days to 50 % flowering, days to maturity, plant height (cm), number of branches plant^{-1}, number of pods plant^{-1}, 100 seed weight (g), oil content (%) and seed yield plant^{-1}(g) were recorded. Correlation and path analysis were calculated for all characters according to the methods suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

In correlation study (Table 2), days to 50% flowering, days to maturity, number of branches and oil content (%) had negative correlation with seed yield plant^{-1}. Malik *et al*. (2006) reported correlation coefficient for bean yield was positive with leaf area, first pod height, days to flowering, days to maturity, plant height and number of branches also. Muhammad *et al*. (2007) reported grain yield had positive and significant correlation with all the characters except days to flowering.

Similar results were reported by Mahbub *et al*. (2015).They stated that plant height, pod length, number of seeds per pod, number of pods plant^{-1},hundred seed weight, branches plant^{-1} and number of seeds pod^{-1} showed significant positive genotypic and phenotypic correlation with seed yield. Jain *et al*. (2014) reported number of pods plant^{-1} and 100 seed weight exhibited positive and significant correlation with seed yield plant^{-1}.Oil content reported negative but significant correlation at both genotypic and phenotypic level (-0.4991, -0.3161) with seed yield plant^{-1}. Similar results were reported by Haghi *et al*. (2012). They found positive and significant correlation among100 seed weight and oil content. Number of pods plant^{-1}followed by plant height and 100 seed weight also exhibited positive and significant correlation at both the levels with seed yield plant^{-1}.

In path analysis (Table 3) it was found that number of pods plant^{-1} (0.4098) recorded magnitudinally the highest positive direct effect on seed yield plant^{-1} followed by 100 seed weight (0.3938) and plant height (0.0393). The characters days to 50% flowering (-0.5369) recorded highest but negative direct effect on seed yield plant^{-1} followed by oil content (-0.2514), days to maturity (-0.0227) and number of branches (- 0.0405). The residual effect was found to be

Table 1. Details of treatments (Mutant lines) used in the study

Mutant line no.	Pedigree	Characters
1	T2/5/8-1	Early flowering and eliptic leaves
2	T2/19/2-1	High yielding and more number of Pods
3	T2/5/4-1	High yielding, oblong leaves, more branches and pod
4	T2/20/6-1	Early maturity
5	T2/20/7-1	High yielding
6	T2/20/6-1	Early maturity
7	T2/5/3-2	Early maturity
8	T2/20/12-1	High yield and good plant type
9	T2/21/6-1	Early maturity and more pods
10	T2/2/1-1	More number of pods and branches
11	T2/18/2-1	More number of pods, late maturity
12	T2/23/5-1	More number of pods and branches
13	T2/20/10-1	Early maturity and high yielding
14	T2/5/1-1	Early flowering
15	T2/23/5-3	More number of pods and branches
16	T2/19/4-2	High yielding
17	T2/5/5-1	More number of pods and highYielding
18	T2/20/11-1	High yielding
19	T2/20/4-1	High yielding
20	T2/21/15-1	Early flowering and maturity
21	TAMS-38	Check variety
22	JS-335	Check variety

Table 2. Genotypic and phenotypic correlation of different traits with seed yield plant^{-1}

Characters		Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches plant^{-1}	No. of pods plant^{-1}	100 seed weight (g)	Oil content (%)	Seed yield plant^{-1}
Days to 50%flowering	G	**1.000**	0.5335**	-0.2237	-0.0431	-0.2019	0.5308**	-0.2827**	-0.3588**
	P	**1.000**	0.2863*	-0.2102	-0.1257	-0.0874	0.0759	-0.1617	-0.1574
Days to maturity	G		**1.000**	-0.4313**	-0.0266	-0.3420**	0.0096	0.3531**	-0.5520**
	P		**1.000**	-0.1994	-0.1169	-0.2290	-0.0194	0.2504*	-0.2417*
Plant height (cm)	G			**1.000**	-0.1299	0.5114**	0.2456*	-0.5491**	0.6188**
	P			**1.000**	-0.1269	0.3624**	0.2509*	-0.4529***	0.3866**
No. of branches plant^{-1}	G				**1.000**	-0.1485	0.0959	0.1503	-0.0828
	P				**1.000**	0.0090	0.1088	0.1304	0.1021
No. of pods plant^{-1}	G					**1.000**	0.1535	-0.4522**	0.7262**
	P					**1.000**	-0.0009	-0.2806*	0.7834**
100 seed weight(g)	G						**1.000**	-0.4531**	0.2912**
	P						**1.000**	-0.3019	0.1052
Oil content (%)	G							**1.000**	-0.4991**
	P							**1.000**	-0.3161**
Seed yield plant^{-1}(g)	G								1.000
	P								1.000

Table 3. Direct and indirect effects of seven variables on yield of soybean mutant lines

Sr. No.	Characters	Days to 50% flowering	Days to maturity	Plant height (cm) plant^{-1}	No. of branches plant^{-1}	No. of pods	100 seed weight (g)	Oil content	Seed yield plant^{-1}
1	**Days to 50%flowering**	**-0.5369**	-0.0121	-0.0088	0.0017	-0.0827	0.2090	0.0711	-0.3588**
2	**Days to maturity**	-0.2865	**-0.0227**	-0.0169	0.0011	-0.1401	0.0038	-0.0888	-0.5502**
3	**Plant height (cm)**	0.1201	0.0098	**0.0393**	0.0053	0.2096	0.0967	1.1381	0.6188**
4	**No. of branches**	0.0231	0.0006	-0.0051	**-0.0405**	-0.0609	0.0378	-0.0378	-0.0828
5	**No. of pods plant^{-1}**	0.1084	0.0078	0.0201	0.0060	**0.4098**	0.0604	0.1137	0.7262**
6	**100 seedweight (g)**	-0.2850	-0.0002	0.0096	-0.0039	0.0629	**0.3938**	0.1139	0.2912**
7	Oil content(%)	0.1518	-0.0080	-0.0216	-0.0061	-0.1853	-0.1785	-0.2514	-0.4991**

0.479 which reveals that sufficient characters were included in the path coefficient and hence, the information drawn can be used. From the foregoing discussion we concluded that plant height, number of pods plant^{-1} and 100 seed weight were emerged as major components of seed yield in soybean.

Similar results also reported by Balla and Ibrahim (2017). They detected highly positive direct effect for grain yield with days to 50% flowering, days to maturity, plant height and number of pods plant^{-1}.Ekka and Lal (2016) reported that seed index, plant height and pod length showed positive direct effect with seed yield plant^{-1}. Shilpashree *et al*. (2019) studied path analysis on vegetable soybean and revealed that number of pods plant^{-1} showed highest direct positive effect on green pod yield plant^{-1} followed by pod weight, days to first harvest and pod length. Jogdande *et al*. (2017) identified parameters like stalk length, canopy diameter, stem girth and plant height for primary selection based on positive significant and high direct effect. Based on these characters five characters were selected for further purification

REFERENCES

Balla, M. Y. and S. E. Ibrahim, 2017. Genotypic correlation and path coefficient analysis of soybean [*Glycine max* (L.) Merril] for yield and Its components. Agri. Res. and Tech., Open Access J. **7(3)**: 555715.

Chauhan, G. S., N. S. Verma and G. S. Bains, 1988. Effect of extrusion processing on the nutritional quality of protein in rice-legume blends. Nahrung, **32(1)**: 43.

Darlington, C. D. and E. K. J. Ammal, 1945. Chromosome atlas of cultivated plants. George Allen and Unwin Ltd., London. Pp:**397**.

Dewey, D. R. and K. H. Lu, 1958. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J. **51**:515-518.

Ekka, N. P. and G. M. Lal, 2016. Study on genetic variability and character association in soybean [*Glycine max* (L.) Merrill] germplasm at vindhyan zone of Uttar Pradesh Agric. Sci. Digest.**36** (1) : 69-71.

Haghi, Y., B. Pardis, M. Mahshid, H. Manna, F. Pegah, F. Foroozandeh and D. Shokooh, 2012. Correlation and path analysis for yield, oil and protein content of soybean (*Glycine max* L.) genotypes under different levels of nitrogen starter and plant density. Bih. Biol. **6(1)**:32-37.

Hymowitz, T. 1970. On the domestication of the soybean. Econ. Bot. **24(4):** 408–421.

Jain, S., S. C. Srivastava, S. K. Singh, Y. M. Indapurkar and B. K. Singh, 2014. Studies on genetic variability, character association and path analysis for yield and its contributing traits in soybean [*Glycine max* (L.) Merrill]. Legume Res. **38 (2):** 182-184.

Jogdande, P. N., Shanti Patil, V. S. Jayade, R. V. Chahande and V. R. Jaybhange, 2017. Character association & path coefficient analysis in rose (*Rosa spp.).* J. Soils and Crops. **27(2):** 109-115.

Khan, M. H. and S. D. Tyagi, 2013. A review on induced mutagenesis in soybean. J. Cereals Oilseeds, **4(2)**: 19-25.

Mahbub, M. M., M. M. Rahman, M. Hossain, F. Mahmucl and M. M. Kabir, 2015. Genetic variability, correlation and path analysis for yield and yield components in soybean. American-Eurasian J. Agric. and Environ. Sci.**15 (2)**: 231-236.

Malik, M.F.A., M. Ashraf, A. Qureshi and A Ghaffor, 2007. Assessment of genetic variability, correlation and path analysis for yield and its components in soybean, Pak J. Bol. **39** (2) : 405-413.

Muhammad, A., A Nazar and A. Ghafoor, 2007. Character correlation and path coefficient in soybean (*Glycine max* L.) Merrill). Pak. J. Bol. **38** (1) : 121-130.

Shilpashree, N., S. N. Devi, P. Anitha and P. Indira, 2019. Character Association and Path Analysis Studies in Vegetable Soybean (*Glycine max* L.). Int. J. Curr. Microbiol. App. Sci. **8(08):** 1011-1018.

Rec. on 05.10.2020 & Acc. on 25.10.2020