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Inter-relationship analysis for yield and yield attributing traits in mungbean (*Vignaradiata* (L.) wilczek)

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Abstract
The objective of this test is to establish the nature of relation between seed yield and other yield components by partitioning the correlation co-efficient between yield and its component by using simple correlation analysis. The study was conducted with 19 parents and their 60 crosses (F_1) for thirteen component characters including seed yield. The correlation studies of these crosses showed that seed yield per plant showed positive and significant correlation with biological yield per plant, pods per plant, seeds per pod, clusters peer plant, pods per clusters, primary branches per plant, harvest index, 100-seed weight and plant height so they emerged as most important association for seed yield improvement in mungbean during breeding programme.

Keywords: Correlation, harvest index, biological yield per plant and 100-seed weight

Introduction
Mungbean also known as green gram are cultivated in different agro-climatic conditions and soil types in India and various other countries. Mungbean has established itself as a highly valuable short duration grain legume crop having many desirable characteristics like wider adaptability, low input requirement and ability to improve the soil fertility by fixing atmospheric nitrogen with the help of symbiotic bacteria present in root nodules. Moong can be used as a feed for cattle. Even husk of the seed can be soaked in water and used as cattle feed. *Vigna* comprises about 80 species belonging to the genus, *Phaseolus*, sub genus *Ceratotropis*, a relatively homogenous, morphologically and taxonomically distinct group. *Vigna radiata* is an erect, bushy, annual shrub widely cultivated in warm regions of India, Indonesia and United States for its edible nature of seeds and forage. It grows up to 60 cm in height. It branches freely, but not heavily foliaged. Leaves, stems and pods are slightly hairy. Leaves are trifoliate, imparipinnate, leaflets entire and membranous. Pale yellow flowers are borne in long pedicles in clusters of 12 –15 numbers which are usually at the apex of the plant. Fruits are thin cylindrical pods and the mature pods are variable in colour (yellowish-brown to black), five inches long and contain 10 to 15 seeds. The flowers are self-pollinated. Mature seeds are globular and yellow, brown, mottled black or green in colour depending upon its variety. If the association between two characters is considerably positive, it will increase the rate of genetic advancement, while the negative correlation will decrease the genetic improvement progress after selection for the character.

Materials and Methods
The present investigation was carried out at The Instruction Farm of Aacharya Narendra Dev University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya. The crosses were made during *Zaid*, 2019 and the hybrids along with parental lines and check varieties were evaluated during *Kharif*, 2019. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. All eighty genotypes in a replication will be grown in 4 m. long single row plots following between rows and within rows spacing of 60 cm. and 10 cm, respectively. All the recommended package of practices was adopted to raise a good crop. Observations were recorded on five randomly selected plants from each entry for thirteen traits *viz.*, Days to 50% flowering, Days to maturity, Plant height (cm.), Primary branches per plant, Clusters per plant, Pods per cluster, Pod length (cm.), Pods per plant, Seeds per pod, Seed yield per plant (g.), 100-seed weight (g.), Biological yield per plant (g.) and Harvest index (%). The mean values from five randomly selected plants were calculated and used for the statistical analysis.

Result and Discussion

Crop improvement programmes depends to a large extent on availability of sufficient variability among different characters which are the pre-requisite for executing an effective selection programme. Seed yield, being a complex quantitative trait, is dependent on a number of component characters. Thirteen characters under study are presented in table 1&2. The seed yield per plant exhibited highly significant and positive correlation with biological yield per plant (0.933), pods per plant (0.719), seeds per pod (0.616), clusters peer plant (0.600), pods per clusters (0.541), primary branches per plant (0.424), harvest index (0.325), 100-seed weight (0.284) and plant height (0.238) but it had negatively correlation with days to maturity (-0.007). 100-seed weight showed positive correlation of highly significant level with biological yield per plant (0.262) and days to 50% flowering (0.141). Biological yield per plant showed positive association with pods per plant (0.710), cluster per plant (0.598), seeds per pod (0.545), pods per clusters (0.523), primary branches per plant (0.353), harvest index (0.174) and plant height (0.167). Harvest index showed highly significant positive correlation with primary branches per plant (0.300), plant height (0.273), seeds per pod (0.252), pods per cluster (0.194), pods per plant (0.173) but had negative association of highly significant degree with days to maturity (-0.172) and days to 50% flowering (-0.156). Seeds per pod showed highly significant positive correlation with plant height (0.438), primary branches per plant (0.431) and pod length (0.231). Pod length is positively associated with plant height (0.234). Pods per plant showed highly significant positive correlation with cluster per plant (0.825), pods per cluster (0.754) and primary branches per plant (0.129). Pods per cluster showed highly significant positive correlation with cluster per plant (0.377). Primary branches per plant showed significant positive association with plant height (0.502) but had highly significant negative correlation with days to 50% flowering (-0.335) and days to maturity (-0.271). Plant height showed negative correlation with days to 50% flowering (-0.154) while days to maturity recorded highly significant and positive association with days to 50% flowering (0.864). phenotypic (Table 1) and genotypic (Table 2) correlation coefficients were computed among 13 characters. Seed yield per plant showed highly significant and positive phenotypic correlation and very high order positive genotypic correlation with biological yield per plant, pods per plant, seeds per pod, clusters peer plant, pods per cluster, primary branches per plant, harvest index, 100-seed weight and plant height but it had negatively correlation with days to maturity. Therefore, these nine characters emerged as most important associates of seed yield per plant in mungbean. Seeds per pod showed highly significant positive correlation with plant height (0.438), primary branches per plant (0.431) and pod length (0.231). Pod length is positively associated with plant height (0.234). The positive association between above mentioned characters have also been reported by Kumar *et al.*, (2015) [2], Suresh *et al.*, (2016) [4] and Garg *et al.* (2017) [1].

Table 1: Estimates of phenotypic correlation coefficients between 13 traits in mungbean

Sr. No.	Traits	DM	PH	PB/P	C/P	P/C	P/P	PL	S/P	HI	BY/P	100-SW	SY/P
1	D50 %f	0.864**	-0.154*	-0.335**	0.111	0.076	0.096	-0.010	-0.089	-0.156*	0.062	0.141*	0.004
2	DM		-0.083	-0.271**	0.077	0.090	0.070	0.104	-0.066	-0.172**	0.035	0.103	-0.007
3	PH			0.502**	-0.018	0.013	-0.012	0.234**	0.438**	0.273**	0.167**	0.003	0.238**
4	PB/P				0.085	0.099	0.129*	0.118	0.431**	0.300**	0.353**	0.115	0.0424**
5	C/P					0.377**	0.825**	-0.028	0.051	0.079	0.598**	0.101	0.600**
6	P/C						0.754**	-0.053	0.041	0.194**	0.523**	0.020	0.541**
7	PL							-0.066	0.061	0.173**	0.710**	0.061	0.719**
8	P/P								0.231**	0.111	0.060	0.056	0.089
9	S/P									0.252**	0.545**	0.031	0.616**
10	100-SW										0.174**	0.126	0.325**
11	BY/P											0.262**	0.933**
12	HI												0.284**

Traits: D 50% F = Days to 50% flowering, DM = Days to maturity, PH = Plant height (cm), PBTP = Primary branches plant^{-1}, C/P = Cluster plant$^{-1,}$ P/C = Pods cluster^{-1}, PL = Pod length (cm), P/P = Pods Plant^{-1}, S/P = Seeds plant^{-1}, 100-SW = 100-Seed weight (g), BY/P = Biological yield plant^{-1} (g), HI = Harvest index (%), SY/P = Seed yield plant^{-1} (g)

Table 2: Estimates of genotypic correlation coefficients between 13 traits in mungbean

Sr. No.	Traits	DM	PH	PB/P	C/P	P/C	P/P	P/L	S/P	HI	BY/P	100-SW	SY/P
1	D50%f	0.916**	-0.172**	-0.446**	0.137*	0.117	0.116	-0.002	-0.112	-0.255**	0.061	0.189**	-0.004
2	DM		-0.090	-0.368**	0.115	0.116	0.096	0.147*	-0.091	-0.262**	0.032	0.158*	-0.011
3	PH			0.626**	-0.010	0.013	-0.015	0.304**	0.482**	0.533**	0.193**	-0.008	0.272**
4	PB/P				0.120	0.095	0.132*	0.113	0.590**	0.615**	0.474**	0.283**	0.571**
5	C/P					0.762**	0.947**	-0.049	0.053	-0.003	0.664**	0.059	0.671**
6	P/C						0.938**	-0.077	0.106	0.319**	0.675**	0.011	0.679**
7	PL							-0.076	0.099	0.209**	0.738**	0.035	0.726**
8	P/P								0.292**	0.113	0.085	0.146*	0.113
9	S/P									0.546**	0.592**	0.081	0.679**
10	100-SW										0.523**	0.139*	0.575**
11	BY/P											0.350**	0.955**
12	HI												0.362**

Traits: D 50% F = Days to 50% flowering, DM = Days to maturity, PH = Plant height (cm), PBTP = Primary branches plant^{-1}, C/P = Cluster plant$^{-1,}$ P/C = Pods cluster^{-1}, PL = Pod length(cm), P/P = Pods Plant^{-1}, S/P = Seeds plant^{-1}, 100-SW = 100-Seed weight(g), BY/P = Biological yield plant^{-1} (g), HI = Harvest index (%), SY/P = Seed yield plant^{-1} (g)

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