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Variability, correlation and path coefficient analysis of yield attributing traits in different genotypes of Mung bean (*Vigna radiata* L.) in Rupandehi, Nepal

Sunil Ghimire[1], Arun Khanal[1], Ganga Ram Kohar[1], Bimala Acharya[1], Anu Basnet[1], Pragya Kandel[1], Binita Subedi[1], Kshitiz Dhakal[2*]

[1]Tribhuvan University, Institute of Agriculture and Animal Science (IAAS), Nepal; [2]West Virginia State University, West Virginia, U.S. A

*Corresponding author: dhakal.kshitiz@gmail.com

Abstract

An experiment was conducted in RCBD design with four replications and seven treatments to estimate the genetic variability, correlation and path coefficient analysis of yield attributing traits in seven genotypes of mung bean at IAAS, Paklihawa Campus, Agronomy farm, Rupandehi, Nepal. During the research time of summer season 2017, the traits data were first recorded, and variation was analyzed using descriptive statistics, genetic parameters, correlation and path coefficient analysis. Mean, Range, Genotypic coefficient of variance, Phenotype coefficient of variance, Heritability, genetic advance, genetic advance as percentage of mean, correlation and path coefficient analysis were conducted for yield and yield component in 7 genotypes of Mungbean. Highest mean estimates coupled with highest range for primary branches, secondary branches, days to 50% flowering and biological yield, Number of pod per plant, grain weight per plant. Yield was positive and significant correlated with primary branch, secondary branch, biological yield and grain weight. Biological yield, pod length, days to 50% flowering and no. of grains per pod contributed maximum positive and direct effect on yield indicating these four traits should be given emphasis while selecting high yielding mungbean cultivar for irrigated condition.

Key words: Genotype, heritability, mungbean, path coefficient, variance.

Introduction

Mungbean [*Vigna radiata* (L.) Wilczek], also known as green gram or Moong. It is one of the most important pulse crops extensively grown in tropical, subtropical and temperate zones of Asia. Its input requirements are low, and its drought tolerance enables it to withstand adverse environmental conditions, allowing it to be successfully grown in rainfed areas (Anjum et al., 2006). Mungbean is commonly grown in midhills, inner terai and terai region on Nepal.

Grain legumes rank fourth in terms of average (about 10% of total cultivated land) and fifth in production. At the farm level, more than 600 newly adopting farmers were involved in mungbean grain production covering more than 100 ha and producing 85 MT of grains (MoAD, 2016).

Estimation of correlation, path coefficient analysis, heritability and genetic advance would be useful in developing appropriate breeding and selection strategies. Therefore, understanding the yield and yield components relationship as well as heritability estimate of hybrid parental lines is essential in determining traits that contributes significantly to yield, facilitate their selection and utilization in hybrid development (Angarawai et al., 2015). Correlation analysis provides the information of interrelationship of important plant characters and hence, leads to a directional model for direct and/or indirect improvement in grain yield (Khan et al., 2004).

The main purpose of the study was to find out correlation between yield attributing traits as well as direct and indirect contribution of these individual traits in yield. Thus, the result obtain from the study could be further used for the breeding strategies and developing new mungbean varieties of higher productivity.

Materials and Method

The experiment was carried out during spring season at Institute of Agriculture and Animal Science, Tribhuvan University, Paklihawa Campus, Agronomy Farm. located in Western development region having humid subtropical climate with annual rainfall of 1500 mm. The research site was located 27°29'2'' N latitude and 83° 27'13'' E longitude and at an altitude of 84 masl (meters above sea level) having humid subtropical climate with annual rainfall of 1500 mm. The experiment was conducted from 20th March 2017 to 7th July 2017. Seven genotypes of Mungbean were used as an experimental material. All genotypes were collected from National Grain Legumes Research Programme (NGLRP), Khajura, Banke, Nepal.

The experiment was conducted in a Randomized Complete Block Design (RCBD) with four replications and seven treatments. There were total 28 plots and each plot size was 3m × 2m = 6m². There were 5 rows per plot, row to row spacing was 30cm and plant to plant spacing was 15 cm. The spacing between two plots was 50cm and inter spacing between the replication was 1m.

25 plants were taken for collection of data per plot i.e. 5 plants from each row of the plot. The data from the sample plants were collected in such a way that first 5 plants from first line, last 5 plants from second line, again middle 5 plants from third line and so on.

Germination percentage, days to anthesis, number of branches per plant, number of grains per pod, pod length, days to maturity, plant height, grain weight per pod, test weight (1000 grain weight), grain yield and biomass yield were recorded.

Population mean for each trait was computed based on individual plant observation. Similarly, analysis of variance was computed by using mean data for each location separately to partition the variability due to different sources. Genotypic and Phenotypic coefficient of variance was computed and expressed as percentage.The values of PCV and GCV were categorized as low, moderate and high indicated by Sivasubramanjan and Menon (1973)

The broad sense heritability was estimated as the ratio of genotypic variance (Vg) to the phenotypic variance (Vp) and expressed in percentage (Hanson et al., 1956). The heritability percentage categorized as low, moderate and high as followed by (Robinson et al., 1949).

The extent of genetic advance to be expected by selecting five percent of superior progeny was calculated by using the formula given by Robinson et al., (1949). The GA as percent of mean was categorized as low, moderate and high as followed by Johnson et al., (1955).

Result and Discussion

Analysis of variance

The analysis of variance for 11 quantitative traits including grain yield and its related traits in the present set of 7mung bean genotypes are presented in Table 1. It was evident from the analysis of variance that the treatment (genotype) differences were highly significant for all the traits under study. This suggested that there was an inherent genetic difference among the genotypes. Significant variability for various traits in a different set of germplasms were also reported by many mungbean workers in their experimental material (Shobha Rani et al., 2001; Pandey and Awasthi, 2002; Akter et al., 2004 ; Singh et al., 2007).

Range and mean

The upper limit of range for various characters under study was exhibited by different genotypes. However, genotypes which recorded highest values for more than one character were line 7, line 6 and line 2. The highest values of grain weight (18.2972 g) and no. of pod per plant (54.25) were recorded in line 2. In line 6 the highest values of test weight (59.5975), grains per pod (10.45) and plant height (63.7890 cm) were recorded. Similarly, line 7 produced biological yield, primary branch, secondary branch and days to 50% flowering and the values for these attributes were 109.1388, 4.89, 23.90 and 41.50, respectively. On other hand genotypes which recorded lowest values for more than one character were line 6, line 3, line 7 and lowest value for more than 1 characters were in line 5 and line 1. The lowest pod length (8.3780 cm) was recorded in line 6. In line 3 the lowest values of days to 50% flowering (37.25) was recorded and in line 5 the lowest values of grain weight per plant(7.9150) and yield per plant were recorded. Line 1 produced the lowest number of plant height (49.7625); primary branch (3.56), secondary branch (11.91) and the lowest values of grain per pod (9.63 g) and biological yield (68.8715 g) were recorded.

Phenotypic and Genotypic Coefficient of Variation

A perusal of the data in appendix 16 revealed considerable variation for all traits under study with a wide range of phenotypic as well as genotypic coefficient of variation. In general, as could normally be expected, the values of phenotypic variance were higher than those of genotypic variance for all the traits. The relative magnitudes of the phenotypic as well as genotypic variances between the traits were compared based on the phenotypic and genotypic coefficient of variation.

Phenotypic coefficient of variation was highest for grains weight per plant followed by yield per plant, secondary branch, pod per plant and biological yield exhibited moderate high phenotypic coefficient. Lowest magnitude of phenotypic coefficient of variation was exhibited by pod length. All other traits exhibited considerable values of phenotypic coefficient of variation. The results are in accordance with the findings of other researchers (Bai and Tran, 1991; Chaubey and Singh, 1994; Panwar and Sarma, 1995).

Table 1. List of Genotypes of mungbean.

Genotype entry/ Line	Name of genotypes	Origin
1	**Pant -5**	Foreign germplasm
2	**Bari mung**	Foreign germplasm
3	**Pratikshya**	National Grain Legumes Research Center, Khajura
4	**SML-668**	Foreign germplasm
5	**Hum-16**	Foreign germplasm
6	**Kalyan**	National Grain Legumes Research Center, Khajura
7	**Maya (local)**	Rupandehi

Table 2. Genotypes with highest and lowest value for different traits.

Traits	Genotype with lowest value	Genotype with highest value
Days to 50% flowering	line3	line 7
Plant height (cm)	line 1	line 6
Primary branch /plant	line 1	line 7
Secondary branch /plant	line 1	line 7
No. of pod /plant	line 1	line 2
Pod length (cm)	line 6	line1
Grains /pod	line 1	line 6
Biological yield	line 1	line 7
Grain weight /plant	line 5	line 2
Test weight	line 7	line 6
Yield /plant	line 5	line 1

Table 3. Variability parameter for 11 quantitative traits of 7 genotypes of Mungbean.

Traits	Days to 50% flowering	Plant height (cm)	Primary branches (cm)	Secondary branches (cm)	Pod /plant
Range	37.25-41.50	49.77-6379	3.56-4.89	11.91-23.90	36.81-54.93
Mean	38.40	55.98	3.9243	17.29	45.39
SEM (±)	0.6582	2.9627	0.2581	0.9857	3.4238
PCV (%)	4.80	13.21	16.16	22.67	20.75
GCV (%)	3.36	7.91	9.38	19.59	14.24
Heritability (%)	0.49	0.36	0.34	0.75	0.47
Genetic advance (K=2.06)	1.86	5.46	0.44	6.03	9.14
Genetic advance (% of mean)	4.85	9.75	11.21	34.89	20.14

Traits	Pod length (cm)	Grains /pod	Biological yield/plant (g)	Grain weight /plant (g)	Test weight	Yield /plant (g)
Range	8.38-9.19	9.63-10.45	68.88-109.14	7.92-1830	43.64-59.60	0.66-1.21
Mean	8.7145	9.9214	82.3538	12.3329	51.3011	0.9119
SEM (±)	0.1196	0.2001	5.3927	1.1901	0.1987	0.0718
PCV (%)	3.68	4.88	19.50	35.24	11.17	24.68
GCV (%)	2.45	2.75	14.45	29.48	11.15	19.01
Heritability (%)	0.44	0.32	0.55	0.70	1.00	0.59
Genetic advance (K=2.06)	0.29	0.32	18.16	6.27	11.75	0.28
Genetic advance (% of mean)	3.36	3.20	22.06	50.82	22.91	30.16

Table 4. PATH matrix of Yield/ Plant.

No	Character	Days to 50% Flowering	Plant Height (cm)	Primary Branches/ Plant	Secondary Branches/ Plant
1	**Days to 50% Flowering**	0.5660	0.2520	0.6245	0.4012
2	**Plant Height cm**	0.0081	0.0181	0.0059	0.0168
3	**Primary Branches/ Plant**	-0.6088	-0.1791	-0.5518	-0.5612
4	**Secondary Branches/ Plant**	-0.2075	-0.2719	-0.2977	-0.2927
5	**Pod/ Plant**	-0.1869	-0.1712	-0.2658	-0.2404
6	**Pod Length cm**	0.1208	-0.9442	-0.2342	-0.6205
7	**Grains/ Panicle**	-0.1127	0.3717	-0.1071	0.1059
8	**Biological yield/ Plant**	1.1372	0.8261	1.1777	1.1277
9	**Test Weight**	-0.0315	0.0015	-0.0501	-0.0337
10	**Yield/ Plant**	0.6846	-0.0970	0.3014	-0.0970
11	**Partial R^2**	0.3875	-0.0018	-0.1663	0.0284
R SQUARE = 0.8524 RESIDUAL EFFECT = 0.3842					

No	Character	Pod/ Plant	Pod Length (cm)	Grains/ Panicle	Biological yield/ Plant	Test Weight
1	**Days to 50% Flowering**	0.3129	0.0821	-0.1604	0.5839	-0.3083
2	**Plant Height cm**	0.0092	-0.0205	0.0169	0.0136	0.0005
3	**Primary Branches/ Plant**	-0.4337	0.1552	0.1487	-0.5894	0.4774
4	**Secondary Branches/ Plant**	-0.2082	0.2182	-0.0779	-0.2994	0.1703
5	**Pod/ Plant**	-0.3381	0.1463	-0.2120	-0.2745	0.0395

6	**Pod Length cm**	-0.3602	0.8326	-0.5728	-0.4239	0.1124
7	**Grains/ Panicle**	0.2493	-0.2735	0.3976	0.0967	0.3119
8	**Biological yield/ Plant**	0.8951	-0.5613	0.2682	1.1025	-0.5722
9	**Test Weight**	-0.0068	0.0078	0.0454	-0.0301	0.0579
10	**Yield/ Plant**	0.1195	0.5869	-0.1463	0.1793	0.2892
11	**Partial R^2**	-0.0404	0.4886	-0.0582	0.1977	0.0167
R SQUARE = 0.8524 RESIDUAL EFFECT = 0.3842						

Genotypic coefficient of variation was also high for grain weight per plant followed by secondary branch, yield per plant, biological yield and test weight. Similarly, lower magnitude of coefficient of variation was exhibited by pod length and grain per pod. The differences between the values of PCV and GCV were small for almost all the traits indicating less influence of environment in expression of these traits. This difference was comparatively smallest in case of Plant height, pod length and grain per pod. Coefficient of variation with high heritability and genetic advance as percent mean was observed for grains weight per plant, secondary branch, and yield per plant which indicates additive gene action and good scope for selection followed by test weight and grain yield per plant. Kumar et al., (1998) also suggested that high GCV along with heritability and genetic advance gave better picture for selection of the parents. Similar results were also reported by Tripathy et al., (1999), Yadav (2000) and Patra et al., (2006)

Path-coefficient analysis

The correlation coefficient between yield per plant and its ten main component characters *viz.* Days to 50 % flowering, plant height, primary branch, secondary branch, pod per plant, pod length per plant, grain per pod, biological yield, grain weight per plant were partitioned into their corresponding direct and indirect effects through path-coefficient analysis. The estimates of the path-coefficient for the different attributes on the grain yield are presented in table 4. The traits namely days to 50% flowering, number of effective tillers per plants, pod length, number of grains/pod, test weight exhibited direct positive effect on grain yield of varying magnitude. The character wise indirect contributions are discussed below. These finding agreed with the findings of Akter et al., (2004) for days to maturity, Reuben and Katuli (1998) for panicle length, Girolkar et al. (2008) and Shanthala et al., (2004) for test weight on grain yield per plant. The traits like plant height and total number of tillers per plant exhibited direct negative effect on grain yield. These finding were in agreement with the earlier report of Amrithadevathinam (1983) and Shavini and Reddy (2000).

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