International Journal of Agriculture, Environment and Biotechnology
Citation: IJAEB: 8(3): 561-565 September 2015
DOI Number: 10.5958/2230-732X.2015.00086.8

GENETICS AND PLANT BREEDING

Association Studies for Yield and its components in Green Gram

Reecha. T. Das* and Purna K. Barua

Department of Plant Breeding and Genetics, Assam Agricultural University, Jorhat-785013, India.

*Corresponding author: das.reecha@gmail.com

Paper No. 347 Received: 10 July 2014 Accepted: 18 August 2015

Abstract

Twenty three genotypes of green gram were studied for genetic variability, correlation and path analysis for eight economically important traits. The genotypes viz. SG1, MH 709, ML 1278, Pant M 4, SG 21-5, OGG 56, CGG 973, ML 1354 and RVSM 11 were found promising for seed yield per plant. In general, PCV were higher than the corresponding GCV values for all the characters, suggesting the influence of environment in the expression of these traits. The broad sense heritability were high for plant height followed by 100-seed weight, pod length, seed yield per plant, days to flowering, seeds per pod, days to maturity, pod filling percentage and pods per plant . Seeds per pod, 100 seed weight, pods per plant, pod filling percentage and pod length showed significant positive correlations with seed yield per plant both at phenotypic and genotypic levels. Path analysis revealed that seeds per pod had the maximum direct effect on seed yield followed by 100 seed weight, pod filling percentage and pods per plant. Therefore, main emphasis should be given on these traits during phenotypic selection for developing high yielding genotypes of green gram.

Highlights

- Correlation and path analysis was studied in 23 green gram genotypes
- Seeds per pod, 100 seed weight and pods per plant were potential selection criteria for improvement of green gram yield.
- Genotypes exhibiting higher performance for the above mentioned characters can be used as parents for yield improvement

Keywords: Genetic variability, correlation, path analysis, green gram

The grain legumes or the pulses are important food grains of the world after the cereals. Pulses are main source of dietary proteins, and they contain about three times more proteins than the cereals. Green gram or mungbean (*Vigna radiata* (L.) Wilczek) is an important pulse crop grown extensively in both tropical and sub-tropical regions of the world. In addition mungbean is also known for its easy digestibility and non-flatulence behaviour. Although numbers of varieties have been recommended for cultivation the productivity is very low which may be attributed to narrow genetic base of the varieties resulting in low yield potential and susceptibility to biotic and abiotic stresses. To increase its yield potential several genetic improvement methods have been employed. Existence of adequate genetic variability is a pre-requisite for the genetic improvement of any crop. Similarly, the correlation and path analysis studies are of great help in formulating efficient scheme of multiple trait selection. Thus, knowledge on genetic variability, heritability, genetic advance, correlation and path analysis is essential for a breeder to choose best genotypes and to decide the correct breeding methodology for crop improvement. With these objectives, the present investigation was undertaken for the genetic improvement of green gram.

Materials and Methods

The experiment was conducted during summer season, at the Instructional Cum Research Farm (ICR), Assam Agricultural University, Jorhat in a randomized block design with three replications. Each genotype was grown in 4-row plots, 6 m long with 30 X 10 cm spacing. The experimental material comprised of twenty three genotypes of green gram *viz.* MH 709, ML 1354, KM 2272, GM 04-02, Pusa 0972, RMG 987, NM 1, IPM 02-09-1, Pant M-4, MH 721, SG 63-14, Pusa 0971, RVSM 11, GM 05-08, SG 33-5, KM 2268, CGG 973, SG 21-5, ML 1278, MGG 360, OGG 56, SG 1 (Pratap) and NDMZ 09-18. The recommended packages of practices were followed to raise the crop. Data on the basis of five randomly selected competitive plants were recorded on seed yield per plant (g), 100 seed weight (g), pod filling percentage, pod length (cm), number of seeds/ pods, number of pods/ plant, number of primary branches/ plant, days to maturity, days to 50% flowering. The genotypic and phenotypic correlation coefficient of all the characters was worked out through covariance analysis as per Al-Jibouri *et al.* (1958). The path analysis was carried out with the formula as given by Dewey ad Lu (1959) considering yield as the dependable variable and yield component characters as independent characters.

Results and Discussion

The association analysis among ten characters at genotypic and phenotypic levels is given in Table 1, respectively. In general, genotypic correlation coefficients were of higher magnitude than the corresponding phenotypic correlation coefficients. The highest genotypic and phenotypic coefficients of variation were observed for seed yield per plant. The other characters that showed relatively high genotypic variation are seeds per pod, plant height and pods per plant. Similar results were also reported by Narashimhulu *et al.* (2013) and Garge *et al.* (2014) for number of pods per plant and seed yield yield per plant.100-seed weight and pod length showed moderate level of genotypic variation. The highest estimate of heritability in broad sense was recorded

Table 1. Estimates of genetic parameters for different characters in green gram

Character	PCV (%)	GCV (%)	$h^2_{b.s.}$ (%)	GA (%)
Days to 50% flowering	9.31	9.12	95.89	18.39
Plant height	18.97	18.37	98.88	37.63
Pods/plant	16.47	15.19	85.13	28.88
Pod length	11.16	11.00	97.14	22.34
Seeds/pod	20.04	19.43	93.99	38.80
Pod filling percentage	9.69	9.14	89.05	17.78
100 seed weight	12.09	12.02	98.83	24.62
Seed yield/ plant	29.58	28.65	96.31	58.29

for plant height, followed by 100-seed weight, pod length, seed yield per plant, days to flowering (95.9%), seeds per pod, days to maturity, pod filling percentage and pods per plant . Similar results were obtained by Siddique *et al.* (2006) for pods per plant and seed yield per plant in green gram. In the present study, no variation was for primary branches per plant. The highest genetic advance was recorded for seed yield plant. Seeds per pod and plant height also showed relatively high genetic advance. Pods per plant, 100-seed weight , pod length , days to 50% flowering and pod filling percentage showed moderate level of genetic advance. Burton (1952) suggested that the GCV together with the heritability in broad sense is perhaps a bet er index of the extent of genetic advance that can be expected from a given selection scheme. In the present study high heritability with high genetic advance was observed for characters like seed yield per plant, seeds per pod and plant height. These characters are expected to be governed by additive genes and therefore selection to would be more effective for these characters compared to the others. Similar findings were reported by Rahim *et al.* (2010) for seed yield per plant, plant height and seeds per pod in green gram. Siddique *et al.* (2006) also reported high heritability coupled with high genetic advance for seed protein, plant height, and test weight in this crop.

Table 2. Genotypic (upper diagonal) and phenotypic (lower diagonal) correlation coefficients between different characters in green gram

	Days to 50% flowering	Plant height	100 seed weight	Pod length	Seeds/ pod	Pods/ plant	Pods filling%	Seed yield/ plant
Days to 50% flowering		0.295	0.08	0.019	0.088	-0.289	-0.077	0.179
Plant height	0.288		-0.031	-0.004	0.095	-0.13	0.233	0.307
100 seed weight	00.08	-0.028		0.415*	0.546**	0.266	0.238	0.678**
Pod length	0.012	-0.012	0.404		0.628**	0.494*	0.308	0.454*
Seeds/ pod	0.094	0.092	0.526**	0.608**		0.477*	0.121	0.692**
Pods/ plant	-0.264	-0.119	0.234	0.439*	0.422*		0.253	0.522*
Pod filling%	-0.078	0.223	0.222	0.281	0.099	0.206		0.530*
Seed yield/plant	0.175	0.304	0.673**	0.447*	0.669**	0.480*	0.502*	

*Significant at 5 % probability level
**Significant at 1 % probability level

Table 3. Direct (diagonal values in bold face) and indirect effects of component characters on seed yield per plant in green gram

	Days to 50% flowering	Plant height	100 seed weight	Pod length	Seeds/ pod	Pods/ plant	Pod filling%
Days to 50% flowering	0.187	0.055	0.015	0.004	0.017	-0.054	-0.014
Plant height	0.055	0.188	-0.006	-0.001	0.018	-0.024	0.044
100 seed weight	0.030	-0.012	0.377	0.156	0.206	0.100	0.090
Pod length	-0.004	0.001	-0.093	-0.224	-0.141	-0.111	-0.069
Seeds/pod	0.034	0.037	0.213	0.245	0.390	0.186	0.047
Pods/ plant	-0.097	-0.044	0.090	0.166	0.160	0.336	0.085
Pod filling%	-0.027	0.081	0.083	0.107	0.042	0.088	0.348
r_g (with yield)	0.179	0.307	0.678**	0.454*	0.692**	0.522*	0.530*

* Significant at 5% probability level
** Significant at 1% probability level

The yield is a complex character and depends on a number of yield attributing traits. In order to understand the inter-character associations among different yield contributing characters, it is necessary to interpret correlation in the crop plants. Between yield components, 100 seed weight showed significant positive correlations at genotypic and phenotypic levels with seeds per pod. Seeds per pod was positively correlated to pod length and pods per plant. On the other hand, pod filling percentage was positively correlated to only seed yield per plant at both levels of analysis.

Knowledge on association of seed yield with different characters as well among the component characters is very much important for breeders to formulate an effective breeding programme. Seed yield per plant showed significant positive correlation with 100 seed weight, pod length, seeds per pod, pods per plant and pod filling per cent. Similar positive correlations for pods per plant by Ahmad *et al.* (2015) . Kousar *et al.* (2007) observed that seeds per pod and pods per plant were positively correlated for with seed yield per plant. This indicates that selection based on 100 seed weight, pod length, seeds per pod, pods per plant and pod filling percentage might result in improved yield. Among these yield components seeds per pod exhibited high estimates of heritability (broad sense) and genetic advance with relatively good genotypic variation. This character could be a very useful selection criterion for improvement of seed yield in green gram.

To partition the genotypic correlation coefficient between a component trait and seed yield per plant into direct and indirect effects on seed yield, path coefficient analysis was adopted. These direct and indirect effects are presented in Table 3. Path analysis revealed that seeds per pod had the maximum direct effect on seed yield followed by 100 seed weight, pod filling percentage and pods per plant. Previously high positive direct effect by seeds per pod was reported by Patel *et al.* (2014) and pods per plant and 100 seed weight on seed yield per plant was reported by Tabasum *et al.* (2010). Considerable positive indirect effects of seeds per pod via 100 seed weight and pods per plant, and negative indirect effect through pod length were observed. Positive indirect effects of 100 seed weight via seeds per pod. In addition, the indirect effects of pod per plant via seeds per pod and 100 seed weight were also non-negligible. Pod length showed negative direct effect on seed yield per plant but its correlation with yield was positive. The positive correlation was mainly due to positive indirect effects through seeds per pod, 100 seed weight, pod filling percentage and pods per plant.

Therefore, from correlation and path analysis it could be concluded that the characters seeds per pod, 100 seed weight, pod filling percentage and pods per plant, which exerted positive direct effects and were positively correlated with seed yield per plant, deserve consideration in breeding programme as selection criteria to bring about improvement in seed yield. Earlier in analysis of genetic parameters, it was concluded that apart from seed yield per plant, seeds per pod, pods per plant, plant height and 100 seed weight could be effective selection criteria. Thus by considering both genetic parameters and character relationships, three characters viz. seeds per pod, 100 seed weight and pods per plant were potential selection criteria for improvement of green gram yield.In a study on genetic variability, correlation and path analysis in green gram, Khanpara *et al.* (2012) found similar positive direct effects of pods per plant and seeds per pod on seed yield. Kumar *et al.* (2013) also reported high positive direct effect of number of pods per plant, number of grains per pod and 100 seed weight on grain yield.

Thus, correlation and path coefficient analysis revealed that 100 seed weight, pod length, seeds per pod, pods per plant and pod filling percentage were positively correlated with seed yield both at genotypic and phenotypic levels. Seeds per pod, 100 seed weight, pod filling percentage and pods per plant exhibited positive direct effects on seed yield per plant.

Conclusion

The results of the present study suggested presence of adequate genetic variability present in the material studied.By considering both genetic parameters and character relationships, three characters viz. seeds per pod, 100 seed weight and pods per plant were potential selection criteria for improvement of green gram yield, apart from possible effectiveness of selection for seed yield per plant.The estimate of residual effects was high (0.354). That means yield attributing characters considered in the present investigation explain only 65% of variability in seed yield, indicating possibilities of some other characters effecting seed yield per plant.

References

Ahmad, H.B., Rauf, S., Hussain, I., Rafiq, C.M., Rehman, A.U., Aulakh, A.M. and Zahid, M.A. 2015. Genetic variability, association and path analysis in mung bean (Vigna radiata L.). *International Journal of Agronomy and Agricultural Research* **6**(6): 75-81.

Al-Jibouri, N.A., Miller, F.A. and Robinson, H.P. 1958. Genotypic and environmental variances, covariances in an upland cotton cross of interspecific origin. *Agronomy Journal* **50**: 633-637.

Biradar, S., Kaveri, S., Salimath, P.M. and Ravikumar, R.L. 2007. Genetic studies in green gram and association analysis. *Karnataka Journal of Agricultural Sciences* **20**(4): 843-844.

Burton, G.W. 1952. Quantitative inheritance in grasses. *Proc 6th Grassland Cong.,* **1**: 277- 281.

Dewey, D.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal* **51**: 515 – 518.

Garje, U.A., Bhailume, M.S., Nagawade, Deepak, R. and Parhe Sachin, D. 2014. Genetic association and path coefficient analysis in green gram [*Vigna radiata* (L.) Wilczek]. *Journal Food Leg.* **27**(2): 151-154.

Gul, R., Ali, S., Khan, H., Nazia, Ali, F. and Ali, I. 2007. Variability among mungbean (*Vigna radiata*) genotypes for yield and yield components grown in Peshwar valley. *J. Agric. Bio. Sci*. **2**(3): 5-9.

Hakim, L. 2008. Variability and correlation of agronomic characters of mungbean and their utilization for variety improvement program. *Indonesian Journal of Agricultural Science* **9**(1): 24-28.

Khanpara, M.D., Vachhani, J.H., Jivani, L.L., Jethava, A.S. and Vaghasia, P.M. 2012. Correlation and path coefficient analysis in greengram (Vigna radiata (L.) Wilczek). *Asian Journal of Bio Science* 7(1): 34-38

Kousar, M., Abrahim, G., Jan, A. and Singh, A.K. 2007. Genetic variability and correlation studies on yield and its components in mungbean (*Vigna radiata* (L.) Wilczek). *J. Agronomy* **6**: 216-218

Kumar, K., Prasad, Y., Mishra S.B., Pandey, S.S. and Kumar, R. 2013. Study on genetic variability, correlation and path analysis with grain yield and yield attributing traits in green gram [Vigna radiata (L.) Wilczek]. *The BioScan* **8**(4): 1551-1555.

Narasimhulu, R., Naidu, N.V., Priya, M.S., Rajarajeswari, V. and Reddy, K.H.P. 2013. Genetic variability and association studies for yield attributes in mungbean (*Vigna radiata* L. Wilczek). *Indian Journal of Political Science* **2**(3):82-86.

Patel, S.R., Patel, K.K. and Parmar, H.K. 2014. Genetic variability, correlation and path analysis for seed yield and its components in green gram [*Vigna radiata* (L.) Wilczek]. *The Bioscan*. **9**(4): 1845-1847.

Rahim, M.A., Mia, A.A., Mahmud, F., Zeba, N. and Afrin, K.S. 2010. Genetic variability, character association and genetic divergence in mungbean (*Vigna radiata* L. Wilczek). *Plant Omics J*. **3**(1).1-6.

Siddique, M., Malik, M.F.A. and Awan, S.I. 2006. Genetic divergence, association and performance evaluation of different genotypes of mungbean (*Vigna radiata*). *International Journal of Agricultural and Biological Engineering* **8**(6): 793-795.

Tabasum, A., Muhammad, S. and Aziz, I. 2010. Genetic variability, trait association and path analysis of yield and yield components in mungbean (*Vigna Radiata* (L.) Wilczek). *Pakistan Journal of Botany* **42**(6): 3915-3924