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Correlation and Path Analysis of Yield and its Components Plant Traits in Ricebean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi]

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A B S T R A C T

Forty ricebean genotypes were evaluated for different quantitative traits in RBD design at the experimental farm of the Department of Organic Agriculture, CSKHPKV, Palampur. The objective of the present study was to estimate the extent of association between pairs of characters at genotypic and phenotypic levels and thereby compare the direct and indirect effects of the characters. Correlation studies revealed that seed yield had significant positive correlation with days to maturity, plant height, pods/plant, pod length, seeds/pod, 100-seed weight, clusters/plant and pods/cluster indicating that selection through these traits would be effective. Path studies revealed clusters/plant, pods/cluster and plant height as important traits for direct selection for yield as these traits have high direct effects. Days to maturity have high indirect effect via plant height which contributed to the positive and significant correlation with seed yield/plant.

Introduction

Rice bean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] is one of the underutilized warm season annual vine legume with diploid chromosome number (2n=2x=22) which belong to subgenus *Ceratotropus* in the genus *Vigna* is widely cultivated in India, China, Korea, Japan, Myanmar, Malaysia, Indonesia, Philippines, Java, Fiji, Bangladesh, Sri Lanka and Nepal. In India its distribution is mainly confined to tribal region of the North- Eastern hills, Western and Eastern Ghats in peninsular region and the Western peninsular tract particularly-temperate hilly region in Himachal Pradesh. It is important crop of Mid-Himalayan region and has emerged as a good alternative to other pulse crops such as black gram and green gram which do not flourish in this region due to their susceptibility to cold temperate stress and high rainfall. It is a potentially valuable but underutilized multipurpose grain legume, which gives satisfactory grain yield even in marginal lands and adverse growing conditions. It is an important food legume in niche environments and has a pivotal role as a pulse in supporting the food security of the rural poor people.

Correlation analysis is a handy technique which provides information that selection for one character results in progress for other positively correlated characters. The importance of correlation studies in selection programmes is appreciable when highly heritable characters are associated with the important character like yield. Correlation coefficients, although, very useful in quantifying the size and direction of trait associations can be misleading if the high correlation between two traits is a consequence of the indirect effect of other traits (Bizeti *et al.,* 2004). Path coefficient is an excellent means of studying direct and indirect effects of inter-related components of a complex trait which measures the direct influence of one variable on another. Each correlation coefficient between a predictor variable and the response variable is partitioned into its component parts: the direct effect or path coefficient (a standardized partial regression coefficient) for the predictor variable and indirect effects which involve the product of a correlation coefficient between two predictor variables with the appropriate path coefficient in the path diagram (Dewey and Lu, 1959). By determining the inter-relationships among seed yield components, a better understanding of both the direct and indirect effects of the specific components can be attained (Chaudhary and Joshi, 2005).

Materials and Methods

The experimental material for the present study consisted of 40 ricebean genotypes. These genotypes were evaluated for different quantitative traits in RBD design during *kharif* 2015 with plot size of 3 m x 0.6 m with row to row and plant to plant distance of 30 cm and 10 cm, respectively with 3 replications. The crop was raised following standard package of practices. Data pertaining to various quantitative traits except days to flowering and maturity was recorded on ten randomly taken plants. Days to flowering and maturity were computed on plot basis. For computing phenotypic, genotypic and environmental correlation coefficients, analysis of co-variance was carried out in all possible pairs of combinations of the characters following Al-Jibouri *et al.,* (1958). The genotypic correlation coefficients and phenotypic correlation coefficients were used in finding out their direct and indirect contribution towards yield/plant as proposed by Wright (1921). The direct and indirect paths were carried out by following Dewey and Lu (1959).

Results and Discussion

In the present study, the estimates of phenotypic and genotypic correlation coefficients were computed for different characters and same have been presented in Table 1. The estimates of genotypic correlations, in general, were higher than their respective phenotypic correlations for most of the traits indicating strong inherent relationship between the traits.

Perusal of the data showed significant positive correlation of seed yield/plant with days to maturity, plant height, pods/plant, pod length, 100-seed weight, seeds/pod, clusters/plant and pods/cluster indicating that selection through these traits will lead to increase in yield. Days to maturity were significantly positively correlation with pod length, 100-seed weight and plant height. Plant height in turn showed significant positive correlation with pods/plant, pod length, 100-seed weight and seeds/pod.

Pods/plant showed positive correlation with pod length, 100-seed weight, seeds/pod and clusters/plant. Pod length showed positive correlation with 100-seed weight, seeds/pod, clusters/plant, pods/cluster. 100-seed weight showed positive correlation with seeds/pod which in turn showed positive correlation with clusters/plant while clusters/plant showed positive and significant correlation with pods/clusters.

Gupta *et al.,* (2014) also observed that seed yield was positively correlated with all the characters except days to maturity in ricebean. Similarly Dash (2012) and observed positive and significant correlation for green fodder yield with days to flowering, main stem length, branches/plant, branch length, leaves/plant, leaf weight and stem weight both at phenotypic and genotypic level in this crop.

Dodake and Dahat (2011) also studied characters association in ricebean which revealed that the seed yield/plant exhibited significantly positive correlation with number of pods/plant, number of seeds/pod and pod length, which is in agreement with the present study.

Seed yield is within great influence of environmental conditions, has complex mode of inheritance and low heritability (Bocanski *et al.,* 2010). On the contrary most of the yield components are less complex, and because of this by using some other trait which is highly correlated with seed yield and has higher heritability, should make the selection of the best progenies more reliable (Vasic *et al.,* 2001, Bekavac *et al.,* 2008). Study of yield components and their inter relationship along with yield and their direct and indirect contributions towards yield is of immense importance.

The phenotype of a plant is the result of interaction of a large number of factors. Hence, the final yield is the sum total of effects of several component factors. Therefore, it is important to know the extent and nature of inter-relationship between seed yield and its contributing characters and also among themselves. Grafius (1956) had also opined that the improvement of complex characters such as seed yield might be accomplished better through component breeding. Therefore, it is also important to gather information on association of yield with other characters and among themselves, and their basis to identify characters for increasing the efficiency of both direct and indirect selection and thereby defining an ideal plant type. Correlation coefficients are quite helpful in determining the components of a complex trait like seed yield but an exact picture of the relative importance of direct and indirect influence of each component trait which is not provided by such studies as these estimates provide nature and magnitude but not its cause. Path coefficient (Wright 1921; Dewey and Lu 1959) under such circumstances plays an important role in partitioning the correlations into direct and indirect effects of a specific causal factor.

The values of path analysis at the phenotypic and genotypic levels are presented in Table 2. The significant positive correlation of seed yield with clusters/plant, pods/cluster, plant height and pods/plant was because of high direct effects of these traits indicating importance of direct selection of these traits. Days to maturity showed positive correlation with seed yield/plant via high indirect effects of plant height followed by pods/plant and branches/plant while plant height showed positive correlation with seed yield/plant via high indirect effects of clusters/pod, pods/plant and days to maturity.

On the other hand, pods/plant showed positive correlation with seed yield/plant via high indirect effects of clusters/plant, pods/cluster and plant height whereas, pod length showed positive correlation with seed yield/plant via highest indirect effects of clusters/plant followed by plant height and pods/cluster. 100-seed weight showed positive correlation with seed yield/plant via high indirect effects of plant height followed by clusters/plant and pods/plant and; seeds/pod showed positive correlation with seed yield/plant via high indirect effects of clusters/plant followed by plant height and pods/plant.

Table.1 Estimates of phenotypic and genotypic correlation coefficient among various yield and morphological traits in ricebean

Traits		Days to flowering	Days to maturity	Plant Height	Branches/ plant	Pods /plant	Pod length	100-seed weight	Seeds /pod	Clusters /plant	Pods /cluster	Seed yield/plant
Days to flowering	**P**		0.44*	0.46*	0.17	0.13	0.34*	0.21	0.18	0.12	0.05	0.13
	G		0.60*	0.63*	0.49*	0.44*	0.47*	0.35*	0.88*	0.18	0.07	0.32*
Days to maturity	**P**			0.67*	0.15	0.15	0.33*	0.36*	0.22	0.03	0.01	0.20*
	G			0.94*	0.35*	0.69*	0.68*	0.44*	1.16*	0.19	-0.06	0.33*
Plant height	**P**				0.03	0.24*	0.45*	0.39*	0.35*	0.13	0.00	0.28*
	G				0.22	0.77*	0.81*	0.61*	1.23*	0.33*	0.04	0.43*
Branches /plant	**P**					-0.00	0.06	0.13	0.05	-0.03	-0.02	0.09
	G					0.43*	0.21	0.12	0.72*	0.29*	0.02	0.21*
Pods/plant	**P**						0.34*	0.31*	0.36*	0.24*	0.17	0.34*
	G						1.36*	0.94*	2.20*	1.06*	0.45*	1.33*
Pod length	**P**							0.44*	0.32*	0.30*	0.27*	0.33*
	G							0.98*	1.63*	0.64*	0.40*	0.81*
100-seed weight	**P**								0.38*	0.18	0.14	0.27*
	G								1.61*	0.45*	0.22	0.74*
Seeds/pod	**P**									0.40*	0.21	0.29*
	G									0.87*	0.87*	1.77*
Clusters/plant	**P**										0.28*	0.46*
	G										0.70*	0.96*
Pods/cluster	**P**											0.43*
	G											0.73*

*significant at 5% level of significance

Table.2 Estimates of direct and indirect effects on seed yield at genotypic level and phenotypic level for different traits in ricebean

Traits		Days to flowering	Days to maturity	Plant Height	Branches per plant	Pods per plant	Pod length	100-seed weight	Seeds/ pod	Clusters/plant	Pods/cluster	Correlation with yield
Days to flowering	**P**	**-0.08**	0.02	0.10	0.02	0.02	0.00	0.01	-0.01	0.04	0.02	0.13
	G	**0.28**	-0.27	-0.46	-0.02	0.30	1.27	-0.53	-0.17	-0.08	0.01	0.32*
Days to maturity	**P**	-0.03	**0.04**	0.14	0.02	0.02	0.00	0.01	-0.01	0.01	0.00	0.20*
	G	0.17	**-0.45**	-0.68	-0.02	0.46	1.82	-0.68	-0.22	-0.08	-0.01	0.33*
Plant height	**P**	-0.04	0.03	**0.21**	0.00	0.04	0.00	0.02	-0.02	0.04	0.00	0.28*
	G	0.17	-0.42	**-0.72**	-0.01	0.51	2.19	-0.92	-0.23	-0.14	0.01	0.43*
Branches/plant	**P**	-0.01	0.01	0.01	**0.11**	-0.00	0.00	0.01	-0.00	-0.01	-0.00	0.09
	G	0.13	-0.16	-0.16	**-0.05**	0.29	0.58	-0.18	-0.14	-0.12	0.00	0.21*
Pods /plant	**P**	-0.01	0.01	0.05	-0.00	**0.16**	0.00	0.01	-0.02	0.08	0.05	0.34*
	G	0.12	-0.31	-0.55	-0.02	**0.67**	3.66	-1.43	-0.42	-0.45	0.06	1.33*
Pod length	**P**	-0.03	0.01	0.09	0.01	0.06	**0.00**	0.02	-0.02	0.10	0.08	0.32*
	G	0.13	-0.31	-0.59	-0.01	0.91	**2.70**	-1.50	-0.31	-0.27	0.05	0.81*
100-seed weight	**P**	-0.02	0.01	0.08	0.01	0.05	0.00	**0.04**	-0.02	0.06	0.04	0.27*
	G	0.10	-0.20	-0.44	-0.01	0.63	2.65	**-1.52**	-0.30	-0.19	0.03	0.74*
Seeds /pod	**P**	-0.01	0.01	0.07	0.01	0.06	0.00	0.01	**-0.05**	0.13	0.07	0.29*
	G	0.24	-0.52	-0.89	-0.03	1.48	4.38	-2.46	**-0.19**	-0.37	0.12	1.77*
Clusters/plant	**P**	-0.01	0.00	0.03	-0.00	0.04	0.00	0.01	-0.10	**0.33**	0.09	0.46*
	G	0.05	-0.09	-0.24	-0.01	0.71	1.72	-0.69	-0.16	**-0.43**	0.10	0.96*
Pods/cluster	**P**	-0.00	0.00	0.00	-0.00	0.03	0.00	0.01	-0.01	0.09	**0.32**	0.43*
	G	0.02	0.02	-0.03	-0.00	0.30	1.07	-0.34	-0.16	-0.30	**0.14**	0.73*

*significant at 5% level of significance

Fig.1 (a) Phenotypic path diagram representing cause and effect relationships among quantitative traits and seed yield per plant (SYPP) in ricebean germplasm lines

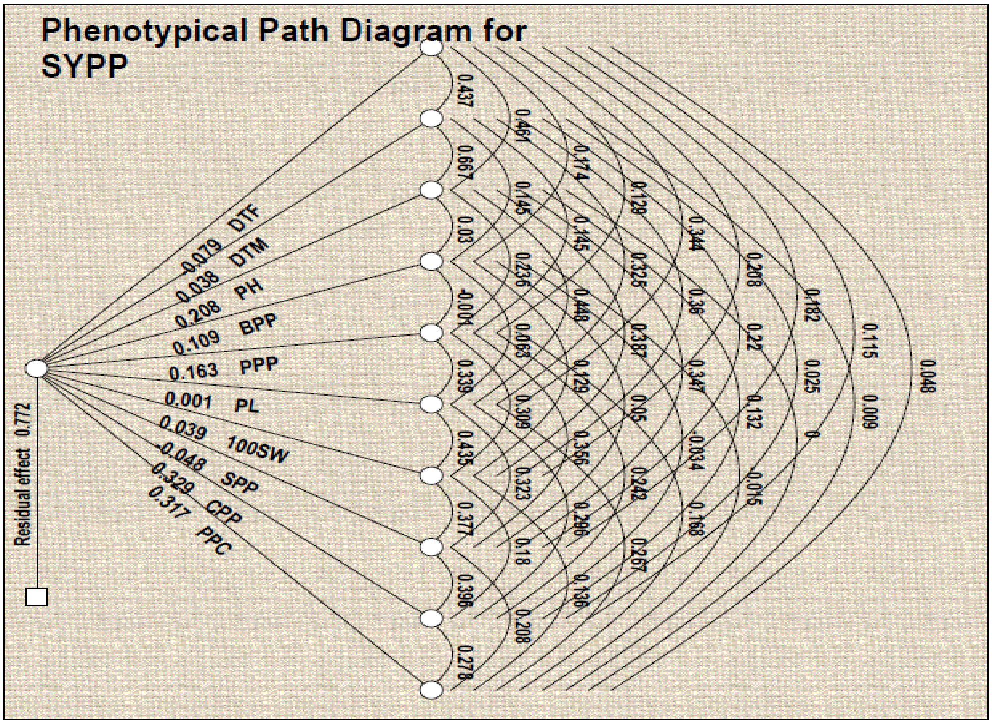
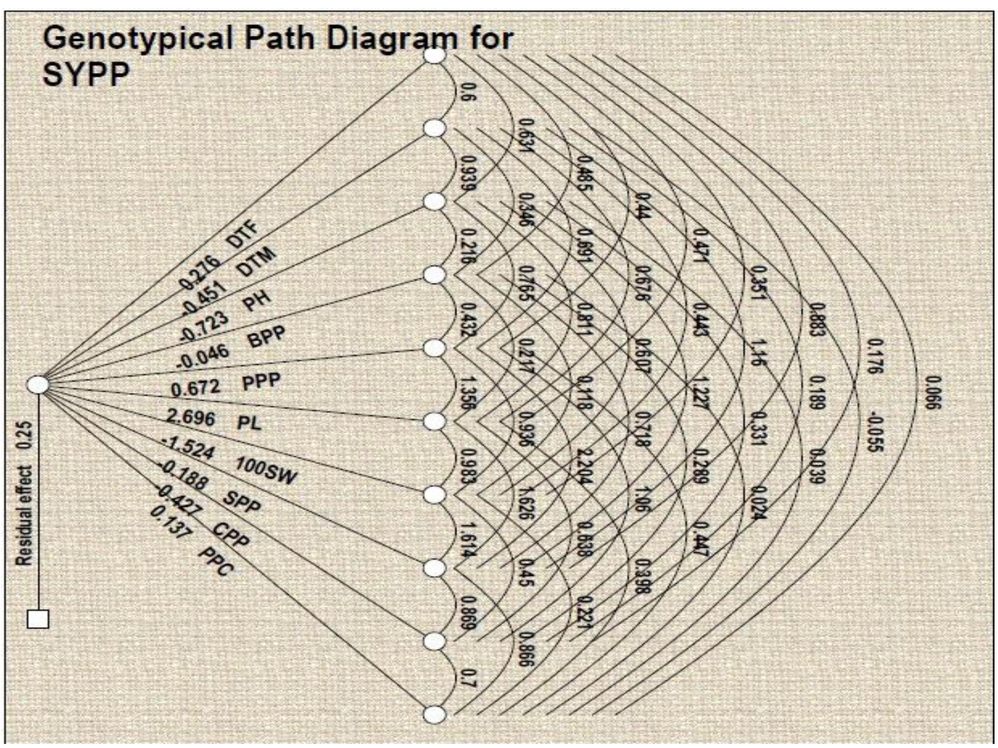


Fig.1 (b) Genotypic path diagram representing cause and effect relationships among quantitative traits and seed yield per plant (SYPP) in ricebean germplasm lines



Clusters/plant showed positive correlation with seed yield/plant via high indirect effects of pods/cluster followed by pods/plant and plant height while pods/cluster showed positive correlation with seed yield/plant via high indirect effects of cluster/plant followed by pods/plant and 100-seed weight. High indirect effects of these traits indicate indirect selection for increased yield via these traits. Phenotypic and genotypic path diagrams representing cause and effect relationships among quantitative traits and seed yield per plant (SYPP) in ricebean germplasm lines are shown in figure 1(a) and 1(b). Since clusters/plant, pods/cluster, plant height and pods/plant showed high direct effects can be considered for direct selection for high seed yield in comparison to rest of the traits which are useful in indirect selection towards yield.

Similar results were obtained by various workers. Dash (2012) did analysis of path coefficient analysis and revealed that leaves/plant and days to flowering had high positive direct effect on fodder yield while branches/plant and branch length had moderate direct effect. Similarly, Dodake and Dahat (2011) studied characters association and path coefficient analysis in ricebean and revealed that number of pods/plant had the highest direct effect and contributed towards yield.

Correlation studies revealed that seed yield had significant positive correlation with days to maturity, plant height, pods/plant, pod length, seeds/pod, 100-seed weight, clusters/plant and pods/cluster indicating that selection through these traits would be effective. Path studies revealed that clusters/plant, pods/cluster and plant height as important traits for direct selection for yield as these traits have high direct effects. Days to maturity have high indirect effect via plant height which contributed to the positive and significant correlation with seed yield/plant. Other indirects effects that have shown positive and significant correlation with seed yield/plant comprised of pods/plant by pod length, pod length by plant height, 100-seed weight by pod length, seeds/pod by branches/plant, clusters/plant by pod length and pods/cluster by clusters/plant.

References

Al-Jibouri H.A., Miller P.A. and Robinson H.F. 1958. Genotypic and environment variances and covariance in upland cotton cross of interspecific origin. *Agronomy Journal,* 50: 633-636.

Bekavac G., Purar B. and Jockovic D. 2008. Relationships between line per se and testcross performance for agronomic traits in two broad-based populations. *Euphytica,* 162: 363-369.

Bizeti H.S., deCarvalho C.G.P., deSouza J.R.P., Destro D. 2004. Path Analysis under Multicollinearity in Soybean. *Agron. J.,* 47(5): 669-676.

Bocanski A., Sreckov Z., Natasic I., Alovic and Vukosavjev M. 2010. Correlation and path coefficient analysis of morphological traits of maize (*Zea mays* L.). *Research Journal of Agricultural Sciences* 42: 292-296.

Chaudhary R.R. and Joshi B.K. 2005. Correlation and Path Coefficient Analyses in Sugarcane. *Nepal Agric. Res. J.,* 6: 24-28.

Dash G.B. 2012. Variability and character association studies among micromutants of forage ricebean. *Forage Research* 38: 119-121.

Dewey D.R. and Lu K.H. 1959. Correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal* 51: 510-515.

Dodake M.M. and Dahat D.V. 2011. Association of characters and path coefficient analysis studies in ricebean

[*Vigna umbellata* (Thunb) Ohwi and Ohashi]. *International Journal of Agricultural Sciences*, 2: 359-361.

Grafius J.E. 1956. Components of yield in oats-a geometrical interpretation. *Agronomy Journal*, 48: 419-423.

Gupta S., Pandey A., Kumar A. and Pattanayaka 2014. Evaluation of genotypic variation and suitability of ricebean genotypes for mid-altitudes of Meghalaya, India. *Legume Research*, 37: 56-58.

Vasic, Mirjana, Varga, Jelica and Takac A. 2001. Selekcija pasulija (Dry bean breeding) Savremena poljoprivreda. *Contemporary Agriculture* 2: 237-245.

Wright S. 1921. The method of path coefficient. *Annals of Mathematical statistics* 5: 160-169.

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