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Correlation and path coefficient analysis for yield and its component characters in rice bean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] landraces of Nagaland in different environments

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ABSTRACT

The analysis of variance revealed significant differences among genotypes for all the characters studied, indicating high degree of variability in the material. The magnitude of genotypic correlation tended to be higher than phenotypic correlation for most of the characters. This suggested a strong genetic association between these traits. Correlation studies indicated that yield/plant was significantly positively associated with pod length, number of seeds per pod, 100 seed weight at both phenotypic and genotypic level indicating that selection through these traits would be effective. Negative significant correlation was recorded for 50% flowering with seed yield per plant. Genotypic Path analysis revealed that the maximum positive direct effect on seed yield has been shown by number of primary branches, number of pods per plant, plant height followed by 80% maturity and 100 seed weight. Primary branches and plant height exhibited positive direct effect and also showed significant positive correlation with yield at genotypic level indicating a true relationship between the characters. This suggests that while selection emphasis should be given on primary branches and plant height in increasing seed yield. The residual effect estimated was 0.2488 indicating that the characters under study are not sufficient to account for variability and there might be a few more characters other than those studied in the present investigation and thus inclusion of some more characters is required. Inclusion of some characters like leaf area index, chlorophyll content etc. could be considered important in order to derive a much clear picture of casual relationship. The present study suggested that while selection emphasis should be given on primary branches and plant height for improvement in seed yield.

Introduction

Rice bean *[Vigna umbellata (Thunb.) Ohwi and Ohashi]* is diploid (2n= 24) native to south and south east Asia (Ohwi Jisabura, 1965). This underutilized grain legume possesses high nutritional quality, has multipurpose usages and is more tolerant to pest and diseases (Chatterjee and Dana, 1977). Yield is a very complex character and dependent upon several component characters. The principal step for effective selection is the knowledge of association of economically important characters with yield and association among characters. The information on nature and magnitude of correlation coefficient help breeders to determine the selection criteria for simultaneous improvement of various characters along with seed yield. A study on correlation alone is not enough to give an exact picture of relative importance of direct and indirect influence of each of component characters on seed yield. In this context, path coefficient analysis is an important tool for plant breeder in partitioning the correlation coefficients into direct and indirect effects of independent variables on dependent variable (Jha *et al.,* 1996). The present research study was conducted to find out the correlation among different traits, direct and indirect contribution of these traits towards rice bean yield and to identify better combinations as selection criteria for developing high yielding rice bean genotype.

Materials and methods

The present study on correlation and path coefficient analysis in rice bean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] under varying Environments was under taken at School of Agriculture Sciences and Rural Development Farm (SASRD), Medziphema, Nagaland. Thirteen genotypes of rice bean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi] were collected from different district of Nagaland, *viz*, Tuensang, Wokha and Medziphema. These genotypes were evaluated in the cropping seasons of 2016 and 2017. Genotypes were sown on three different sowing dates by creating six environments in randomized block design with three replications in a plot size of 3m x 1m with 1m row-to-row spacing and 50cm plant to plant spacing. In each cropping season the genotypes were arranged in Randomized Block Design (RBD) with six sowing dates. 1st week July and 1st July, 2nd week July and 1st week August 2016 and 1st week June, 2nd week June in 2017. Observations were recorded on 5 randomly sampled plants for days to 50% flowering, number of primary branches, pods per cluster, number of pods per plant, pod length, number of seeds per pod, plant height, 80% maturity, 100 seed weight and seed yield per plant. The mean values were used for statistical analysis. Analysis of variance was done according to procedure given by Panse and Sukhatme (1987). The correlations were worked out as per methods suggested by Al-Jibouri *et al*. (1958) and path analysis was calculated according to Dewey and Lu (1959).

Results and discussion

The results of analysis of variance is presented in (Table 1) which revealed that significant genotypic differences existed for all the characters studied across the environments, indicating the presence of substantial genetic variability in rice bean.

Table 1. Analysis of variance (Mean squares) for yield and its component traits in six different Environments

Sources of Variation	Df	Days to 50% flowering	Primary branches	Pods per cluster	No. of pods per plant	Pod length (cm)	No. of seeds per pod	plant height (cm)	80% maturity	100 seeds weight (g)	seed yield per plant (g)
Env	5	4312.674	3.3901	2.287	1280.298	1.022	25.577	40530.13	7102.756	46.789	211.088
Rep (Env)	12	14.974	0.0721	0.0602	20.069	0.103	0.055	39.083	17.957	0.637	5.184
Genotype	12	316.46**	0.66**	1.71**	1249.44**	6.52**	33.04**	7968.33**	317.33**	906.98**	177.57**
Error	144	2.488	0.034	0.045	11.524	0.088	0.074	27.796	3.054	0.538	3.439

* Significant at 1% level of probability

Correlation analysis

Correlation studies indicated that (Table 2) yield/plant was significantly positively associated with pod length, number of seeds per pod, 100 seed weight at both phenotypic and genotypic level. Similar finding were reported on genotypic and phenotypic correlation coefficients observed that seed yield/ plant was significantly positively correlated with pod length and number of seeds/pod at both genotypic and phenotypic level (Gupta *et al*., 2014)**.** Direct Negative significant was recorded for 50% flowering with seed yield per plant. 50 per cent flowering was recorded highly significant and positive correlation with days to 80% maturity (0.7957*, 0.7436*) at both genotypic and phenotypic level. Days to 50% flowering showed significant negative genotypic correlation with seed yield per plant.

Association of primary branches with others characters revealed low correlation at both phenotypic and genotypic level. At both genotypic and phenotypic level the correlation coefficient of pods per cluster was found significant and positive correlation with number of pods per plant (0.7394*, 0.6800*). It is recorded negative significant correlation with 100 seed weight at genotypic level. Number of pods per plant exhibited high positive signification correlation with number of seeds per pod (0.776*, 0.742*) and plant height (0.779*, 0.739*) at both genotypic and phenotypic level. Negative significant association with 100 seed weight (-0.646*,-0.625*) was recorded at both genotypic and phenotypic level. At phenotypic level pod length exhibited high positive significant association with seed yield (0.689*).Number of seeds per pod exhibited high positive significant correlation with plant height (0.7255*, 0.682*) and seed yield (0.5825*, 0.689*) at both genotypic and phenotypic level. High negative significant association with 100 seed weight (-0.775*,-0.754*) at both the level was recorded. Plant height showed negative significant association with 100 seed weight (-0.531*,-0.516*) at both genotypic and phenotypic level. Association of seed yield with plant height revealed positive correlation. 80 % maturity did not exhibit any significant positive and negative correlation with the rest of the characters both at genotypic and phenotypic level. Association of 100 seed weight at both genotypic and phenotypic correlation revealed positive significant correlation with seed yield per plant (0.679, 0.678). Sonone and Saste (2004) revealed that seed yield had significant positive correlation with number of pods per plant, number of branches per plant, pod length, number of clusters per plant, 100 seed weight, number of pods per cluster, number of seeds per plant. Days to 50% flowering and days to maturity shows negative but significant correlation. Chaudhari (2000) reported that plant height, number of branches per plant and pod length showed significant positive association with grain yield. Gadekar and Dhumale (1990) reported that grain yield per plant was positively and significantly correlated with plant height, grains per pod, pods per plant, length of pod, cluster per plant and pods per cluster.

Table 2. Estimates of genotypic and phenotypic correlation coefficients for yield and its component characters in rice bean

Characters	50% flowering	Primary branches	Pods/cluster	No. of pods per plant	Pod length	No. of seed per pod	Plant height	80% maturity	100 seeds weight	Seed yield/plant
50%flowering	1(g)	-0.26249	-0.00819	-0.1363	0.1706	-0.2059	-0.1841	0.7957*	0.0589	-0.6013*
	1(p)	-0.2075	-0.0631	-0.1186	0.156	-0.1825	-0.1941	0.7436*	0.0533	-0.5697
Primary branches		1(g)	0.26901	0.17604	-0.2655	0.3724	0.4117	-0.1013	-0.3531	0.2743
		1(p)	0.1983	0.1697	-0.3017	0.3546	0.3696	-0.1047	-0.3279	0.2342
Pods/cluster			1(g)	0.7394*	0.4295	0.3854	0.3282	0.4363	-0.535*	0.229
			1(p)	0.6800*	0.3418	0.3534	0.3166	0.4045	-0.4948	0.2456
No.ofpods/Plant				1(g)	0.0609	0.7765*	0.7729*	0.2719	-0.6463*	0.3570
				1(p)	0.054	0.742*	0.739*	0.253	-0.625*	0.340
Pod length					1(g)	-0.0385	0.0182	-0.1296	0.3565	0.562
					1(p)	-0.019	0.016	-0.096	0.291	0.689*
Number of seeds/pod						1(g)	0.7255*	-0.1059	-0.7757*	0.5825*
						1(p)	0.682*	-0.096	-0.754*	0.689*
Plant height							1(g)	0.0413	-0.5312*	0.3437
							1(p)	0.046	-0.516*	0.336
80% maturity								1(g)	-0.2133	-0.5162
								1(p)	-0.204	-0.493
100 seeds weight									1(g)	0.6791*
									1(p)	0.678*

*Significant at 5% level

Path Coefficient analysis

The results obtained from pooled analysis on genotypic and phenotypic direct and indirect effects are presented (Table 3) as under.

Direct effect

Days to 50% flowering (3.9617*), pods per cluster (8.083*), number of pods per plant (6.195*), plant height (3.531), 80% maturity (0.6393*) and 100 seed weight (0.9242*) contributed maximum positive direct effect on seed yield per plant. Negative direct effect on yield was contributed by primary branches (--9.6719*), pod length (-6.476) and 80% maturity (-5.406).Reddy *etal* (2013) revealed Number of capsules per plant showed the higher and positive direct effect on seed yield. Such positive and high direct effects of these variables have also been reported Dahiya and Singh (1994).

Indirect effect

Days to 50% flowering

At phenotypic level, days to 50% flowering showed a high significant positive direct effect (**0.9617***). It showed high positive indirect effect via primary branches (0.7854*) 80% maturity (0.7726*) and 100 seed weight (0.6848*) .The indirect effects via other traits were of low magnitude. At genotypic level also day to 50% flowering showed low negative direct effect (**-0.2742**). It showed positive indirect effect via number of seeds per pod (0.1145) and pod length (0.4768). The indirect effects via other traits were of low magnitude.

Primary branches

At phenotypic level, primary branches showed very high negative direct effect (-9.671). It showed positive significant indirect effects via, pods per cluster (0.497), number of pods per plant (2.117*), plant height (1.428*), 80% maturity (0.6748*) and 100 seed weight (0.718*). At genotypic level primary branches showed low positive direct effect (0.082). The indirect effects via, number of pods (0.104), pods lenght (0.493) and plant height (0.621*) showed positive high indirect effects and negative indirect effects via, pods per cluster (-1.124) and 80% maturity (-0.218). Thanki and Sawargaonkar (2010) reported that number of branches per plant contributed indirectly via number of pods per plant towards seed yield per plant.

Pods per cluster

At phenotypic level, pods per cluster showed very high positive direct effect (8.083). It showed positive indirect effects via, days to 50% flowering (0.672*), number of pods per plant (0.336), plant height (0.892*), 80% maturity (3.378) and 100 seed weight (0.994). At genotypic level pods per cluster showed negative direct effect (-1.520). The indirect effects via, pods length (0.994), number of seeds per pod (0.214) and plant height (0.387) showed positive high indirect effects and negative indirect effects via, 80% maturity (-0.264).

Number of pods per plant

At phenotypic level, number of pods per plant showed very high positive direct effect (6.195). It showed positive indirect effects via, to pods per cluster (0.438), plant height (0.892) and indirect negative effect via, 50%flowering (-1.195), primary branches (-3.305), pod length (-4.807), number of seeds per pod (-3.091), 80% maturity (-1.57) and 100 seed weight (-0.126). At genotypic level number of pods per plant showed positive direct effect (0.242). The indirect effects via, plant height (0.334), 80% maturity (0.145) showed positive effect. The indirect effects via other traits were of low magnitude.

Pod length (cm)

At phenotypic level, Pod length showed very high negative direct effect (-6.476). It showed positive indirect effects via, 50%flowering (1.404) pods per cluster (6.000), 80% maturity (4.078). At genotypic level Pod length showed positive direct effect (1.280). The indirect effects via, showed positive indirect effects, number of seeds per pod (0.201) and negative indirect effect via,50% flowering (-0.102),pods per cluster (0.6825*), 80% maturity (-0.485).

Plant height (cm)

At phenotypic level plant height showed very high positive direct effect (3.531). It showed positive indirect effects via, pods per cluster (2.043), pods length (0.623), 80% maturity (1.101), and indirect negative effect via, primary branches (-3.912) and 100 seed weight (-1.441). At genotypic level plant height showed positive direct effect (1.423). The indirect effects showed negative indirect effect via, pods per cluster (-0.413) and pod length (-0.135). Thanki and Sawargaonkar (2010) exhibited that plant height contributed indirectly via number of pods per plant towards seed yield per plant.

80% maturity

At phenotypic level 80% maturity showed very high negative direct effect (-5.406). It showed positive indirect effects via, primary branches (4.785), number of pods (1.800), pods length (4.885), number of seeds (2.156), and indirect negative effect via, pods per cluster (-5.051), plant height(-0.719) and 100 seed weight (-1.099). At genotypic level 80% maturity showed positive direct effect (0.409). The indirect effects showed positive indirect effect via, pods per cluster (0.982). The indirect effects via other traits were of low magnitude. Thakur and Bhardwaj (2017) repored that Days to maturity have high indirect effect via plant height which contributed to the positive and significant correlation with seed yield/plant.

100 seeds weight (gm)

At phenotypic level 100 seeds weight showed very high positive direct effect (2.924). It showed high positive significant indirect effects via, 50%f lowering (0.927*), pods per cluster (2.747), 80% maturity (2.031) and indirect negative effect via, primary branches (-2.375), number of pods per plant (-0.268), pod length (-3.411). At genotypic level 100 seeds wgt showed positive direct effect (0.068). The indirect effects showed positive indirect effect via, pods length (0.745) and indirect negative effect via, pods per cluster (-0.542) and plant height (-0.734). The indirect effects via other traits were of low magnitude.

From this result, it was indicated that there is a true relationship between grain yield with days to 50% flowering, pods per cluster, number of pods per plant, plant height, 80% maturity and 100 seed weight. Reddy *et al* (2013) revealed Number of capsules per plant showed the higher and positive direct effect on seed yield. Dash (2012) did analysis of path coefficient 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.

Primary branches and plant height exhibited positive direct effect and also showed significant positive correlation with yield at genotypic level indicating a true relationship between the characters. This suggests that while selection emphasis should be given on primary branches and plant height in increasing seed yield. The residual effect estimated was 0.2488 indicating that the characters under study are not sufficient to account for variability and there might be a few more characters other than those studied in the present investigation and thus inclusion of some more characters is required. Inclusion of some characters like leaf area index, chlorophyll content etc. could be considered important in order to derive a much clear picture of casual relationship. The present study suggested that while selection emphasis should be given on primary branches and plant height for improvement in seed yield.

Table 3. Direct and indirect effects for yield and its component characters for six different environments at phenotypic and genotypic level

Character	50% flowering	Primary branches	pods/ cluster	No. of pods per plant	pod length	No. of seed per pod	plant height	80% maturity	100 seeds weight	P and G correlation with seed yield per plant
50%flowering	3.9617*(p)	0.7854*	-0.6417*	-0.869*	-0.2965	-0.5459	-0.3697	0.7726*	0.6848*	-1.9375*
	-0.2742(g)	0.0222	0.0124	-0.0644	0.4768	0.1145	-0.1442	-0.1445	0.0189	0.0175
Primary branches	0.7854*(p)	-9.6719*	0.4968	2.117*	-0.2885	-0.3240	1.428	0.6748*	0.7183*	0.6645*
	-0.0738(g)	0.0826	-1.124	0.1041	0.4936	0.0912	0.6210*	-0.2186	0.0157	0.645*
pods/cluster	0.6725*(p)	-0.5772	8.083*	0.3360	-0.8078*	-0.0904	0.8926*	3.378*	0.9941*	-0.6779*
	-0.0483(g)	0.0611	-1.520	0.0148	0.9944*	0.2149	0.3870	-0.2644	0.0245	0.0983
No of pods per plant	--1.195 (p)	-3.305	0.0116	6.195	-4.807	-3.091	0.1067	0.152	-0.126	0.8521*
	0.242 (g)	-0.0058	-0.0488	-0.0878	-0.0435	0.0225	0.3343	0.145	-0.0202	0.6712*
pod length(cm)	1.404 (p)	-0.4176	6.000	-0.1211	-6.476	-0.8510	-0.3398	4.078	-0.1267	-1.892*
	-0.102 (g)	-0.0347	0.6825*	0.0377	1.280	0.201	0.0284	-0.4856	-0.0224	0.361
No. of seeds per pod	0.4643(p)	-0.0618	0.9727*	0.0967	-0.4149	-0.1824	0.1612	0.7870*	0.9830*	0.5898*
	-0.1129(g)	0.0271	-0.1750	0.0044	0.9291*	0.2780	0.0588	-0.2173	0.0236	0.4692
plant height (cm)	-0.0001(p)	-3.912	2.043	0.0339	0.623*	0.0718	3.531	1.101	-1.441	0.9774*
	0.1554(g)	-0.333	-0.413	0.0104	-0.135	0.1499	1.423	-0.0331	-0.0105	0.6802*
80%maturity	-0.2990(p)	4.785	-5.051	1.800	4.885	2.156	-0.7190*	-5.406	-1.099	-1.1922*
	-0.0344(g)	0.0487	0.982*	-0.0292	-0.0770	0.0659	-0.1529	0.409	0.0227	-0.8614*
100 seeds weight (gm)	0.9278*(p)	-2.375	2.747	-0.2685	-3.411	-0.4060	-0.7401*	2.031	2.924	-1.8054*
	-0.0752(g)	0.0189	-0.5428	-0.0163	0.7459*	0.0955	-0.7348*	-0.0271	0.0687	-0.1263

***Significant at 5% level** **Residual effect:** = 0.8866(phenotypic path), Residual **effect:** 0.2488(genotypic path)

References

1. Al-Jibouri, H. A., Miller, P. A. and Robinson, H. F. (1958) Genotypic and environmental variances, covariances in upland cotton cross of interspecific origin. *Agronomy Journal* 50: 633-636.
2. Chatterjee, B. N. And Dana, S. (1977) Rice bean (*Vigna umbellata*) (Thumb, Ohwi and Ohashi*).* Trop. Grain Legume Buel. 10: 22-25
3. Chauduari, G. B., Patil, J. V. and Barhate, K. K. (2000) Character association in rice bean (*Vigna umbellata*) (Thumb, Ohwi and Ohashi*). Legume Res.* 23 (1): 25-28.
4. Dahiya, S.K. and Singh, S. (1994) Path analysis in pigeonpea. *Crop Res*. Hisar, **20**: 160-163.
5. 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.
6. Dewey, D. R. and Lu, K. H., (1959) A correlation and path coefficient analysis components of crested wheat grass seed production. *Agronomy Journal* 51: 515-518.
7. Dash, G.B. (2012) Variability and character association studies among micromutants of forage ricebean. *Forage Research* **38**: 119-121.
8. Gupta, S., Pandey, A, Amit, K. and Pattanayak, A. (2014) Evaluation of Genotypic variation and suitability of rice bean for mid-altitudes of Meghalaya, India. *Legume Research-An International Journal*, **37**.568-574.
9. Gadekar, P. and Dhumale, D. B. (1990) Study of genetic variability in rice bean. *Annals Pant. Physiology* **4 (1):** 92-95.
10. Jha, S.K., Awasthi, L.P. and Maurya D. M. (1996) Nature of association among some quantitative traits in wild rice. Indian Journal of Genetics and Plant Breeding. 58 (3):307-311.
11. Ohwi Jisabura (1965) Flora of Japan. Smithsonian Insti. Washington D C, 565.
12. Panse, V. G. and Sukhatme, P. V. (1957) Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi.
13. Thanki, H. P. and Sawargaonkar, S. L. (2010) Path coefficient analysis in pigeonpea (Cajanus cajan L. Millsp.). *Electronic Journal of Plant Breeding*, **1(4):** 936-939.
14. Sanchit, T. and Neelam, B. (2017) Correlation and Path Analysis of Yield and its Components Plant Traits in Ricebean [*Vigna umbellata* (Thunb.) Ohwi and Ohashi]. *International Journal of Current Microbiology and Applied Sciences,* Vol **(6):**3272-3278.
15. Sonone A H, Saste S V. (2004). Genetic diversity and path analysis in rice bean (*Vigna umbellata* (Thumb) Ohwi and Ohashi.
16. Reddy, M. P., Reddy B. R., Arsul, B. T and Maheshwari, J. J. (2013) Character Association and Path Coefficient Studies in Linseed. *Int. J. Curr. Microbiol. App.Sci.* **2(9):** 250-254

