Indian J. Plant Physiol., Vol. 9, No. 1, (N.S.) pp. 94-97 (Jan.-March, 2004)

SHORT COMMUNICATION

ASSOCIATION AMONG GROWTH AND YIELD PARAMETERS IN RICEBEAN (*VIGNA UMBELLATA*) GENOTYPES

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Received on 17 Jan., 2003, Revised on 4 Dec., 2003

Correlation and path analysis of various growth parameters in 25 genotypes of ricebean showed significant correlations of AGR, CGR, LAI and LAD with seed number/plant and seed yield/plant. The correlation between seed number/plant and yield/plant was significant. Growth parameters AGR, CGR and number of seeds/plant were the most suitable traits for achieving yield enhancement in ricebean. Though CGR and LAD showed high positive correlation with yield, their direct effect was high and negative. Therefore, AGR and LAI with seeds/plant are the most effective traits for selection for higher yield.

***Key words*: Correlation, growth parameters, path-coefficient, ricebean, *Vigna umbellata*, yield**

Selection is one of the simplest methods to improve yield and it suits specially for crops like ricebean [*Vigna umbellata* (Thunb.) Ohwi & Ohashi] which has remained underutilized specially in India. Ricebean, a native of south and south east Asia, has wide adaptability, high nutritional and storage quality and high grain yield with resistance to yellow mosaic virus. It is gaining popularity as a supplementary food crop and therefore, having potential for future. (Sarma *et al*. 1991, Lokesh and Veeresh, 1993, Arya and Singh 1994, Sharma and Hore, 1994). The interrelationship and association between growth parameters and yield need to be evaluated so as to use them as selection criteria for quick varietal improvement. Since, path analysis gives much better estimate of association between traits than correlation, both the correlation and path coefficient analysis were undertaken to identify suitable yield identifying traits.

The trial for the present investigations was carried out during summer season of 1999 at the experimental farm of the Department of Plant Breeding and Genetics, Chaudhary Sarwan Kumar, Himachal Pradesh Krishi Vishwavidyalaya, Palampur (1300 m amsl, 36º6'N & 76º3'E) which represent mid hill zone of Himachal Pradesh and in general a high rainfall area. The experiment was laid out in a randomised block design in three replications with plot size of 3.0 x 2.25 m^2. Spacing was kept at 45 cm x 15 cm. The twenty five genotypes of rice bean obtained from NBPGR, New Delhi were RBL33-1, RBL35, PRR9301, PRR9302, PRR9303, PRR9401, PRR9402, Naini, Chaukhamba, Mansa, BRS1, BRS2, BRS4, PRR8901, PRR8801, BDS1139, C x M7811, IC14647, EC18185, TCR 623, BDS2430, IC19352, H1658, EC1818-3 and TCR48. Data on dry matter and leaf area were recorded. The area of leaves was measured by ΔT Area Meter (MK2, Hittachi) and expressed as total leaf area per plant. The dry matter of leaves plus twigs, stems and pods was taken separately and total dry weight accumulation was determined. The data was recorded initially on 35 days after sowing and repeated after 12 days interval till maturity. The growth parameters AGR, CGR, RGR, NAR, LAR, SLA, SLW, LWR, LAI and

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LAD were calculated and average of different stages covering the period from 35 days to 107 days after sowing was determined. However, for the calculation of NAR, LAR, SLA, LAI and LAD the last interval i.e. from 108 days to maturity was not included in calculating the averages as leaves were dried or dropped and leaf area could not be measued at this stage. Various growth parameters were calculated as per the formulae of Blackman (1919) and Radford (1967). Phenotypic and genotypic correlations were compared as per A1 Jibouri *et al.* (1958) and path coefficients by the method of Dewey and Lu (1959).

AGR and CGR showed significant correlations with seed yield, seed/plant, LAI and LAD (Table 1). AGR and CGR also showed significant correlation between them. LAI and LAD also showed significant correlations with grain yield. LAR showed high

Table 1. Phenotypic and genotypic correlation coefficients of growth parameters with yield in ricebean.

Growth parameters		CGR (g/dm^2 day)	RGR (g/g/ day)	NAR (g/dm^2/ day)	LAR	SLA (dm^2/g)	SLW (g/dm^2)	LWR	LAI	LAD (day)	Seeds/ Plant	100 seed weight (g)	Protein content (%)	Yield/ plant (g)
AGR (g/day)	P	0.907*	0.283	-0.139	0.150	0.031	-0.060	0.317	0.574*	0.553*	0.634*	0.284	-0.208	0.842*
	G	0.998	0.908	-0.311	0.176	0.018	0.054	0.444	0.606	0.596	0.678	0.294	-0.244	0.924
CGR (g/dm^2/day)	P		0.151	-0.197	0.185	0.014	0.017	0.407*	0.585*	0.569*	0.581*	0.327	-0.247	0.822*
	G		0.937	-0.238	0.190	-0.084	0.074	0.534	0.665	0.636	0.614	0.375	-0.289	0.879
RGR (g/g/day)	P			0.096	0.033	0.022	-0.070	0.048	-0.007	-0.013	0.306	-0.142	0.001	0.204
	G			-0.028	-0.134	0.695	0.221	-0.463	0.045	0.246	1.400	-0.769	-0.219	1.184
NAR (g/dm^2/day)	P				-0.670*	-0.479*	0.393*	-0.229	-0.420	-0.442*	-0.090	-0.227	0.201	-0.201
	G				-0.887	-0.791	0.710	-0.494	-0.610	-0.630	-0.129	-0.382	0.412	-0.324
LAR	P					0.662*	-0.614*	0.239	0.399*	0.420*	0.226	0.051	-0.086	0.248
	G					0.872	-0.691	0.351	0.395	0.420	0.291	0.110	-0.159	0.366
SLA (dm^2/g)	P						-0.645*	-0.334	0.191	0.245	0.107	-0.084	0.055	0.038
	G						-0.759	-0.233	0.184	0.278	0.196	-0.169	0.045	0.119
SLW (g/dm^2)	P							0.142	-0.447*	-0.480*	-0.137	0.045	-0.226	-0.089
	G							-0.015	-0.442	-0.501	-0.203	0.017	-0.229	-0.145
LWR	P								0.456*	0.388*	0.103	0.412*	-0.183	0.362
	G								0.613	0.517	0.122	0.602	-0.241	0.450
LAI	P									0.983*	0.257	0.385	0.037	0.467*
	G									0.992	0.279	0.457	-0.024	0.528
LAD (day)	P										0.297	0.308	0.045	0.464*
	G										0.320	0.380	-0.013	0.525
Seeds/plant	P											-0.368	-0.137	0.847*
	G											-0.397	-0.137	0.869
100 seed weight (g)	P												-0.244	0.142
	G												-0.296	0.107
Protein content (%)	P													-0.412*
	G													-0.440

*Significant at 5% level

correlation with SLA, LAI and LAD while LWR showed high correlation with LAI, LAD and 100 seed weight. LAR & LWR, however, did not correlate with grain yield. Thakur *et al.* (2003) have reported corrleations of CGR, LAI and RGR exclusively during grain filling period with seed yield in ricebean while Chatterjee *et al.* (1987) reported association of seed yield with LAD between flowering to maturity. Thus, AGR, CGR, LAI and LAD are the most important growth parameters in ricebean for making indirect selection for yield. RGR and NAR though seem important did not show correlations with grain yield. LAR shows assimilatory material (leaf area) per unit of plant material and LWR leaf weight to total dry weight ratio both exhibited association with LAI and LAD, important parameters of yield. However, LAR and LWR *per se* could not exhibit correlation with yield in the present study. Similarly SLA and SLW measuring leaf thickness were also found to be unrelated with grain yield.

Path coefficient analysis has revealed high direct positive effect of AGR and high indirect positive effect through leaf area index, seeds/plant and 100 seed weight at genotypic level of which indirect effect was highest through seeds/plant (Table 2). Though direct effect of CGR was high and negative, it contributed positively through AGR, LAI seed number and 100 seed weight to a greater extent and through LAR and SLW to lesser extent. Both the AGR and CGR showed high correlation with yield. The other two growth parameters which showed high correlations with yield were LAI and LAD. Direct contribution of LAI was very high and positive while that of LAD high and negative. However, both contributed positively and indirectly through AGR, seeds/ plant, seed weight and NAR specifically at genotypic level. LAD also contributed with high positive magnitude through LAI. Correlations between LAR & SLW with yield were not significant, however, path analysis revealed their positive direct effect.

The variation, associations and path analysis studies of growth parameters and yield components have shown that AGR, CGR, LAI and LAD alongwith seed number per plant and seed weight will be the most suitable criteria of selection for higher yield. Seed number and seed weight are the direct component of grain yield and these could be most reliable criteria of selection alongwith growth parameters. Since, CGR and LAD showed negative direct effect, though these have positive correlations, these have to be given less importance than AGR and LAI. The genotypes PRR9303, PRR9302,

Table 2. Estimate of direct and indirect effects of growth parameters on yield of ricebean.

Traits	AGR	CGR	RGR	NAR	LAR	SLA	SLW	LWR	LAI	LAD	Seeds/ plants	100 seed weight	Protein content	Correlation
AGR	14.385	-26.265	-2.642	0.394	0.813	-0.012	0.587	-4.549	23.413	-16.522	9.601	1.899	-0.177	0.924
CGR	14.363	-26.305	-2.728	0.302	0.878	0.054	0.804	-5.469	25.690	-17.616	8.692	2.423	-0.209	0.879
RGR	13.060	-24.657	-2.910	0.036	-0.618	-0.451	2.392	4.744	1.721	-6.827	19.816	-4.962	-0.158	1.184
NAR	-4.468	6.272	0.082	-1.269	-4.094	0.514	7.690	5.058	-23.551	17.441	-1.830	-2.468	0.298	-0.324
LAR	2.535	-5.006	0.390	1.125	4.615	-0.566	-7.485	-3.596	15.267	-11.627	4.120	0.708	-0.115	0.366
SLA	0.261	2.203	-2.022	1.004	4.024	-0.649	-8.226	2.392	7.117	-7.707	2.778	-1.089	0.032	0.119
SLW	0.780	-1.952	-0.643	-0.901	-3.189	0.493	10.832	0.153	-17.068	13.883	-2.868	0.499	-0.165	-0.145
LWR	6.387	-14.042	1.347	0.626	1.620	0.152	-0.162	-10.246	23.666	-14.332	1.720	3.887	-0.175	0.450
LAI	8.721	-17.500	-0.130	0.774	1.825	-0.12	-4.788	-6.279	38.617	-27.472	3.948	2.949	-0.017	0.528
LAD	8.579	-16.728	-0.716	0.799	1.937	-0.181	-5.429	-5.301	38.295	-27.703	4.529	2.453	-0.009	0.525
Seeds/plant	9.758	-16.155	-4.075	0.164	1.344	-0.127	-2.195	-1.245	10.773	-8.865	14.153	-2.561	-0.099	0.869
100 seed weight	4.230	-9.870	2.237	0.485	0.506	0.110	0.836	-6.167	17.633	-10.523	-5.613	6.457	-0.214	0.107
Protein content	-5.522	11.922	1.001	-0.820	-1.154	-0.045	-3.891	3.883	-1.454	0.546	-3.040	-3.002	1.137	-0.440

Residual value = -0.021

PRR9301 and RBL33-1 in the early maturity group and BDS2430, IC14647 and TCR48 in the late group have given yields which were higher than the other genotypes (Das 2000). All these genotypes have shown higher magnitudes of AGR, CGR, LAI and LAD thereby validifying the conclusions drawn in the present study.

REFERENCES

A1-Jibouri, H.A., Miller, P.A. and Robinson, H.P. (1958). Genotypic and phenotypic covariance in an upland cotton cross of interspecific origin. *Agron. J.* **50:** 633-636.

Arya, M.P.S. and Singh, R.V. (1994). Response of ricebean (*Vigna umbellata*) to source and levels of phosphorus. *Legume Res.* **17:** 41-46.

Blackman, V.N. (1919). The compound interest law and plant growth. *Ann. Bot.* **33:** 353-360.

Chatterjee, B.N., Bhattacharya, K.K., Miah, A.A., Wallis, E.S. and Mlyth, D.F. (1987). Growth analysis of ricebean. Food Legume Improvement for Asian Farming System 249, Proc. No. 18, ACIAR. Aust. Centre for International Agri. Res. (Queensland), Australia.

Das, Y. (2000). Genetic studies on growth and yield attributes in ricebean [*Vigna umbellata* (Thumb.) Ohawi & Ohashi]. M.Sc. Thesis, Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

Dewey, D.R. and Lu, K.H. (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.* **51:** 515-518.

Radford, P.J. (1967) Growth analysis formulae-their use and abuses. *Crop. Sci.* **7:** 171-175.

Lokesh, R. and Veeresh, L.A. (1993). Induced mutagenesis and genetic improvement of ricebean [*Vigna umbellata* (Thumb.) Ohawi & Ohashi]. *Legume Res.* **16:** 37-40.

Sarma, B.K., Singh, M. and Pattanayak, A. (1991). Evaluation of ricebean (*Vigna umbellata*) germplasm in upland terraces of Meghalaya. *Indian J. Agric. Sci.* **61:** 182-184.

Sharma B.D. and Hore, D.K. (1994). Association of yield attributes in ricebean (*Vigna umbellate*). *Legume Res.* **17:** 135-137.

Thakur, S.R., Das, Y. and Singh, K.P. (2003). Stage specificity in growth parameter analysis for indirect selection in riceban. *J. Nature Conserv.* **15:** 507-515.