

Genetic variability and character association study in dolichos bean

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ABSTRACT

Twenty four dolichos bean genotypes from different parts of India were evaluated for ten quantitative traits in Andaman Islands. Moderate to low genotypic and phenotypic coefficients of variation were recorded for all the traits. High heritability (70.97%) and high genetic advance (74.96%) were observed for plant height, while high heritability (64.24%) but low genetic advance (2.58%) were recorded for pod length. Pod length ($r = 0.611$), number of seeds per pod ($r = 0.764$), number of pods per plant ($r = 1.00$) and pod yield per plant ($r = 1.00$) had positive and significant correlation with pod yield. Path coefficient analysis revealed maximum direct effect of days to 50% flowering, pod width, number of pods per plant and pod yield per plant on pod yield indicating traits of importance for yield improvement.

Key words: Dolichos bean, heritability, genetic advance, correlation, path coefficient.

INTRODUCTION

Dolichos bean (*Dolichos lablab* L.; Fabaceae) also called as Indian bean, is grown throughout the tropical region of Asia, Africa and America. It has good potential in nutrition and livelihood of people with sustainable land care (National Research Council, 5). Its green pods (100 g) contain 6.7 g carbohydrates, 3.8 g protein, 210 mg Ca, 1.7 mg Fe, 312 IU vitamin A and 0.1 mg thiamine (Gopalan *et al.*, 2). However, this crop still not gained desired attention from geneticists and breeders even though wide genetic base exists for breeding programmes (Magalingam *et al.*, 3; Patel *et al.*, 6; Upadhyay and Mehta, 9). High heritability coupled with high genetic gain for most of characters also indicate for selection with a view to improve yield and its component traits (Singh and Parthasarthy, 7; Parmar *et al.*, 5; Upadhyay *et al.*, 10). Path coefficient analysis helps in identifying the most promising components and minimizes undesired characters in selection process by partitioning the total correlation into direct and indirect effects of different components (Wright, 11). Hence, the study was aimed to ascertain the influence of different characters on pod yield in different dolichos bean genotypes under Island conditions.

MATERIALS AND METHODS

Twenty four genotypes of dolichos bean were collected from different parts of India and maintained at ICAR-Central Island Agricultural Research Institute, Port Blair. Each genotype was planted in complete randomized block design with three replications. Each

plot was 4 m long and consisted four rows spaced 1 m apart. Fertilizers were applied @ 50 kg urea and 40 kg super phosphate per hectare. Morphological observations were recorded from middle two rows of each plot for different characters, viz., plant height (cm), days to 50% flowering, days to first harvesting, days to maturity, pod length (cm), pod width (cm), No. of seeds per pod, No. of pods per plant, pod yield per plant (g) and pod yield (q/ha). Two years mean data were subjected to analysis for variance, mean and range of each character. Genetic parameters such as phenotypic and genotypic coefficients of variation (PCV and GCV), broad sense heritability (h^2), genetic advance as percent over mean (genetic gain), and path coefficient analyses was done by online OPSTAT software (<http://hau.ernet.in/opstat.html>).

RESULTS AND DISCUSSION

The differences were found to be significant for all the traits under study (Table 1). In the present study, all the traits exhibited low to moderate genotypic and phenotypic correlation variations (Table 2). The magnitude of differences between genotypic coefficient of variation and phenotypic coefficient of variation were observed to narrow for plant height, days to 50% flowering and days to maturity. It indicated less influence of environment on the expression of these traits. The range of variation were higher for pod yield per plant (292.82-873.30 g) followed by plant height (118.10-271.80 cm), pod yield (q/ha) and days to maturity (105.00-141.25 days). The phenotypic coefficient of variation is higher than genotypic coefficient of variation.

Though the GCV and PCV were slightly higher for No. of pods per plant (27.84, 39.44) and pod yield

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Table 1. Analysis of variance for different traits in dolichos bean.

Source of variation	DF	Mean sum of squares									
		Plant height (cm)	Days to 50% flowering	Days to first harvesting	Days to maturity	Pod length (cm)	Pod width (cm)	No. of seeds/pod	No. of pod/plant	Pod yield/plant (g)	Pod yield (q/ha)
Replication	3	455.16	10.18	10.16	10.16	0.37	0.63	0.01	13.66	516.66	33.85
Treatment	23	8,227.25*	334.60**	341.08**	341.09*	11.08**	4.98**	0.60**	794.70**	101,004.27*	1,013.77**
Error	69	763.39	60.38	60.38	60.38	1.35	3.96	0.16	159.79	16,689.90	180.11

*,** Significant at 5 and 1% levels

Table 2. Mean, range, GCV, PCV, h², genetic advance and genetic advance percent over mean in different traits of dolichos bean.

Trait	Mean	Range	GCV (%)	PCV (%)	Heritability (%)	Genetic advance	Genetic advance percent over mean
Plant height (cm)	183.75	118.10-271.80	23.51	27.91	70.97	74.96	40.80
Days to 50% flowering	81.29	59.00-95.25	10.19	13.97	53.17	12.44	15.30
Days to first harvesting	92.38	81.75-106.25	9.07	12.37	53.75	12.65	13.70
Days to maturity	127.38	105.00-141.25	6.58	8.97	53.75	12.65	9.93
Pod length (cm)	8.25	6.15-11.72	18.91	23.59	64.24	2.58	31.22
Pod width (cm)	10.90	8.24-12.83	4.62	18.85	6.01	0.25	2.33
No. of seeds/pod	4.23	3.81-5.77	7.83	12.32	40.44	0.43	10.26
No. of pods/plant	45.25	30.50-80.75	27.84	39.44	49.83	18.32	40.49
Pod yield/plant (g)	485.46	292.82-873.30	29.91	40.03	55.81	223.43	46.02
Pod yield (q/ha)	48.35	29.35-87.37	29.86	40.77	53.64	21.78	45.05

(q/ha) (29.86, 40.77) but these were accompanied low genetic advance 18.32 and 21.78%, respectively (Table 2). Thus, the expression of these traits was found to be governed by non-additive gene action. Plant height possesses high heritability accompanied with high genetic advance (74.96%) and this character is governed by additive gene action and selection will be rewarding for this trait. However, pod yield per plant has moderate heritability (55.81) accompanied with high genetic advance (223.43%) (Table 2). Singh and Parthasarathy (7) also reported high heritability and genetic advance for pods/plant, pod yield/plant and pods/panicle in dolichos bean. It indicated that this trait is governed by additive gene action and the low heritability is being exhibited due to high environment effect. In such situation selection may be effective. Rest of the traits exhibited low heritability accompanied with low genetic advance. It again indicates that these characters are highly influenced by environment effects and selection of these traits will be less effective.

In general, genotypic correlation coefficients were higher than the phenotypic correlation coefficients

which might be due to masking or modifying effect between these characters (Table 3). Pod yield per plant was positively and significantly correlated with pod length (0.48, 0.61), number of seeds per pod (0.39, 0.76), number of pods per plant (0.89, 1.02) and pod yield per plant (0.97, 1.01) at genotypic and phenotypic levels. While plant height negatively and significantly correlated with yield at both the levels. Inter-correlation coefficient be useful information in breeding programme for simultaneous improvement of various yield contributing traits. In the present study, the important yield contributing, *i.e.*, pod length was positively significantly correlated with days to 50% flowering, days to first harvesting and days to maturity. The results were in conformity with the earlier findings (Uddin and Newaz, 8; Parmar *et al.*, 5). While number of pods and seeds per pod were positively and significantly correlated with pod length. However, number of pods per plant was also positively and significantly correlated with pod length and number of seeds per pod.

The path coefficient analysis revealed that the traits like pod yield per plant, number of pods

Table 3. Phenotypic and genotypic correlations coefficient matrix for different traits of dolichos bean.

Trait		Plant height (cm)	Days to 50% flowering	Days to first harvesting	Days to maturity	Pod length (cm)	Pod width (cm)	No. of seeds/pod	No. of pods/plant	Pod yield/plant (g)	Pod yield (q/ha)
Plant height (cm)	P	1.000									
	G	1.000									
Days to 50% flowering	P	-0.049 ^{NS}	1.000								
	G	-0.077 ^{NS}	1.000								
Days to first harvesting	P	-0.036 ^{NS}	0.999 ^{**}	1.000							
	G	-0.073 ^{NS}	0.999 ^{**}	1.000							
Days to maturity	P	-0.036 ^{NS}	0.999 ^{**}	1.000 ^{**}	1.000						
	G	-0.073 ^{NS}	0.999 ^{**}	1.000 ^{**}	1.000						
Pod length (cm)	P	0.005 ^{NS}	0.243 [*]	0.245 [*]	0.245 [*]	1.000					
	G	-0.027 ^{NS}	0.399 ^{**}	0.401 ^{**}	0.401 ^{**}	1.000					
Pod width (cm)	P	-0.220 [*]	-0.008 ^{NS}	-0.007 ^{NS}	-0.007 ^{NS}	0.024 ^{NS}	1.000				
	G	-1.006 ^{**}	-0.133 ^{NS}	-0.126 ^{NS}	-0.126 ^{NS}	0.346 ^{**}	1.000				
No. of seeds/pod	P	-0.084 ^{NS}	0.005 ^{NS}	0.005 ^{NS}	0.005 ^{NS}	0.374 ^{**}	-0.011 ^{NS}	1.000			
	G	-0.237 [*]	0.064 ^{NS}	0.064 ^{NS}	0.064 ^{NS}	0.471 ^{**}	-0.227 [*]	1.000			
No. of pods/plant	P	-0.220 [*]	0.150 ^{NS}	0.146 ^{NS}	0.146 ^{NS}	0.474 ^{**}	-0.219 [*]	0.376 ^{**}	1.000		
	G	-0.329 ^{**}	0.300 ^{**}	0.292 ^{**}	0.292 ^{**}	0.594 ^{**}	0.320 ^{**}	0.841 ^{**}	1.000		
Pod yield/plant (g)	P	-0.297 ^{**}	0.159 ^{NS}	0.156 ^{NS}	0.156 ^{NS}	0.501 ^{**}	0.171 ^{NS}	0.396 ^{**}	0.917 ^{**}	1.000	
	G	-0.426 ^{**}	0.281 ^{**}	0.274 ^{**}	0.274 ^{**}	0.610 ^{**}	0.377 ^{**}	0.763 ^{**}	1.004 ^{**}	1.000	
Pod yield (q/ha)	P	-0.297 ^{**}	0.147 ^{NS}	0.144 ^{NS}	0.144 ^{NS}	0.485 ^{**}	0.177 ^{NS}	0.393 ^{**}	0.893 ^{**}	0.972 ^{**}	1.000
	G	-0.440 ^{**}	0.269 ^{**}	0.260 [*]	0.260 [*]	0.611 ^{**}	0.354 ^{**}	0.764 ^{**}	1.017 ^{**}	1.013 ^{**}	1.000

*,** Significant at 5 and 1% levels; NS = Non significant

per plant, pod width and days to 50% flowering exercised maximum direct effect on pod yield (q/ha) at genotypic and phenotypic levels (Table 4). The results were in conformity with earlier findings of Upadhyay *et al.* (10), and Anburani and Shalini (1). Plant height, days to first flowering and days to maturity had negative direct effect on pod yield (q/ha). Although, pod length had positive and significant correlation with yield but negative direct effect on yield it means this character can also be included in selection. It was seen that pod yield per plant, number of pods per plant, pod width and days to 50% flowering exhibited maximum direct effect on pod yield indicating these traits are important for yield improvement.

From the above study, it can be concluded that sufficient variability exists in most of the traits under study. High heritability and genetic advance for plant height demonstrated the possibility of improvement through selection. Evaluation of yield components indicated that pod length, No. of seeds per pod, No. of pods per plant and pod yield per plant are the major

attributes through which high yielding genotypes may be selected. The results of path analysis indicated that days to 50% flowering, pod width, No. of pods per plant and pod yield per plant were the important characters determining pod yield in dolichos bean. These traits may be considered as important criteria for selection in dolichos bean.

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Table 4. Direct and indirect effects of different trait on pod yield of dolichos bean.

Trait		Plant height (cm)	Days to 50% flowering	Days to first harvesting	Days to maturity	Pod length (cm)	Pod width (cm)	No. of seeds/pod	No. of pods/plant	Pod yield/plant (g)	Correlation with pod yield q/ha
Plant height (cm)	P	-0.001	-0.019	0.009	0.009	0.000	-0.037	-0.002	-0.089	-0.167	-0.297**
	G	0.103	-0.071	-0.004	0.068	0.002	-0.207	-0.018	-0.300	-0.014	-0.440**
Days to 50% flowering	P	0.000	0.489	-0.246	-0.245	0.000	-0.001	0.000	0.060	0.089	0.147 ^{NS}
	G	-0.008	0.916	0.055	-0.927	-0.027	-0.027	0.005	0.273	0.009	0.269**
Days to first harvesting	P	0.000	0.489	-0.246	-0.245	0.000	-0.001	0.000	0.059	0.087	0.144 ^{NS}
	G	-0.008	0.914	0.055	-0.928	-0.028	-0.026	0.005	0.265	0.009	0.260*
Days to maturity	P	0.000	0.489	-0.246	-0.245	0.000	-0.001	0.000	0.059	0.087	0.144 ^{NS}
	G	-0.008	0.914	0.055	-0.928	-0.028	-0.026	0.005	0.265	0.009	0.260*
Pod length (cm)	P	0.000	0.119	-0.060	-0.060	0.002	0.004	0.008	0.192	0.282	0.485**
	G	-0.003	0.366	0.022	-0.372	-0.069	0.071	0.035	0.540	0.020	0.611**
Pod width (cm)	P	0.000	-0.004	0.002	0.002	0.000	0.169	0.000	-0.089	0.096	0.177 ^{NS}
	G	-0.104	-0.121	-0.007	0.117	-0.024	0.206	-0.017	0.292	0.012	0.354**
No. of seeds/pod	P	0.000	0.002	-0.001	-0.001	0.001	-0.002	0.020	0.152	0.222	0.393**
	G	-0.025	0.059	0.004	-0.059	-0.032	-0.047	0.075	0.765	0.025	0.764**
No. of pod/plant	P	0.000	0.073	-0.036	-0.036	0.001	-0.037	0.008	0.404	0.515	0.893**
	G	-0.034	0.275	0.016	-0.271	-0.041	0.066	0.063	0.910	0.033	1.017**
Pod yield/plant (g)	P	0.000	0.078	-0.038	-0.038	0.001	0.029	0.008	0.371	0.562	0.972**
	G	-0.044	0.257	0.015	-0.254	-0.042	0.078	0.057	0.913	0.033	1.013**

Residual = 0.0521 (P), Residual = -0.020 (G); *,** Significant at 5 and 1% levels

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