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**Bhagyashri**  
Department of Vegetable  
Science, College of Horticulture,  
Mudigere, Karnataka, India

**V Srinivasa**  
Department of Vegetable  
Science, College of Horticulture,  
Mudigere, Karnataka, India

**Devaraju**  
Department of Vegetable  
Science, College of Horticulture,  
Mudigere, Karnataka, India

**SY Chandrashekar**  
Department of Floriculture and  
Landscape Architecture, College  
of Horticulture, Mudigere,  
Karnataka, India

**Corresponding Author:**  
**Bhagyashri**  
Department of Vegetable  
Science, College of Horticulture,  
Mudigere, Karnataka, India

## Genetic investigation on yield and yield attributing characters in pole type of dolichos bean (*Lablab purpureus* L.) germplasm under hill zone of Karnataka

**Bhagyashri, V Srinivasa, Devaraju and SY Chandrashekar**

### Abstract

The field experiment was conducted to study genetic variability in pole type of dolichos bean genotypes (*Lablab purpureus* L.). Analysis of variance revealed highly significant differences among the genotypes for most of the characters under the study. The range, genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean were calculated. The genotypes showed considerable amount of variability for all the traits. High estimate of heritability coupled with high genetic advance over per cent of mean were noticed for days to first flowering, number of flowers per cluster, number of pods per cluster, number of pods per plant, average pod weight and pod length which indicates that these attributes are under the influence of additive gene action. Thus, there was plentiful scope for improving these characters through direct selection.

**Keywords:** dolichos bean, variability, heritability, genetic advance, GCV and PCV

### Introduction

Dolichos bean (*Lablab purpureus* L.) is one of the most ancient crop among cultivated plants belongs to family leguminosae of Indian origin having diploid chromosome number of  $2n=2x=22$  (Deka and Sarkar, 1990) [5]. Dolichos bean is popularly known as Indian Bean, Lablab Bean, Field Bean, Hyacinth Bean, Bonavist Bean, Country Bean, Egyptian Bean and Sem. It is also known as 'Poor Man's Bean' (Ismunandji and Arsyad, 1990) [10] or 'Meat of the Poor' as it contributes essential protein to undernourished people living in hills and rural remote areas. Dolichos bean is mostly confined to peninsular region of India and cultivated to a large extent in Karnataka and adjoining districts of Tamil Nadu, Andhra Pradesh, Maharashtra, Gujarat and Haryana.

Dolichos bean is a multiuseful crop grown for pulse, vegetable and forage crop for livestock. This crop is grown for its green pods for vegetable purpose as well as dried seeds in vegetable food preparation. It occupies a unique position for vegetable purpose among the legume vegetables (Biju *et al.*, 2001) [1]. Dolichos bean is rich in protein (20-25 %), amino acid like lysine, vitamins (A, C and Riboflavin) and minerals (Gopalan *et al.*, 1982) [6]. Its green pods (100 g) contain 6.7 gram carbohydrates, 3.8 gram proteins, 210 milligram calcium, 1.7 milligram iron, 312 IU vitamin A and 0.1 milligram thiamine (Gopalan *et al.*, 2004) [7]. Immature pods and seeds are rich in dietary fibre and low in carbohydrates and lipids. Thus, Dolichos bean is most important from nutritional point of view due to changing pattern of lifestyle and food habit of people.

Indian bean is a herbaceous annual plant. Leaves are alternate and trifoliate. Inflorescence is a stiff axillary raceme with many flowers and essentially self-pollinated (94-99 %) crop which is due to presence of chasmogamy. But 6-10 per cent natural cross pollination have been reported. Anthesis occurs between 9 a.m. to 5 p.m. Anther dehiscence is from 5.00 a.m. to 2.00 p.m. Stigma is receptive on the day of anthesis (Pokle and Deshmukh, 1972) [17].

A great range of variability with plant and pod characters of pole type of dolichos bean is found all over the country (Peter and Kumar, 2008) [16] and thus variability can be exploited for evolving a high yielding type. The success of any breeding programme and improvement of specific trait through selection in particular totally depends upon the genetic variability present in the available germplasm of the crop (Parmar *et al.*, 2013) [14]. Hence, it is essential to partition the variability into heritable and non- heritable components with the help of genetic parameters like genetic coefficient of variability, heritability and genetic advance.

The present study was conducted to study the genetic variability for yield and yield attributing characters in dolichos bean.

### Material and Methods

The present investigation was carried out at the Department of Vegetable Science, College of Horticulture, Mudigere, University of Agricultural and Horticultural Sciences, Shivamogga during the *Rabi* 2020-2021. Thirty genotypes of dolichos bean were procured from different sources like IIHR,

Bangalore and NBPGR, New Delhi, have been taken for investigation. The experiment was laid out in a randomized complete block design (RCBD) with two replications. The treatments in each replication were allotted randomly by using random number table. Dolichos bean seeds were sown in each replication with 2 m × 2 m plot size at 60 cm × 45 cm spacing. The crop was raised by following the recommended package of practices of University of Horticultural Sciences, Bagalkot (Plate 1)



**Plate 1:** General view of the experimental site at A. 60 days after sowing



**Plate 2:** General view of the experimental site at B. At peak harvest

Observations were recorded on five randomly selected plants in each replication for different traits *viz.*, vine length, number of primary branches, number of leaves per plant, days to first flowering, days to 50 per cent flowering, days to first picking,

number of pods per cluster, number of pods per plant, pod weight, number of seeds per pod, green seed weight, shelling per cent, pod length, pod width, pod thickness, hundred seed weight and pod yield per plant.

Analysis of variance was performed by following the standard procedure given by Panse and Sukhatme (1967) [13]. Genotypic and phenotypic coefficients of variation were estimated according to Burton and Devane (1953) [2] based on estimate of genotypic and phenotypic variance. The broad sense heritability ( $h^2$ ) was estimated by following the procedure suggested by Weber and Moorthy (1952) [23]. Genetic advance and Genetic advance as per cent over mean for each character was predicted by the formula given by Johnson *et al.* (1955) [11].

### Result and Discussion

Analysis of variance showed significant differences among the genotypes for all the characters studied at five per cent level of significance. The mean sum of squares for 18 yield and yield attributing characters in 30 genotypes of dolichos bean were presented in Table 1.

**Table 1:** Analysis of variance for 18 yield and yield attributing characters in thirty genotypes of dolichos bean

Sl. No.	Source of variation /character	Replication	Treatment (genotypes)	Error	S.Em.±	CD at 5%	CD at 1%
	Degrees of freedom	1	29	29			
1	Vine length at Harvest (cm)	24.14	196.50*	81.42	6.38	18.45	24.87
2	Number of primary branches at Harvest	0.000	0.358**	0.072	0.189	0.548	0.738
3	Number of leaves per plant at Harvest	70.50	54.78*	22.70	3.37	9.74	13.13
4	Days to first flowering	11.27	104.74**	16.27	2.85	8.25	11.18
5	Days to 50 per cent flowering	3.75	51.92**	18.42	3.03	8.78	11.83
6	Number of flowers per cluster	0.01	7.20**	1.50	0.87	2.50	3.37
7	Days to first picking	73.93	235.78**	84.63	6.51	18.82	25.36
8	Number of pods per cluster	0.067	6.60**	0.34	0.41	1.19	1.61
9	Number of pods per plant	0.82	632.41**	55.12	5.25	15.18	20.46
10	Average pod weight (g)	0.00	4.63**	0.38	0.43	1.25	1.69

11	Number of seeds per pod	0.01	0.63**	0.12	0.24	0.69	0.93
12	Average green seed weight (g)	0.00	0.004**	0.001	0.024	0.071	0.10
13	Pod yield per plant (g)	1996.38	1614.20**	666.08	18.25	52.78	71.14
14	Shelling per cent	51.41	66.80**	20.65	3.21	9.29	12.53
15	Pod length (cm)	0.86	2.98**	0.70	0.59	1.72	2.31
16	Pod width (cm)	0.002	0.09**	0.024	0.11	0.314	0.42
17	Pod thickness (mm)	0.002	0.77**	0.27	0.36	1.05	1.42
18	Weight of 100 seeds (g)	1.44	43.91**	10.27	2.27	6.56	8.83

\* Significant @ 5 % \*\* Significant @ 1 % level of significance

Components of variation exhibited by the genotypes for all the characters indicated wide range of variability present in the genotypes. A wide range of variability existing for various the quantitative traits has also been reported in dolichos bean by Hadawani *et al.* (2018) [9], Peer *et al.* (2018) [15], Rony *et al.* (2019) [19] and Shete and Deshmukh (2019) [20]. In general, phenotypic coefficients of variation were higher than genotypic coefficients of variation indicating that the genotypic influence is lessened under the influence of the given environment (Table 2).

Among the different characters studied, high GCV and PCV were observed for number of pods per plant, number of pods per cluster, average pod weight, It indicates the presence of higher magnitude of variability for these characters, which would be helpful for further selection. Moderate GCV and PCV were observed for days to first flowering, number of seeds per pod, pod yield per plant, pod length. This indicates equal importance of additive and non-additive gene action in these traits. Low GCV and PCV were noticed in vine length at harvest, number of leaves per plant at harvest and days to 50 % flowering which had narrow genetic base for these traits (Table 2). Hence variability has to be created in these traits can be done by either through introduction or by hybridization between divergent parents (Table 2). These results are in conformity with the findings of Chaitanya *et al.* (2014) [3], Verma *et al.* (2015) [22].

Close relationship between GCV and PCV was found in all the characters and PCV values were slightly greater than

GCV indicating a very little influence of environment for their expression (Table 2). This is in confirmation with the results reported by Chaitanya *et al.* (2013) [3], Goudar *et al.* (2017) [8], Verma *et al.*, (2015) [22], and Noorjahan *et al.* (2019) [12].

Only the extent of variability present in genotypes for different characters is indicated by coefficient of variation but for the prediction of response to selection heritability estimates are useful. Since heritability is a important factor for expressing the phenotypic variability value as a tool to breeding value. Hence Heritability is a fundamental important factor in practicability of selection.

High broad sense of heritability (> 60 %) was shown by number of primary branches at harvest days to first flowering, number of flowers per cluster, number of pods per cluster, number of pods per plant, average pod weight, number of seeds per pod, pod length, weight of hundred seeds (Table 2 and 3).

The high (> 60 %) estimates of heritability coupled with high (> 20 %) genetic advance over per cent of mean were observed for traits such as a days to first flowering, number of flowers per cluster, number of pods per cluster, number of pods per plant, average pod weight, pod length, which indicates that these characters are under the influence of additive gene action similar results were also obtained by Chaitanya *et al.* (2014) [3], Verma *et al.* (2015) [22], Hadavani *et al.* (2018) [9], Susant and Bahadur (2018) [21] and Noorjahan *et al.* (2019) [12]

**Table 2:** Mean, range and genetic components for morphological and yield parameters in dolichos bean germplasm

Characters	Mean $\pm$ S.E.m.	Range		GV	PV	GCV (%)	PCV (%)	h <sup>2</sup> (%)	GA	GAM (%)
		Min.	Max.							
Vine length (cm) at harvest	182.60 $\pm$ 6.38	162.00	199.00	57.54	138.96	4.15	6.46	41.41	10.06	5.51
Number of primary branches at harvest	3.98 $\pm$ 0.19	2.70	4.60	0.14	0.21	9.50	11.64	66.60	0.64	15.98
Number of leaves per plant at harvest	129.7 $\pm$ 3.37	122.00	143.50	16.04	38.74	3.09	4.80	41.41	5.31	4.09
Days to first flowering	54.40 $\pm$ 2.85	39.50	66.50	44.24	60.50	12.23	14.30	73.11	11.72	21.54
Days to 50 per cent flowering	68.12 $\pm$ 3.03	58.00	75.00	16.75	35.17	6.01	8.71	47.64	5.82	8.54
Number of flowers per cluster	9.48 $\pm$ 0.86	7.30	16.00	2.85	4.35	17.81	21.99	65.58	2.82	29.70
Days to first picking	104.66 $\pm$ 6.50	75.00	117.10	75.58	160.21	8.31	12.09	47.18	12.30	11.75
Number of pods per cluster	8.56 $\pm$ 0.41	5.80	13.80	3.13	3.47	20.68	21.76	90.22	3.46	40.45
Number of pods per plant	79.06 $\pm$ 5.25	50.20	103.10	288.65	343.76	21.49	23.45	83.97	32.07	40.56
Average pod weight (g)	4.61 $\pm$ 0.43	2.04	7.43	2.13	2.50	31.64	34.32	84.98	2.77	60.08
Number of seeds per pod	5.05 $\pm$ 0.24	4.00	6.00	0.26	0.37	10.10	12.12	69.37	0.87	17.33
Average green seed weight (g)	0.44 $\pm$ 0.02	0.35	0.54	0.001	0.003	8.69	11.75	54.77	0.06	13.26
Pod yield per plant (g)	194.96 $\pm$ 18.25	107.45	242.80	474.06	1140.14	11.17	17.32	41.58	28.92	14.83
Shelling per cent	55.28 $\pm$ 3.21	39.62	64.75	23.08	43.73	8.70	11.96	52.78	7.19	13.00
Pod length (cm)	7.73 $\pm$ 0.59	4.72	9.34	1.14	1.84	13.81	17.56	61.83	1.73	22.36
Pod width (cm)	1.87 $\pm$ 0.11	1.33	2.19	0.03	0.06	9.39	12.47	56.66	0.27	14.56
Pod thickness (mm)	5.23 $\pm$ 0.36	4.20	7.02	0.25	0.52	9.63	13.78	48.80	0.72	13.85
Weight of 100 seeds (g)	44.39 $\pm$ 2.27	37.70	55.70	16.82	27.09	9.24	11.73	62.08	6.66	14.10

DAS - Days After Sowing

GCV - Genotypic Coefficient of Variation

h<sup>2</sup> - Broad sense heritability

GAM - Genetic Advance as per cent of Mean

GV - Genotypic Variance

PCV - Phenotypic Coefficient of Variation

GA - Genetic Advance

PV - Phenotypic Variance



**Table 3:** Summary of genetic parameters of variability for various characters in thirty dolichos bean genotypes

Characters	GCV (%)	PCV (%)	h <sup>2</sup> (%)	GA	GAM (%)
Plant height (cm) at Harvest	L	L	M	M	L
No. of primary branches at Harvest	L	M	H	L	M
No. of leaves per plant at Harvest	L	L	M	L	L
Days to first flowering	M	M	H	M	H
Days to 50 per cent flowering	L	L	M	L	L
Number of flowers per cluster	M	H	H	L	H
Days to first picking	L	M	M	M	M
Number of pods per cluster	H	H	H	L	H
Number of pods per plant	H	H	H	H	H
Average pod weight (g)	H	H	H	L	H
Number of seeds per pod	M	M	H	L	M
Average green seed weight (g)	L	M	M	L	M
Pod yield per plant (g)	M	M	M	H	M
Shelling per cent (%)	L	M	M	L	M
Pod length (cm)	M	M	H	L	H
Pod width (cm)	L	M	M	L	M
Pod thickness (mm)	L	M	M	L	M
Weight of 100 seeds (g)	L	M	H	L	M

### Conclusion

Significant differences were observed among the genotypes for all the characters studied at five and one per cent level of significance. Components of variation exhibited by the genotypes for all the characters indicated wide range of variability present in the genotypes. Low to high GCV and PCV were observed by the most of the characters studied, and most of the characters exhibited moderate to high heritability coupled with high genetic advance as per cent of mean which indicates that these characters are under the influence of additive gene action.

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