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Variability, Heritability and Genetic Advance for Yield and Yield Attributing Characters in Dolichos Bean (*Dolichos lablab* L.) Genotypes under Hill Zone of Karnataka

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A B S T R A C T

An investigation was conducted on studies on genetic variability for yield and yield attributing characters in dolichos bean (*Dolichos lablab* 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 heritability coupled with high genetic advance as per cent of mean was recorded for plant height at harvest, number of leaves per plant at harvest, days to first flowering, days to 50 per cent flowering, number of flowers per cluster, pod length, pod width and pod thickness, number of pods per cluster, number of pods per plant, average pod weight, average green seed weight, pod yield per plant, pod yield per plot, pod yield per hectare and shelling per cent, which illustrates that these characters are under the influence of additive gene action. Thus, there is a bountiful scope for improving these attributes through direct selection.

Introduction

Dolichos bean is an important leguminous vegetable originated in India. Dolichos Bean is also called as Indian bean, lablab bean, sem or hyacinth bean belongs to the family leguminaceae with chromosome number of 2n=22/24. It is a multi-utility and multi-beneficial leguminous crop, grown for vegetable, pulse, fodder, green manure, cover crop, medicine and ornamental purpose. It is one of the oldest legume crop known to be cultivated in dry and semi-arid regions of Asia, Africa and America (Ayyangar and Nambiar, 1935). In India, it is popularly grown in South, East and North-Eastern parts of the country.

The crop has important value in agricultural economy of the country and importance as

pulse and vegetable crop in human diet. It is a very nutritious vegetable grown in the cool season throughout the world. It is grown as vegetable crop for fresh seeds and as pulse for dried seed. Dolichos bean is rich in proteins, minerals, vitamins and fibers. It's fresh pods contain 86.1 per cent moisture, 3.8 per cent protein, 6.7 per cent carbohydrate, 0.7 per cent fat, 0.9 per cent mineral matter, 312 IU vitamin-A and it is also good source of vitamin B and C.

Nutritional analysis revealed that the dry seed contained 33 per cent starch as the major component, protein 25 per cent, a very low fat content 0.8 per cent and high dietary fiber 7.2 per cent.

Hyacinth bean is a herbaceous annual plant. Leaves are alternate and trifoliate. Flowers are borne in axillary racemes and are typically papilionaceous and are self-pollinated. Flowering takes place under short day periods irrespective of planting time. Anthesis occurs from 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).

A wide range of genetic variability is available in dolichos bean since it is originated in India, providing good scope for improvement in yield and associated characters through selection. The exploitation of genetic variability in available germplasm is a pre-requisite for identification and development of new improved high yielding genotypes to boost the yield potential of crop.

The variability available in the crop measures the possibility of improvement of any crop. 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. Keeping the above points in view, the present study was conducted to study the genetic variability for yield and yield attributing characters in dolichos bean.

Materials 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* 2019-2020. Thirty genotypes of dolichos bean were procured from different sources like UAHS, Shivamogga, CHES, Godra, Gujarat, 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 1.5m × 1.2m plot size at 45cm × 30 cm spacing. The crop was raised by following the recommended package of practices of University of Horticultural Sciences, Bagalkot (Plate 1).

Observations were recorded on five randomly selected plants in each replication for different traits *viz*., plant height, 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 weigh and pod yield per plant.

Analysis of variance was performed by following the standard procedure given by Panse and Sukhatme (1967). Genotypic and phenotypic coefficients of variation were

estimated according to Burton and Devane (1953) 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). Genetic advance and Genetic advance as per cent over mean for each character was predicted by the formula given by Johnson *et al.*, Johnson *et al.*, (1955).

Results 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.

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 Verma *et al.*, (2015), Chaudhari *et al.*, (2016), Ram *et al.*, (2016), Goudar *et al.*, (2017), and Noorjahan *et al.*, (2019). 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).

Table.1 Analysis of variance for 18 yield and yield attributing crackers in thirty genotypes of dolichos bean

Sl. No.	Source of variation /character	Replication	Treatment (genotypes)	Error	S.Em.±	CD at 5%
	Degrees of freedom	**1**	**29**	**29**		
1	Plant height at Harvest (cm)	9.13	207.34***	11.90	2.40	7.05
2	Number of primary branches at Harvest	0.024	1.318**	0.493	0.488	1.436
3	Number of leaves per plant at Harvest	4.37	467.86***	4.82	1.53	4.49
4	Days to first flowering	0.07	152.51***	9.00	2.09	6.13
5	Days to 50 per cent flowering	8.82	125.15***	4.02	1.39	4.10
6	Number of flowers per cluster	10.33	13.95***	2.11	1.01	2.97
7	Days to first picking	14.02	209.54***	2.19	1.03	3.03
8	Number of pods per cluster	1.67	6.80***	0.63	0.55	1.62
9	Number of pods per plant	9.13	640.00***	10.84	2.29	6.73
10	Average pod weight (g)	0.00	0.99***	0.02	0.10	0.30
11	Number of seeds per pod	0.03	0.24***	0.02	0.10	0.29
12	Average green seed weight (g)	0.00	0.01***	0.00	0.01	0.04
13	Pod yield per plant (g)	14.00	1964.58***	42.92	4.55	13.40
14	Shelling per cent	0.07	142.71***	0.04	0.13	0.40
15	Pod length (cm)	0.008	1.12***	0.040	0.14	0.41
16	Pod width (cm)	0.0004	0.09***	0.01	0.05	0.15
17	Pod thickness (mm)	0.01	0.49***	0.04	0.13	0.40
18	Weight of 100 seeds (g)	0.81	71.51***	1.05	0.71	2.10

** significant at 5% level of significance

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

Characters	Mean ±S.Em.	Range		GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
		Min.	Max.							
Plant height (cm) at Harvest	69.60 ± 2.40	54.50	92.30	97.72	109.62	14.20	15.04	89.10	19.23	27.63
No. of primary branches at Harvest	5.41 ± 0.49	3.40	8.00	0.41	0.91	11.87	17.58	45.60	0.89	16.50
No. of leaves per plant at Harvest	92.38±1.53	46.50	108.60	231.52	236.34	16.47	16.64	98.00	31.02	33.58
Days to first flowering	59.37±2.09	38.50	71.50	71.76	80.76	14.27	15.18	88.90	16.45	27.71
Days to 50 per cent flowering	70.05±1.40	58.00	86.50	60.56	64.59	10.37	10.71	93.80	15.52	20.69
Number of flowers per cluster	14.96±1.01	9.30	21.30	5.92	8.03	16.27	18.95	73.70	4.30	28.77
Days to first picking	112.29±1.03	92.50	125.50	103.68	105.87	9.07	9.16	97.90	20.76	18.49
Number of pods per cluster	9.29±0.55	7.10	15.50	3.09	3.71	18.92	20.74	83.22	3.30	35.53
Number of pods per plant	48.79±2.29	32.95	122.85	314.58	325.42	36.35	36.97	96.70	35.92	73.62
Average pod weight (g)	2.93±0.10	1.60	5.70	0.48	0.50	23.65	24.18	95.60	1.40	47.63
Number of seeds per pod	4.00±0.10	3.40	5.10	0.11	0.13	8.21	8.95	84.20	0.62	15.53
Average green seed weight (g)	0.43±0.02	0.31	0.54	0.003	0.003	11.95	12.94	85.20	0.10	22.72
Pod yield per plant (g)	139.18±4.55	101.94	218.43	960.83	1003.75	22.30	22.76	95.70	62.47	44.85
Shelling per cent (%)	56.63±0.13	26.27	66.78	71.34	71.37	14.92	14.92	99.90	17.39	30.72
Pod length (cm)	5.21±0.14	3.84	7.66	0.54	0.58	14.10	14.61	93.10	1.46	28.02
Pod width (cm)	1.73±0.05	1.17	2.09	0.04	0.05	12.13	12.88	88.70	0.41	23.55
Pod thickness (mm)	5.31±0.13	4.34	6.38	0.23	0.26	8.97	9.68	85.90	0.91	17.12
Weight of 100 seeds (g)	40.34±0.71	28.29	54.34	35.23	36.28	14.71	14.93	97.10	12.05	29.87
Pod yield per plant (g)	139.18±4.55	101.94	218.43	960.83	1003.75	22.30	22.76	95.70	62.47	44.85

DAS - Days After Sowing GV - Genotypic Variance PV- Phenotypic Variance
GCV - Genotypic Coefficient of Variation PCV - Phenotypic Coefficient of Variation
h^2 - Broad sense heritability GA - Genetic Advance
GAM - Genetic Advance as per cent of Mean

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

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

Plate.1 General view of the experimental site

Among the different characters studied, high GCV and PCV were observed for number of pods per plant, average pod weight, pod yield per plant, 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 plant height at harvest, number of primary branches at harvest, number of leaves per plant at harvest, number of flowers per cluster, days to first flowering, days to 50 per cent flowering, average green seed weight, shelling per cent, pod length, pod width and hundred seed weight. This indicates equal importance of additive and non-additive gene action in these traits. Low GCV and PCV were noticed in days to first picking, number of seeds per pod and pod thickness 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), Verma *et al.,* (2015).

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), Goudar *et al.,* (2017), Verma *et al.,* (2015), and Noorjahan *et al.,* (2019).

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 plant height at harvest, number of leaves per plant at harvest, days to first flowering, days to 50 per cent flowering, number of flowers per cluster, days to first picking, number of pods per cluster, number of pods per plant, average pod weight, number of seeds per pod, average green seed weight, pod yield per plant, shelling per cent, pod length, pod width, pod thickness, hundred seed weight (Table 2 and 3).

The high estimates of heritability coupled with high genetic advance over per cent of mean were observed for traits such as a plant height at harvest, number of leaves per plant at harvest, days to first flowering, days to 50 per cent flowering, number of flowers per cluster, pod length, pod width and pod thickness, number of pods per cluster, number of pods per plant, average pod weight, average green seed weight, pod yield per plant, pod yield per plot, pod yield per hectare and shelling per cent, which indicates that these characters are under the influence of additive gene action similar results were also obtained by Chaitanya *et al.,* (2014), Verma *et al.,* (2015), Hadavani *et al.,* (2018), Susant and Bahadur (2018) and Noorjahan *et al.,* (2019).

In conclusion the ssignificant differences were observed among the genotypes for all the characters studied at five 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.

High to moderate GCV and PCV were observed by the most of the characters studied, and most of the characters exhibited 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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