Original Research Article

Genetic Variability Studies in Dolichos Bean (*Lablab purpureus* L.) for Yield and Yield Traits

ABSTRACT

Aims: To study the genetic variability by phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance as percent of mean in advance breeding lines of dolichos bean.
Study design: Augmented RCBD with six blocks.
Place and Duration of Study: Department of Genetics and Plant Breeding, College of Agriculture, Shivamogga, during *Late Kharif* 2023.
Methodology: The experimental material consisted of 64 advanced breeding lines of dolichos bean including four checks viz., Hebbal avere-1, Hebbal avere-3, Hebbal avere-4 and Arka Jaya.
Results: Analysis of variance revealed that significant variation was observed among the genotypes for all the characters studied. High genotypic coefficient of variation (GCV) was observed for pods per plant (48.10%) followed by pod yield per plant, clusters per plant, pods per cluster, plant height and pod width, which indicates better scope for improvement of characters. High phenotypic coefficient of variation (PCV) was observed for pod yield per plant (50%) followed by pods per plant, clusters per plant, pods per cluster, plant height and pod width. High heritability (>60%) was observed for all the traits studied. High heritability combined with high genetic advance as *per cent* of mean was found for pods per plant (95.49%) followed by pod yield per plant, clusters per plant, pods per cluster, pod width and plant height which indicates that improvement of these characters through selection can be possible due to additive gene action.
Conclusion: Yield can be increased by selecting number of pods per plant, pod yield per plant, seed yield per plant number of cluster per pod, number of pods per plant and plant height.

Key words: *Doilichos bean, PCV, GCV, Heritability and Genetic advance as per cent of mean*

1. INTROUCTION

Dolichos bean is one of the important food grain legume grown in India for its tender green pods, fresh green feeds and dry seeds. It is commonly known as 'hyacinth bean', 'field bean', 'Indian bean', Australian bean, etc. It is a self-pollinated crop with the chromosome number 2n=22 [1] It is believed that dolichos bean is originated in India [2] and predominantly grown as a rainfed crop for fresh beans as a vegetable. Fresh dolichos beans are one of the most important sources of protein (22 to 28%) to a large number of people, especially those who depend on vegetarian diet. The fresh beans and dry seeds are the consumable economic products of dolichos bean and it is cultivated as pure crop as well as intercrop in irrigated and rainfed ecosystems respectively in southern Karnataka and adjoining districts of AP and TN [1]. In India, it is widely cultivated in eastern, southern and north eastern region of the country due to its wide climatic adaptability, high tolerance to drought and broad consumer acceptability. Karnataka contributes nearly 90% of both area and production of dolichos bean in India and mainly grown in southern districts of Karnataka. It is also cultivated to serve the purpose of vegetables, fodder, medicine, green manure, cover crop and ornamental purpose [3].

Genetic variability in the base population is a prerequisite for any successful breeding programme. The degree of response to selection is proportional to the amount of genetic variability in the base population for economic traits. Yield is a complex character in any crop, influenced by many contributing characters controlled by polygenes and environmental factors. As a result, understanding the genetics of yield and its component traits, as well as the relationship between each component

trait and yield, is required for planning an effective selection procedure for developing high yielding genotypes.

2. MATERIAL AND METHODS

The present investigation was conducted at College of Agriculture, Shivamogga during *Late Kharif* 2023. The experimental material consisted of 64 advanced breeding lines including four checks viz., Hebbal avere-1, Hebbal avere-3, Hebbal avere-4 and Arka jaya were laid out in an augmented design with six blocks. Each line was sown in 2 rows each of 4 meter length with the spacing of 50 cm between the rows and 30 cm between the plants.

Observations were recorded on twelve yield and its attributing traits (*viz.* days to 50% flowering, plant height (cm), days to maturity, No. of cluster per plant, No. of pods per cluster, No. of pods per plant, pod length (cm), pod width (cm), pod weight (g), No. of seeds per pod, test weight (g), pod yield per plant (g), seed yield per plant (g)). The genetic variability parameters were estimated by analysing the data using R- software.

3. RESULTS AND DISCUSSION

The data collected on thirteen quantitative yield attributing traits were subjected to statistical analysis. The analysis of variance revealed significant variations for plant height, days to 50 *per cent* flowering, days to maturity, number of primary branches per plant, number of secondary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, test weight and seed yield per plant indicating the presence of sufficient genetic variability in the material used for the investigation(Table 1).

The mean value of 47.91 days was documented for number of days to 50 *per cent* flowering. The PCV and GCV values observed were low with 6.47 and 5.42 *per cent* respectively. Heritability was high (70.08 %) with low GAM of 9.35 *per cent* for this trait. Overall mean performance for plant height among studied genotypes was 67.06 cm. High PCV (21.87 %) and GCV (20.63 %) were observed and the magnitude of heritability was high (89.04 %) with a high GAM of 40.17 *per cent*. The character's average value is 74.84 days. The PCV and GCV values observed were low with 3.76 and 3.61 *per cent* respectively. Broad sense heritability was high (92.16 %) with a low GAM of 7.14 *per cent*. The variability for number of clusters per plant had a mean of 10.25. High PCV (39.17 %) and GCV (36.93 %) values were observed and the magnitude of heritability was high (88.9 %) with a high GAM of 71.83 *per cent*. The variability for number of pods per noticed with a mean of 10.68. High PCV (30.28 %) and GCV (29.62 %) with a high GAM of 59.75 *per cent* recorded for this trait.

The number of pods per plant observed with a mean of 104.60. High PCV (48.96 %) and GCV (46.72 %) were observed and the magnitude of heritability was high (91.05 %) with a high GAM of 91.97 *per cent*. The variability for pod length had a mean of 4.89 cm. Moderate PCV (8.09 %) and GCV (10.08 %) were observed low. Heritability was high (64.35 %) with a moderate GAM (13.38) was noticed for this trait. The variability for pod width had a mean of 1.22 cm. Moderate PCV (11.22 %) and GCV (9.85 %) observed were low. The trait recorded high heritability (77.02 %) with a moderate GAM (17.83). The variability for pod weight had a mean of 7.74 cm. The PCV and GCV observed were moderate and low with 10.14 and 8.97 *per cent* respectively. Broad sense heritability was high (78.25 %) with a moderate GAM of 16.38 *per cent*. The variability for number of seeds per pod had a mean of 3.68. Moderate PCV (10.44 %) and low GCV (9.06 %) were observed and the magnitude of heritability was high (75.38 %) with a moderate GAM of 16.23 *per cent*. The variability for test weight had a mean of 18.37 g. Low PCV (5.80 %) and GCV (5.34 %) were observed and the magnitude of heritability was high (84.84 %) with moderate GAM of 10.16 *per cent*. The variability for pod yield per plant observed a mean of 82.41. The high PCV (85.44 %) and GCV (48.80 %) values were recorded. Heritability was high (85.44 %) with a high GAM of 86.02 *per cent*. The variability for seed yield per plant noticed a mean of 66.52. The PCV (51.79 %) and GCV (48.60 %) values were high heritability (88.06 %) and high GAM of 94.09 *per cent* for this trait (Table 2).

It is marked from the analysis of variance that the lines showed significantly varied for various traits studied. High PCV and GCV were exhibited by plant height, number of cluster per plant, number of pods per cluster, number of pods per plant, dry pod yield per plant and seed yield per plant. The high PCV and GCV suggest the scope for improvement of these characters through direct selection for these traits. Similar findings were delineated by Chaitanya *et al.* [4]. Moderate PCV and low GCV were noticed for plant height, pod width, pod weight and number of seeds per plant which indicates more significant influence of the environment on expression of these traits and these results are in

agreement with the findings of Singh *et al.* [5].

The PCV values were slightly greater than the equivalent GCV values for all component examined in the current experiment. The narrow difference observed between the PCV and GCV estimates for almost all of the traits, showing that the environment had little on impact expression of these traits suggesting that phenotypic variations among genotypes might be appropriately considered during selection. If the difference was substantially more prominent, the environment significantly influenced these features. So in such traits, other variability parameters like heritability may also be considered for selection (Chaitanya *et al.,* [4], Singh *et al.,* [5] and Mohan *et al.,* [6]).

Estimates of heritability show that genes act in both additive and non-additive ways. As a result, significant genetic increase does not always entail high heritability. Heritability and genetic advance can be employed as effective selection criteria rather than heritability alone. High heritability accompanied by high and moderate GAM was observed for seed yield per plant, number of pods per plant, pod yield per plant, number of cluster per plant, number of pods per cluster, plant height, pod width, pod weight, number of seeds per pod, pod length and test weight which specifies the predominance of additive type of gene action in controlling traits and these traits are least influenced by the environmental effect. High heritability with low GAM noticed for days to 50% flowering and days to maturity indicated that this trait was controlled by non-additive gene action and selection for such a trait might not be rewarding. Thus, an important contribution of additive genetic variance is involved in the expression of these traits. Hence, an excellent response to selection can be attained by improving those traits in early generations. High genetic advance along with high heritability was observed for plant height, number of cluster per plant, number of pods per cluster, number of pods per plant, pod yield per plant and seed yield per plant indicates that these traits are predominantly controlled by additive gene and these are implemented in these character can be achieved through selection (Kambale *et al*., [7]).

It is clear from the results of the present study that the plant height, number of cluster per plant, number of pods per cluster, number of pods per plant, dry pod yield per plant and seed yield per plant exhibited greater values of PCV, GCV, heritability and genetic advance as *per cent* mean. Hence, it is strongly advised that these traits be selected to increase yield.

Table 1: Analysis of variance for yield and yield traits in advance breeding lines of dolichos bean

Sources of variation	Degrees of freedom	Mean sum of square												
		Days to 50% flowering	Plant height (cm)	Days to maturity	No. of cluster per plant	No. of pods per cluster	No. of pods per plant	Pod length (cm)	Pod width (cm)	Pod weight (g)	No. of seeds per pod	Test weight (g)	Pod yield per plant (g)	Seed yield per plant (g)
Block(eliminating treatment)	5	2.28	26.65	1.64	1.77	0.03	61.52	0.21	0.00	0.15	0.04	0.08	92.96	63.35
Genotypes+Checks (eliminating block)	63	19.82**	228.52**	11.77**	62.62**	17.49**	2344.88**	2.64**	0.03**	6.41**	0.57**	1.87**	1644.75**	1279.68**
Genotypes	59	9.61**	216.11**	7.91**	16.12**	10.46**	2622.90**	0.24*	0.02**	0.62**	0.15**	1.14**	1617.39**	1186.94**
Checks	3	40.04**	224.59**	38.15**	88.62**	2.31*	3331.21**	2.27**	0.15**	3.38**	2.05**	8.76**	5276.40**	4916.82**
Checks vs Genotypes	1	693.06**	1355.60**	255.20**	2783.51**	553.72**	4916.47**	145.73**	0.74**	366.17**	22.54**	32.10**	3389.54**	4614.53**
Error	15	2.87	23.69	0.62	1.79	0.46	234.78	0.09	0.00	0.13	0.04	0.17	235.50	141.73

*- Significant@5%, ** -Significant @1%

Table 2: Mean, range and genetic variability parameter for 13 yield and yield related characters in advanced breeding lines of dolichos bean.

Characters	Range		Mean	Co-efficient of variation (%)		h^2 bs (%)	GA (%)	GAM (%)
	Min	Max		GCV (%)	PCV (%)			
Days to 50% flowering	42.00	56.00	47.91	5.42	6.47	70.08	4.48	9.35
Plant height(cm)	37.69	152.39	67.23	20.63	21.87	89.04	27.00	40.17
Days to maturity	70.00	81.00	74.84	3.61	3.76	92.16	5.35	7.14
No. of cluster per plant	3.00	25.00	10.25	36.93	39.17	88.90	7.36	71.83
No. of pods per cluster	5.00	21.00	10.68	29.62	30.28	95.64	6.38	59.75
No. of pods per plant	35.00	228.00	104.60	46.72	48.96	91.05	96.20	91.97
Pod length (cm)	3.70	8.27	4.89	8.09	10.08	64.35	0.65	13.38
Pod width (cm)	1.03	2.09	1.22	9.85	11.22	77.02	0.22	17.83
Pod weight (g)	5.50	9.91	7.74	8.97	10.14	78.25	1.27	16.38
No. of seeds per pod	2.40	5.30	3.68	9.06	10.44	75.38	0.60	16.23
Test weight (g)	15.43	21.09	18.37	5.34	5.80	84.84	1.87	10.16
Pod yield per plant (g)	27.14	193.00	82.41	45.11	48.80	85.44	70.89	86.02
Seed yield per plant (g)	19.25	165.11	66.52	48.60	51.79	88.06	62.59	94.09

GCV (%) = Genotypic coefficients of variation PCV (%)= Phenotypic coefficients of variation

h^2 bs (%) = Heritability in broad sense GA = Genetic advance

GAM (%) = Genetic advance as a per cent mean

4. CONCLUSION

The advance breeding lines of dolichos bean evaluated in the present investigation demonstrated considerable variation for growth and yield attributing traits. Traits like number of pods per plant, pod yield per plant, number of cluster per pod, number of pods per plant and plant height have high, GCV, PCV, heritability and genetic advance as percent of mean indicating ample amount of variation and effectiveness of selection. Therefore, these traits can be prioritised for further improvement of doichos bean.

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