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Selection indices and diversity analysis in Indian bean (*Lablab purpureus* L.)

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Abstract
The investigation was carried out at Vegetable Research Station, Junagadh Agricultural University, Junagadh (Gujarat) during late *kharif* 2017- 18 in Randomized Block Design with three replications. The experiment was conducted to assess selection indices and genetic diversity in Indian bean. The experimental materials comprised of thirty six genotypes and four check varieties. Thirty one selection indices, including green pod yield per plant and four component traits were constructed using discriminant function technique. The selection index based on five characters *viz.,* green pod yield per plant, days to last picking, number of pickings, number of pods per plant and pod length were the most efficient one for obtaining higher yielding lines so, while making selection the maximum weightage should be given to these attributes. The most productive 40 genotypes of Indian bean were grouped in two clusters using D^2- analysis. The maximum intra cluster distance was observed in cluster I. The attributes *viz.,* twig length, number of primary branches per plant, pod length and 10- green pod weight contributed much more too total genetic divergence. So, selection for divergent parent based on these four characters would be useful for exploitation of heterosis in Indian bean, if feasible.

Keywords: Selection indices, diversity, Indian bean

Introduction
Dolichos bean or Hyacinth bean or Egyptian bean or Sem (*Lablab purpureus* L.) is an important legume vegetable crop throughout India. It is one of the most ancient crops known for its food and fodder value. Dolichos bean has chromosome number 2n=2x=22. The ripe and dried seeds are consumed as a split pulse. It is one of the major sources of protein in the dietary of working class especially of whole Gujarat. It is commonly called Hyacinth bean, Bonavist bean, Indian bean, Field bean, Egiptian bean, 'Walpapadi or Valor' in Gujarat state. In India, the major field bean growing states are Karnataka, Tamil Nadu, Andhra Pradesh and Gujarat. In Gujarat, it occupies an area of 0.072 million hectares with production of 0.74 million tonnes (Anon., 2017) [1].

The plant breeder has certain desired plant characteristics in his mind while selecting particular genotype and for this purpose he/ she applies various weight to different traits for arriving on final decision. This suggested the use of selection index, which gives proper weight to each of the two or more characters. The basis for the development of the selection index has been provided by Smith (1936) [5], Hazel (1943) [2] and Robinson (1951) [4].

A successful hybridization programme for varietal improvement depends mainly on the selection of the parents having high genetic divergence. Multivariate analysis by means of Mahalanobis (1936) [3] D^2- statistic is a powerful tool in quantifying the degree of divergence among genotypes, biological populations at genotypic level to assess the relative contribution of different characters to the total variation.

Materials and Methods
The present investigation was carried out to assess selection indices and diversity analysis in Indian bean (*Lablab purpureus* L.). The experiment was conducted at Vegetable Research Station, Junagadh Agricultural University, Junagadh (Gujarat) during late *kharif* of 2017-18. The experimental materials comprised of 36 genotypes and 4 check varieties. The 36 genotypes + four check varieties of Indian bean were sown on 8th September, 2017 in randomized block design with three replications. Five randomly selected plants were considered for different characters *viz.,* days to first flowering, days to 50% flowering, days to first picking, days to last picking, number of pickings, twig length (cm), number of primary

branches per plant, number of pods per plant, pod length (cm), pod width (cm), 10- green pod weight (g) and green pod yield per plant (g). Selection indices were carried out as per the procedure suggested by Smith (1936). Diversity assessed by D^2- statistic developed by Mahalanobis (1936) [3].

Result and discussion

Selection indices

For constructing the selection indices, the characters which had highly significant correlation with green pod yield per plant were considered. In the context, green pod yield per plant (X_1) along with four characters *viz.*, days to last picking (X_2), number of pickings (X_3), number of pods per plant (X_4) and pod length (X_5) were identified and considered (Table 1). Thirty one selection indices, including green pod yield per plant and four component traits, were constructed using discriminant function technique. The efficiency of selection increased with increase in contributing characters in the index. The selection index based on five characters *viz.*, green pod yield per plant, days to last picking, number of pickings, number of pods per plant and pod length were the most efficient one for obtaining higher yielding lines so, while making selection the maximum weightage should be given to this attributes.

Table 1: Selection index, discriminant function, expected genetic advance in green pod yield per plant and relative efficiency from the use of different selection indices in Indian bean

Sr. No.	Selection index	Discriminant function	Expected genetic advance	Relative efficiency (%)	Relative efficiency per character (%)
1	X_1 green pod yield per plant	$0.9624\ X_1$	576.16	100.000	100.000
2	X_2 Days to last picking	$0.7228\ X_2$	4.91	0.852	0.852
3	X_3 Number of picking	$0.9285\ X_3$	1.86	0.323	0.323
4	X_4 Number of pod per plant	$0.9564\ X_4$	238.84	41.454	41.454
5	X_5 Pod length	$0.9823\ X_5$	5.59	0.970	0.970
6	$X_1.X_2$	$0.\ 9563X_1 + 2.1314X_2$	579.43	100.568	50.284
7	$X_1.X_3$	$0.9327\ X_1 + 0.1525\ X_3$	577.88	100.299	50.149
8	$X_1.X_4$	$0.9657X_1 + 0.9362\ X_4$	734.19	127.428	63.714
9	$X_1.X_5$	$0.9548\ X_1 + 3.1095X_5$	578.55	100.415	50.208
10	$X_2.X_3$	$0.6511\ X_2 + 1.3474X_3$	6.28	1.090	0.545
11	$X_2.X_4$	$0.9016\ X_2 + 0.9569\ X_4$	240.52	41.745	20.873
12	$X_2.X_5$	$0.7180\ X_2 + 1.0210\ X_5$	8.05	1.397	0.699
13	$X_3.X_4$	$-52.9562\ X_3 + 1.1232\ X_4$	258.12	44.800	22.400
14	$X_3.X_5$	$-65.5450\ X_3 – 0.6067\ X_5$	132.66	23.025	11.513
15	$X_4.X_5$	$0.9552\ X_4 + 0.7150\ X_5$	237.79	41.272	20.636
16	$X_1.X_2.X_3$	$0.9330\ X_1 + 1.3017\ X_2 + 12.3646\ X_3$	581.10	100.857	33.619
17	$X_1.X_2.X_4$	$0.9579\ X_1 + 2.4205\ X_2 + 00.9371\ X_4$	737.30	127.968	42.656
18	$X_1.X_2.X_5$	$0.9479X_1 + 2.2407\ X_2 + 3.1913\ X_5$	281.825	48.914	16.304
19	$X_1.X_3.X_4$	$0.\ 9268\ X_1 + 16.7893\ X_3 + 0.9382\ X_4$	735.93	127.730	42.577
20	$X_1.X_3.X_5$	$0.9261\ X_1 + 12.6252\ X_3 + 3.0180\ X_5$	580.27	100.713	33.571
21	$X_1.X_4.X_5$	$0.9160\ X_1 + 1.0822\ X_4 + 5.4443\ X_5$	738.13	128.112	42.707
22	$X_2.X_3.X_4$	$0.6012\ X_2 + 3.0834\ X_3 + 0.9522\ X_4$	241.36	41.891	13.964
23	$X_2.X_3.X_5$	$0.6481\ X_2 + 1.3537\ X_3 + 0.9948\ X_5$	9.32	1.618	0.539
24	$X_2.X_4.X_5$	$0.9409\ X_2 + 0.9555\ X_4 + 0.7224\ X_5$	239.49	41.567	13.856
25	$X_3.X_4.X_5$	$3.3572\ X_3 + 0.9463\ X_4 + 0.3982\ X_5$	238.62	41.416	13.805
26	$X_1.X_2.X_3.X_4$	$0.9270X_1 + 1.3380\ X_2 + 15.9305\ X_3 + 0.9382X_4$	738.99	128.261	32.065
27	$X_1.X_2.X_3.X_5$	$0.9261\ X_1 + 1.4345\ X_2 + 11.9326\ X_3 + 3.0530\ X_5$	583.48	101.270	25.310
28	$X_1.X_2.X_4.X_5$	$0.9428\ X_1 + 2.5523\ X_2 + 0.9659\ X_4 + 3.1693X_5$	738.80	128.228	32.057
29	$X_1.X_3.X_4.X_5$	$0.9146\ X_1 + 16.6266\ X_3 + 0.9633\ X_4 + 2.8930\ X_5$	737.42	127.989	31.997
30	$X_2.X_3.X_4.X_5$	$0.5884\ X_2 + 3.8105\ X_3 + 0.9476\ X_4 + 0.4201X_5$	240.37	41.719	10.430
31	$X_1.X_2.X_3.X_4.X_5$	$0.9142\ X_1 + 1.4814\ X_2 + 15.5709\ X_3 + 0.9641\ X_4 + 2.9480X_5$	740.47	128.518	25.704

Diversity analysis

The most productive 40 genotypes of Indian bean were grouped in two clusters using D^2- analysis (Table 2). The maximum intra cluster distance was observed in cluster I (Table 3). The attributes *viz.*, twig length, number of primary branches per plant, pod length and 10- green pod weight contributed much more too total genetic divergence ((Table-4). So, selection for divergent parent based on these four characters would be useful for exploitation of heterosis in Indian bean, if feasible. The most productive hybrids and diverse segregating materials may come from high yielding parent with high genetic diversity.

Table 2: Clustering pattern of Indian bean genotype on the basis of Mahalanobis D^2 statistic

Cluster number	Number of genotypes	Name of genotype
I	39	33(GP- 158), 36 (Gujarat Papadi 1), 29 (GP- 149), 7 (GJIB 15-3), 15 (GP- 36), 16 (GP- 38), 23 (GP- 70), 28 (GP- 80), 32 (GP- 157), 18 (GP- 40), 3 (AFB- P- 09- 12), 8 (GJIB 15- 4), 9 (JDNIB- 01 21), 24 (GP- 71), 2 (AFB- P- 01- 12), 31 (GP- 156), 20 (GP- 64), 27 (GP- 74), 25 (GP- 72), 22 (GP- 66), 6 (GJIB- 13- 07), 19 (GP- 61), 35 (GP- 161), 34 (GP- 160), 17 (GP- 39), 11 (GP- 28), 4 (NIB- 15- 01), 12 (GP- 29), 10 (GP- 27), 14

		(GP- 35), 13 (GP-31), 26 (2016-DOLPVAR-2), 21 (GP- 66), 5 (GJIB 13- 03), 30 (GP- 143), 1 (AFB- P- 01-04), 38 (GJIB 11), 37 (GJIB 2), 40 (GNIB 22)
II	1	39 (GNIB 21)

Table 3: Average inter and intra cluster distance values in Indian bean

Cluster	I	II
I	16.30	73.94
II		0.00

Table 4: Cluster means for different characters in Indian bean

Cluster	Days to first flowering	Days to 50% flowering	Days to first picking	Days to last picking	Number of pickings	Length of twig (cm)
I	59.72	62.59	89.76	138.73	6.56	164.78
II	46.40	50.33	81.40	127.60	3.73	60.40
Mean	59.39	62.29	89.55	138.45	6.49	162.17
S. Em. ±	1.28	1.07	1.55	1.74	0.26	5.24
% contribution toward total genetic divergence	1.54	0.90	1.79	0.13	0.64	20.77
Number of times ranked	12	7	14	1	5	162

Cluster	Number of branches per pant	Number of pods per plant	Pod length (cm)	Pod width (cm)	10- green pod weight (g)	Green pod yield per plant (g)
I	3.78	310.81	8.51	1.79	38.32	1100.28
II	17.87	98.93	5.27	1.35	42.12	410.00
Mean	4.13	305.51	8.43	1.78	38.41	1083.02
S. Em. ±	0.13	25.32	0.37	0.06	1.84	56.39
% contribution toward total genetic divergence	24.10	6.67	20.77	6.67	12.56	3.46
Number of times ranked	188	52	162	52	98	27

Conclusion

On basis of selection indices, days to last picking, number of pickings, number of pods per plant and pod length were the most efficient one for obtaining higher yielding lines so, while making selection, the maximum weightage should be given to this attributes. On the basis of cluster means, genotypes of cluster I were the best for days to last picking, number of pickings, twig length, number of pods per plant, pod length, pod width and green pod yield. While, cluster II for earliness, days to 50% flowering, days to first picking, number of primary branches per plant and 10- green pod weight should be selected for further hybridization programme.

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