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GENETIC ANALYSIS IN FODDER LABLAB (*LABLAB PURPUREUS* L.)

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ABSTRACT

Genetic analysis of fodder yield and yield attributes in lablab with 6 x 6 diallel cross revealed the predominance of dominance genetic component for plant height, total leaf area, dry weight of stem and green fodder yield. The mean degree of dominance indicated over dominance for all the characters studied. Dominant alleles were more frequent than recessive alleles in the parents for plant height, total leaf area, number of leaves, green fodder yield, dry matter production and crude protein content. To exploit both the additive and nonadditive genetic components in lablab for fodder, the use of biparental mating in early generation among selected crosses or use of selection procedure such as diallel selective mating is possible.

Key words: Fodder, genetic analysis, lablab.

In lablab, the study of combining ability will be useful in proper choice of parents. A successful selection programme depends on the methods to exploit the available genetic variation in the population. In order to achieve this, a sound knowledge on the genetic architecture of the characters is a prerequisite. Since this information is very meagre in lablab for fodder attributes, in the present study, therefore, an attempt has been made to elucidate information on nature of gene action involved on the 11 quantitative and six qualitative traits using 6 x 6 diallel crosses.

MATERIALS AND METHODS

Based on the performance for fodder yield attributes in the germplasm, six lablab varieties, viz., Co 2, PLS 55, DL 3196, Co 9, Pondicherry, and Co 10, were chosen for the study and crossed in all possible combinations. The F_1 hybrids were raised in randomized block design with three replications. A uniform spacing of 45 x 30 cm was adopted. When

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50% of population flowered, five plants from each type were cut leaving 5 cm from the ground level and observations were recorded from each replication.

For quality analysis, the chopped plant samples were dried in an electric oven and powdered. Crude protein content was calculated by multiplying the total nitrogen content [1] by 6.25. Phosphorus, potassium and calcium content was estimated by different methods described by Jackson [2]. Carotene content was estimated by Booth's method [3] and nitrate content was calculated as per [4]. The genetic analysis was carried out using the method of Hayman [5].

RESULTS AND DISCUSSION

The results of analysis of variance for different characters revealed significant difference among parents and hybrids. The t^2 estimates to test the uniformity of the Wr, Vr values were not significant indicating fulfillment of assumptions. t^2 was significant for stem girth and total leaf area. The estimates of genetic parameters for the characters studied are given in Tables 1 and 2 which confirms the importance of additive as well as dominant gene action. All the genetic parameters estimated were highly significant for the characters plant height, total leaf area, green fodder yield and dry weight of stem. Dominant genetic variance components H_1 and H_2 were highly significant for crude protein content. The D, H_1, H_2, F and E components were significant for number of leaves. All the components except h^2 were highly significant for dry matter production.

The genetic analysis showed the predominance of dominance genetic components for plant height, total leaf area, stem dry weight, and green fodder yield. H_1 greater than D inferred that manifestation of all the characters except stem girth, nitrate and phosphorus content are mainly governed by dominant gene action. The H_2 component is smaller than H_1 for all the characters except nitrate and phosphorus content indicating the unequal proportion of positive and negative alleles in the loci governing the characters. The asymmetrical distribution of genes at loci showing dominance in the two parents was evidenced by the value of $H_2/4\ H_1$, which was less than 0.25 in all the cases. The number of alleles or groups of alleles showing dominance was more than one for plant height, number of secondaries, dry weight per plant and nitrate content as revealed by the h^2/H_2 value. However, this ratio usually under estimates the number of genes and provides no valid interpretation about gene groups exhibiting dominance [6] and complementary interaction of genes also depresses this value [7]. The mean degree of dominance indicated over dominance for all the characters studied. The significance of F value for important fodder attributes viz., plant height, total leaf area, number of leaves, green fodder yield, dry matter production and crude protein content indicated the presence of more dominant alleles in the parents. The high heritability values and higher magnitude of dominance effect

Table 1. Estimates of t^2 and genetic parameters in lablab bean

Character	D	H_1	H_2	h_2	F	E	t^2
Plant height	388.33 ± 68.5**	993.78 ± 173.94**	905.58 ± 155.38**	2739.08 ± 104.58**	24.70 ± 167.39**	12.68 ± 25.90**	0.695
Stem girth	0.06 ± 0.01	0.06 ± 0.03	0.04 ± 0.03	−0.01 ± 0.02	0.06 ± 0.03	0.01 ± 0.01	18.614**
No. of primaries	0.01 ± 0.03	0.24 ± 0.09	0.18 ± 0.08	−0.02 ± 0.05	0.06 ± 0.09	0.05 ± 0.01	0.849
No. of secondaries	0.10 ± 0.06	0.60 ± 0.16	0.46 ± 0.14	0.70 ± 0.10	0.19 ± 0.16	0.09 ± 0.02	0.076
No. of leaves	1051.72 ± 188.05**	1800.19 ± 477.37**	1350.07 ± 426.45**	−3.41 ± 287.03	457.44 ± 459.39**	26.35 ± 71.07*	0.061
Leaf area	2740580.38 ± 2638730.13**	22414065.18 ± 6698656.65**	19077533.29 ± 5984077.45**	8165342.73 ± 4027679.04**	3151371.15 ± 6446420.39**	76783.16 ± 997346.24**	13.443*
Green fodder yield	985.93 ± 478.58**	3201.44 ± 1214.91**	2770.71 ± 1085.31**	911.48 ± 730.48**	1063.19 ± 1169.16**	121.62 ± 180.88**	1.080
Dry weight of leaf	23.33 ± 7.42**	63.49 ± 18.83**	45.49 ± 16.82**	−1.22 ± 11.32	32.71 ± 18.12**	4.49 ± 2.80*	0.619
Dry weight of stem	130.44 ± 51.35**	325.46 ± 130.37**	269.55 ± 116.46**	13.19 ± 78.38**	132.12 ± 125.46**	13.47 ± 19.41**	0.471
Dry weight/ plant	157.01 ± 76.18**	512.44 ± 193.38**	446.22 ± 172.75**	1.97 ± 116.23	117.02 ± 186.10**	17.27 ± 28.79**	4.099
Dry matter production	136.07 ± 64.41**	438.19 ± 163.51**	378.71 ± 146.07**	1.32 ± 98.32	107.37 ± 157.36**	14.73 ± 24.35**	3.732
Carotene content	0.27 ± 0.05	0.39 ± 0.15	0.30 ± 0.13	0.12 ± 0.09	0.27 ± 0.14	0.03 ± 0.02	1.802
NO_3 content	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.11	0.01 ± 0.01	0.01 ± 0.01	2.528
Phosphorus content	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	−0.01 ± 0.01	3.56 ± 1.49*	0.15 ± 0.23	0.067
Crude protein	2.69 ± 0.61	7.67 ± 1.55**	5.81 ± 1.39**	1.16 ± 0.93	0.01 ± 0.01	0.01 ± 0.01	0.993
Potassium content	0.02 ± 0.03	0.30 ± 0.09	0.28 ± 0.08	−0.01 ± 0.05	0.02 ± 0.09	0.01 ± 0.01	1.896
Calcium content	0.02 ± 0.01	0.10 ± 0.03	0.07 ± 0.02	0.01 ± 0.01	0.04 ± 0.02	0.01 ± 0.01	0.076

*,**Significant at 5% and 1% levels, respectively.

for the above characters suggest the use of reciprocal recurrent selection for improving the characters. However, lablab being a self-pollinated crop, this selection procedure is not practicable. So a possible choice is the use of biparental mating in early generation among selected crosses or use of diallel selective mating designs [8] to exploit both additive and nonadditive genetic components.

Table 2. The ratios of genetic parameters in lablab bean

Character	$(H_1/D)^{\frac{1}{2}}$	$H_2/4\,H_1$	KD/KR	h^2/H_2	Heritability (narrow sense)
Plant height	1.599	0.228	1.041	3.025	94.68
Stem girth	0.984	0.175	3.387	–0.066	38.53
No. of primaries	5.716	0.189	7.270	–0.121	1.82
No. of secondaries	2.455	0.191	2.286	1.520	20.85
No. of leaves	1.308	0.187	1.398	–0.002	95.20
Leaf area	2.859	0.212	1.503	0.428	95.01
Green fodder yield	1.802	0.216	1.854	0.329	59.23
Dry weight of leaf	1.649	0.179	2.478	–0.026	49.01
Dry weight of stem	1.579	0.207	1.943	0.049	66.81
Dry weight/plant	1.806	0.218	1.519	4.411	75.46
Dry matter production	1.794	0.216	1.563	0.003	74.95
Carotene content	1.212	0.189	2.469	0.400	54.09
Nitrate content	4.306	0.192	1.917	1.513	77.57
Crude protein	1.688	0.189	2.286	0.199	76.22
Phosphorus content	1.850	0.216	1.831	–0.023	51.76
Potassium content	3.907	0.228	1.464	–0.014	48.74
Calcium content	1.930	0.185	2.368	0.203	67.83

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