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HETEROSIS IN FODDER LABLAB FOR SPECIFIC LEAF WEIGHT, DRY MATTER, CRUDE PROTEIN AND PHOSPHORUS

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ABSTRACT

In fodder lablab, a diallel design of experiment was conducted with six genotypes for the biometrical traits of specific leaf weight, dry matter production, crude protein and phosphorus contents during 1994. Among the 30 hybrids studied, 16 hybrids recorded higher mean values than the mean of the hybrids in specific leaf weight. The hybrid DL 3196 x Co 9 recorded the highest mean performance for this trait. In crude protein content also, 16 hybrids exceeded the mean of the hybrids (16.92 %). The highest value of 19.50 per cent was observed in the cross MS 9495 x DL 3196. Regarding phosphorus content, 13 hybrids showed higher values than the mean of the hybrids. The cross Co 1 x DPI 1281 showed significant positive standard heterotic value of 61.40 per cent.

KEY WORDS : Fodder lablab, Crude Protein, Phosphorus

Among the forage legumes, lablab (*lablab purpureus* (L.) Sweet assumes important position owing to its better nutritional quality and high fodder yield. Exploitation of hybrid vigour depends upon the direction and magnitude of heterosis involved. The present study was undertaken to study heterotic effects of two quantitative traits namely specific leaf weight and dry matter yield and another two qualitative traits *viz.*, crude protein and phosphorus contents.

MATERIALS AND METHODS

The experimental material consisted of six genotypes crossed in all possible combinations (n (n-1)) as suggested by Griffing (1956) model I and method I of diallel fashion. The field experiment was laid out in a randomised block design with three replications under irrigation. The seeds obtained from 30 cross combinations along with 6 parents and standard parent were sown in a single row of 4 m length on 1 March 1994 with a spacing of 45 cm between the rows and 30 cm between the plants. The trial was conducted in a red loamy soil with a pH of 7.2 and electrical conductivity (EC) of 0.31 millimhos/cm. A fertilizer dose of 25 kg nitrogen and 50 kg phosphorus was applied as basal as per the recommendations. Leaving the two border rows, the middle one was taken for recording the observations. In each row, there were 10 plants, of which 5 plants were selected at random for recording observations in each replication. The specific leaf weight, crude protein and phosphorus were estimated. Significance of heterosis was tested by using 't' test as per Wynne *et al.*, (1970).

RESULTS AND DISCUSSION

The analysis of variance indicated significant differences for the four biometrical traits studied. For specific leaf weight, the mean performances of parents and hybrids ranged from 0.052 (DPI 1281) to 0.062 (Co 9) and from 0.052 (Co 9 x MS 9495)

Table 1. Mean performance : specific leaf weight (mg/cm^2)

Parents	P_1	P_2	P_3	P_4	P_5	P_6
P_1	**0.062**	0.061	0.060	0.059	0.054	0.052
P_2	0.061	**0.061**	0.064	0.060	0.057	0.059
P_3	0.064	0.062	**0.061**	0.063	0.059	0.062
P_4	0.061	0.063	0.063	**0.052**	0.064	0.065
P_5	0.068	0.067	0.059	0.058	**0.057**	0.054
P_6	0.054	0.064	0.066	0.056	0.056	**0.055**

Diagonal figures in bold indicate parents; Values above the diagonal indicate direct crosses; Values below the diagonal indicate reciprocal crosses

Mean of parents = 0.058 Grand mean = 0.060 Mean of hybrids = 0.060

P_1 = Co 9; P_2 = Co 2; P_3 = Co 1; P_4 = DPI 1281 P_5 = DL 3196; P_6 = MS 9495

Table 2. Mean performance : dry matter yield per plant (g)

Parents	P_1	P_2	P_3	P_4	P_5	P_6
P_1	79.03	80.60	75.90	66.03	75.63	65.23
P_2	85.07	80.60	79.67	51.37	77.27	70.93
P_3	81.87	81.50	81.90	60.77	83.30	79.40
P_4	54.17	62.73	45.93	40.60	51.83	41.03
P_5	75.90	81.70	82.80	60.80	78.63	79.43
P_6	73.77	83.67	110.63	53.87	85.00	90.70

Diagonal figures in bold indicate parents ; Values above the diagonal indicate direct crosses ; Values below the diagonal indicate reciprocal crosses ;

Mean of parents = 75.24 Grand mean = 72.48 Mean of hybrids = 71.93

P_1 = Co 9 ; P_2 = Co 2 ; P_3 = Co 1 ; P_4 = DPI 1281 P_5 = DL 3196 ; P_6 = MS 9495

to 0.068 (PL 3196 x Co 9) respectively. The overall mean of parents, hybrids and the grand mean were 0.058, 0.060 and 0.060 respectively. Sixteen hybrids recorded higher mean values than the mean of hybrids (Table 1). The hybrid DL 3196 x Co 9 recorded the highest mean performance for this trait. The superior behaviour of this cross might be due to significant *gca* effects of its parents and *sca* effects of the hybrid. From this it could be inferred that both additive and non-additive gene actions acted on this trait. The Table 5 shows the high heterotic value over better parent as shown by DPI 1281 x MS 9495 (18.91 %)

Regarding dry matter yield, the range of mean performances of parents and hybrid were from 40.60 g (DPI 1281) to 90.70 g (MS 9495) and from 45.93 g (DPI 1281 x Co 1) to 110.63 g (MS 9495 x Co 1) respectively. The mean of parents and hybrids were found to be 75.24 g and 71.93 g. Out of 30 crosses, 18 crosses recorded higher values than the mean of the hybrids (Table 2). Significant positive heterobeltiosis was recorded in five hybrids. The range was from 1.10 per cent (DL 3196 x Co 1) to 21.98 per cent (MS 9495 x Co 1). Significant positive standard heterosis was exhibited by 13 hybrids ranging between 0.97 per cent (Co 1 x MS 9495) and 40.70 per cent (MS 9495 x Co 1) (Table 5).

For crude protein content, among the parents, Co 9 recorded the maximum value (19.30%) and DPI 1281 with the minimum value (14.10%). Significant differences existed among the hybrids and the values ranged from 13.37 per cent (DPI 1281 x DL 3196) to 19.50 per cent (MS 9495 x DL 3196). Sixteen hybrids exceeded the mean of the hybrids (16.92 %) (Table 3). Among the 30 crosses, 6 crosses exhibited significant positive heterobeltiosis, the range was from 3.17 per cent (MS 9495 x DL 3196) to 6.94 per cent (Co 2 x Co 1). For standard heterosis, 25 crosses recorded highly significant positive values ranging between 2.61 per cent (Co 2 x DPI 1281) and 27.45 per cent (MS 9495 x DL 3196) (Table 6). Regarding phosphorus content, the mean performance of parents ranged from 0.171 per cent (DPI 1281) to 0.286 per cent (Co 1). The overall mean for parents was 0.226 per cent. The mean performance of hybrids ranged between 0.178 per cent (Co 9 x DL 3196 and DPI 1281 x DL 3196) and 0.278 per cent (DL 3196 x MS 9495). The overall mean of hybrids and grand mean were 0.230 per cent and 0.229 per cent respectively. Among the 30 hybrids, 13 of

Table 3. Mean performance : crude protein content (%)

Parents	P_1	P_2	P_3	P_4	P_5	P_6
P_1	19.30	17.3	18.43	16.4	17.57	18.47
P_2	16.63	15.20	17.47	15.70	16.30	17.33
P_3	17.47	16.27	16.33	15.17	16.13	17.57
P_4	16.27	15.20	14.50	14.10	13.37	16.13
P_5	18.23	16.30	16.93	15.50	15.30	17.20
P_6	19.20	18.67	18.50	17.77	19.50	18.90

Diagonal figures in bold indicate parents ; Values above the diagonal indicate direct crosses ; Values below the diagonal indicate reciprocal crosses

Mean of parents = 16.52 Grand mean = 16.85 Mean of hybrids = 16.92

Table 4. Mean performance : Phosphorus content (%)

Parents	P_1	P_2	P_3	P_4	P_5	P_6
P_1	0.206	0.205	0.246	0.265	0.178	0.196
P_2	0.230	0.256	0.278	0.292	0.228	0.233
P_3	0.263	0.232	0.286	0.292	0.194	0.199
P_4	0.254	0.215	0.224	0.171	0.178	0.195
P_5	0.196	0.186	0.234	0.223	0.181	0.278
P_6	0.218	0.227	0.258	0.273	0.193	0.257

Diagonal figures in bold indicate parents ; Values above the diagonal indicate direct crosses ; Values below the diagonal indicate reciprocal crosses

Mean of parents = 0.226 Grand mean = 0.229 Mean of hybrids = 0.230

P_1 = Co 9; P_2 = Co 2; P_3 = Co 1; P_4 = DPI 1281 P_5 = KL 3196 ; P_6 = MS 9495

them showed higher values than the mean of the hybrids (Table 4). Seven hybrids exhibited positive significant heterobeltiosis with a range of 2.33 per cent (Co 1 x DPI 1281) to 28.85 per cent (Co 9 x DPI 1281). With regard to standard heterosis, 28 hybrids showed significant positive heterotic values ranging between 2.57 per cent (DL 3196 x Co 2) and 61.40 per cent (Co 1 x DPI 1281) (Table 6).

Table 5. Heterosis (%) for specific leaf weight and dry matter yield in fodder lablab

Cross	Specific leaf weight		Dry matter yield	
	Hetero-beltiosis	Standard Heterosis	Hetero-beltiosis	Standard Heterosis
P1 x P2	-2.55**	6.53**	0.00	2.50**
P1 x P3	-3.53**	5.24**	-7.33**	-3.48**
P1 x P4	-4.11**	4.60**	-16.45**	-16.02**
P1 x P5	-13.46**	-5.59**	-4.30**	-3.32**
P1 x P6	-16.56**	-8.97**	-28.08**	-17.04**
P2 x P1	-2.67**	6.18**	5.54**	8.18**
P2 x P3	5.37**	12.00**	-2.73**	1.31**
P2 x P4	-1.86*	4.31**	-36.27**	-34.68**
P2 x P5	-6.69**	-0.82	-4.14**	-1.74**
P2 x P6	-1.97*	4.20**	-21.79**	-9.79**
P3 x P1	2.99**	12.35**	-0.04	4.11**
P3 x P2	1.32	7.69**	-0.49	3.65**
P3 x P4	4.62**	10.84**	-25.80**	-22.72**
P3 x P5	-1.87*	3.96**	1.71**	5.93**
P3 x P6	2.42**	8.51**	-12.46**	0.97*
P4 x P1	-1.71*	7.23**	-31.46**	-31.11**
P4 x P2	2.85**	9.32**	-22.17**	-20.22**
P4 x P3	3.63**	9.79**	-43.92**	-41.59**
P4 x P5	12.59**	12.59**	-34.08**	-34.08**
P4 x P6	18.91**	14.34**	-54.76**	-47.82**
P5 x P1	8.44**	18.30**	-3.96**	-3.48**
P5 x P2	9.81**	16.72**	1.36**	3.90**
P5 x P3	-2.97**	2.80**	1.10**	5.30**
P5 x P4	0.93	0.93	-22.68**	-22.68**
P5 x P6	-5.48**	-5.48**	-12.42**	1.02**
P6 x P1	-13.35**	-5.48**	-12.42**	1.02**
P6 x P2	5.04**	11.66**	-7.75**	6.40**
P6 x P3	9.57**	16.03**	21.98**	40.70**
P6 x P4	1.21	-2.68**	-40.61**	-31.50**
P6 x P5	-1.40	-1.40	-6.28**	8.10**

* - Significant at 5 per cent level ;

** - Significant at 1 per cent level

P1 = CO9 ; P2 = CO2 ; P3 = CO1 ; P4 = DPI 1281

P5 = DL 3196; P6 = MS 9495

Table 6. Heterosis (%) for crude protein and phosphorus in fodder lablab

Cross	Crude protein		Phosphorus	
	Hetero-beltiosis	Standard Heterosis	Hetero-beltiosis	Standard Heterosis
P1 x P2	-10.36**	13.07**	-19.56**	13.42**
P1 x P3	-4.49**	20.48**	-13.99**	35.66**
P1 x P4	-15.03**	7.19**	28.85**	46.14**
P1 x P5	-8.98**	14.81**	-13.45**	-1.84
P1 x P6	-4.32**	20.70**	-23.96**	7.90**
P2 x P1	-13.82**	8.71**	-10.04**	26.84**
P2 x P3	6.94**	14.16**	-2.91**	53.12**
P2 x P4	3.29**	2.61**	14.34**	61.21**
P2 x P5	6.54**	6.54**	-10.82**	25.74**
P2 x P6	-8.29**	13.29**	-9.46**	28.49**
P3 x P1	-9.48**	14.18**	-8.16**	44.85**
P3 x P2	-0.41	6.32**	-18.76**	28.12**
P3 x P4	-7.14**	-0.87	2.33*	61.40**
P3 x P5	-1.22	5.45**	-32.17**	6.99**
P3 x P6	-7.05**	14.81**	-30.30**	9.93**
P4 x P1	-15.72**	6.32**	23.50**	40.07**
P4 x P2	0.00	-0.65	-15.91**	18.57**
P4 x P3	-11.22**	-5.23**	-21.56**	23.71**
P4 x P5	-12.64**	-12.64**	-1.84	-1.84
P4 x P6	-14.64**	5.45**	-24.09**	7.72**
P5 x P1	-5.53**	19.17**	-4.70**	8.09**
P5 x P2	6.54**	6.54**	-27.25**	2.57**
P5 x P3	3.67**	10.68**	-18.18**	29.04**
P5 x P4	1.31	1.31	22.79**	22.79**
P5 x P6	-8.99**	12.42**	7.90**	53.12**
P6 x P1	-0.52	24.29**	-15.28**	20.22**
P6 x P2	-1.23	22.00**	-11.66**	25.37**
P6 x P3	-2.12*	20.92**	-9.79**	42.28**
P6 x P4	-6.00**	16.12**	5.96**	15.37**
P6 x P5	3.17**	27.45**	-25.13**	6.25**

* - Significant at 5 per cent level ;

** - Significant at 1 per cent level

P^1 = Co9; P^2 = Co2; P^3 = Co1; P^4 = DPI 1281 P^5 = DL 3196; P^6 = MS 9495

The above results show a positive conclusion for improving the traits studied and the results are in close agreement with the studies made by Jatasra *et al.*, (1989) and Mittal and Sohoo (1991) in cowpea.

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RESEARCH NOTES

CORRELATION AND PATH COEFFICIENT ANALYSIS IN F_2 AND F_3 GENERATIONS OF RICE

The inter relationship between yield and yield components in the F_2 and F_3 generations of rice crosses was estimated with a view to identify characters and their combinations which might be useful as indicators of high yield. According to Miller *et al.*, (1958) the correlations analysed and the inter relationships might be quite different in other materials in which gene associations exist in the parental lines of segregating population, or in which the mean values of the traits under study were different. Hence, correlation was computed for each of the three crosses.

Three F_2 cross combinations involving tall ndica variety ASD 1 and three semidwarf varieties *iz.*, CO33, ADT36, and IR50 were raised in a andomised block design replicated thrice along with parents during the *kar* season June-September), 1993. Observations were ecorded on 50 plants in each parent and 100 plants n the F_2 progenies for each cross per replication. Ninety F_3 families at the rate of 30 in each cross ombination were raised along with parents in a andomised block design with three replications uring the late *pishanam* season (October- March), 993-94. In F_3 generation, observations were ecorded on five randomly selected single plants rom each parent/family in each replication. The orrelation coefficient and path co-efficient were orked out following the method suggested by oulden (1952) and Dewey and LU (1959)

The correlation of number of productive tillers, harvest index and dry matter production (DMP) with yield was highly significant and positive for F_2 and F_3 generations. Grain number/panicle showed positive relationship with yield in both the generations. There was positive association for panicle length with grain/panicle and grains panicle with harvest index and DMP indicating the importance of these traits for rice improvement. The difference in direction and magnitude in the correlation values might be attributed to the differences in the gene associations in the parental lines (Miller *et al.*, 1958) and the change in direction between two generations as noted in this study might be due to the differential segregation and recombination.

DMP exerted the highest contribution to the yield with positive direct effect. Direct effect of harvest index on grain yield was also positive in all crosses in both generations. Similar results were reported by Sukanya Subramanian and Rathinam (1984) earlier. Number of productive tillers had low positive direct effect on grain yield but was well compensated by the high indirect effect *via* dry matter production. The path co-efficient analysis indicated that dry matter production, harvest index and number of productive tillers assumed greater importance as they could influence the yield through their considerable positive direct effect.