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Behaviour of different soybean varieties (*Glycine max. L Merril*) on the calcareous soil of Udaipur

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THERE has been an increasing emphasis on stepping up food production by including high yielding cereal varieties in the cropping pattern in Indian agriculture. This seems to have further put a very great strain on the already protein deficient Indian diet. Introduction of soybean which is potentially high yielding and rich in oil and protein can very well be fitted in the cropping pattern. The soybean seeds contains on an average 43.2, 19.5 and 20.9 per cent. protein, fat and carbohydrate respectively.

Lal and Mehta (1968) reported that variety Lee gave 68.6, 21.1 and 12.6 per cent. higher grain yield than varieties Wayne, Hill and Clark-63 respectively. As varietal differences in adaptation to varying soil and climatic conditions are prevalent it is quite necessary to try and select promising varieties. Keeping this objective in view the present investigation was planned.

MATERIALS AND METHODS

An experiment was conducted at Udaipur during *Kharif*, 1968. Eight varieties of soybean, viz., Lee, Wayne, Harosoy, Hampton, Hill, Bragg, Clark-63 and Shelby were tested. The experiment was laid out in a Randomised Block Design with four replications. The experimental plots received a basal dressing of N, P_2O_5 and K_2O at the rate of 20, 80, 20 kg/ha respectively. The soils of this region are calcareous in nature which is evident from the calcium carbonate content and pH which are 2.8 per cent. and 7.9 respectively. The calcareous nature of these soils presents a serious problem of chlorosis in legumes at seedling stage. Hence sulphur at the rate of 250 kg/ha was uniformly

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broadcast one week prior to sowing. The seeds of soybean were treated with soybean inoculum (*Rhizobium japonicum*) at the rate of 250 g/ha and sown.

RESULTS AND DISCUSSION

Growth attributes

Data on germination presented in Table 1 showed that variety Harosoy recorded maximum germination percentage. Significant variations were noted in the germination percentage of soybean varieties. Variety Lee showed 58.3 per cent. germination while variety Bragg had only 29.0 per cent. germination. Variations in the germination capacities of these varieties have also been reported by Lal *et al.* (1968), which were 49.0 per cent. for variety Lee and for varieties Bragg, Clark-63 and Hampton 55.0 25.0 and 11.0 per cent. respectively.

Significant variation in the time taken for 50 per cent. flowering and flowering duration of different soybean varieties was observed (Table 1). Varieties Harosoy, Shelby, Clark-63, Wayne and Lee had flowered earlier and took 31-33 days in attaining 50 per cent. flowering while varieties Hampton, Hill and Bragg had flowered late and took 38 to 43 days. More or less similar results have been reported in the trials conducted at Pantnagar which reveal that on the basis of attainment of 50 per cent. flowering varieties could be put into three groups, Clark-63 as early while varieties Bragg, Lee and Hill as medium and Hampton as late, having taken 27, 35, 36 and 40 days in attaining 50 per cent. flowering respectively. At Jabalpur varieties Shelby and Harosoy emerged as early varieties and took 38 and 23 days in attaining 50 per cent. flowering respectively.

Grain yield and its attributes

Variety Lee gave the highest seed yield per hectare and it was significantly more than that obtained from any other variety (Table 2) except Hill. Variety Wayne produced significantly the lowest yield of grain per hectare being 7.26 quintals only. Variety Lee gave 105.5, 57.4, 40.9, 35.1, 28.7, 25.3 and 15.1 per cent. higher grain yield than varieties Wayne, Shelby, Hampton, Clark-63, Harosoy, Bragg and Hill respectively.

Significantly higher yield of seed by variety Lee seems to be due to better plant population at the time of harvest. In addition to this variety Lee recorded highest uptake of nitrogen and phosphorus (Table 3) which was 106.1 and 11.2 kg/ha respectively. Variations in the uptake of nitrogen and phosphorous by variety Lee when compared with other varieties were found to be significant. The highest yield of variety Lee in comparison with other varieties may be due to higher quantity of uptake of N and P which is assimilated during the period of its growth. These results are in conformity with those obtained by Lathwell and Evans (1951) who reported that yield of soybean was closely correlated with the amount of Nitrogen accumulated by the plants throughout the life cycle.

Data in Table 2 show that on individual plant yield basis variety Lee does not compare with varieties like Bragg, Hill, Hampton and Clark-63 but in soybean varieties tried in this case plant population seemed to be a more dominant character than seed yield. This is borne out of the fact that seed yield per plant of variety Lee as compared to that of Bragg was 80 per cent. less and plant population was only about 90 per cent. more. But with 80 per cent. decreased per plant yield and 90 per cent. increased plant population variety Lee produced more than 25 per cent. increased grain yield per hectare over variety Bragg. Poorer re-productive efficiency incident upon wider spacing and increased percentage of aborted seed might have been responsible for poor yield of variety Bragg as compared to that of variety Lee. Percentage of aborted seed in variety Lee was nil as against 2 per cent. in Bragg.

Variety Hill which produced grain yield very close to that of variety Lee produced almost 2 quintals less grain per hectare. Poor yield in variety Hill seems to be due to poorer grain yield per plant only as plant population in variety Hill was about 10 per cent. more than variety Lee. Thus slightly poor yield of variety Hill than that of variety Lee seems to be a cumulative effect of reduced percentage of fertile pods (about 3 per cent.), reduced number of seeds per pod (0.2), reduced 100 seed weight (about 3 g/100 seed and increased percentage of aborted seed (4 per cent.)

Variety Harosoy behaved in exactly the same manner as variety Hill, while variety Hampton behaved as variety Bragg. Rest of the varieties like Wayne and Shelby were decidedly inferior to any other variety. Variety Clark-63 was as good as variety Hampton.

Oil yield

A perusal of data summarized in Table 2 shows that variety Lee produced highest yield of oil (3.33 q/ha) which was significantly higher than all other varieties. The increases in oil yield as recorded were 0.61, 0.79, 0.82, 0.97, 0.99, 1.48 and 1.86 quintals more than varieties Hill, Hampton, Harosoy, Clark-63, Bragg, Shelby and Wayne respectively. Variety Lee produced 126.5, 80.0, 42.3, 41.1, 32.6, 31.1 and 22.4 per cent. greater oil yield than from varieties Wayne, Shelby, Bragg, Clark-63, Harosoy, Hampton and Hill respectively. Increased oil yield per hectare in variety Lee may be attributed to higher oil content and more grain yield per hectare as the oil yield is the product of oil content of grain and its yield per hectare.

Quality of grain

Out of the oil, crude protein and mineral matter percentage, none of these attributes come out to be significant (Table 3). Variety Hampton contained highest oil content, while variety Bragg showed lowest oil content, but a reverse trend was observed in the content of crude protein in that variety Bragg, which had lowest oil content had the highest protein content. Similarly variety Hampton which contained highest oil content showed lowest protein percentage. These results are in conformity with those observed by Mitrovic (1966) who stated that oil content was highest in dry year and was negatively correlated with protein content of the grain.

SUMMARY

Variety Lee gave highest seed yield per hectare which was significantly more than that obtained from any other variety except Hill. The highest oil yield per hectare was obtained from variety Lee which was of the order of 3.33 q/ha and was significantly more than that obtained from any other variety.

Variety Bragg had the highest fruiting nodes and pods per plant and hence the grain yield per plant was greater than Lee and Hill, but on account of poor crop stand its yield per hectare was less than variety Lee and Hill. Varieties Hampton, Harosoy, Clark-63, Shelby and Wayne were observed to be inferior in grain yield.

BEHAVIOUR OF DIFFERENT SOYBEAN VARIETIES

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TABLE 1.—Plant growth and development studies of different soybean varieties

<i>Treatments</i>		<i>Germi- nation %</i>	<i>Survi- val %</i>	<i>Days to 5 % flowering</i>	<i>Flower- ing dura- tion</i>	<i>No. of branches/ plant</i>	<i>No. of nodes/ plant</i>	<i>No. of pods/ plant</i>	<i>No. of pods/ node</i>	<i>% of fertile pods</i>	<i>No. of seeds/ pod</i>	<i>Wt. of 100 seeds in gm.</i>	<i>% of aborted seed</i>	<i>Crops stand plants/ plot</i>
Lee	..	58.32	94.82	33.25	21.50	8.35	18.27	4 .70	2.40	96.20	2.72	16.43	0.00	175
Wayne	..	48.40	71.75	33.00	37.75	2.47	18.72	33.40	1.76	93.72	2.80	16.67	6.00	104
Harosoy	..	89.10	87.35	31.25	37.25	2.72	14.80	28.87	1.95	98.05	2.51	16.13	3.50	229
Hampton	..	36.60	79.12	43.00	32.25	9.45	26.42	82.25	3.10	95.80	2.28	17.25	1.00	97
Hill	..	53.55	96.95	41.00	30.25	9.47	23.85	53.55	2.24	93.50	2.60	13.41	4.00	195
Bragg	..	29.07	89.55	38.00	41.25	11.27	28.70	012.50	3.55	95.45	2.51	13.99	2.00	92
Clark-63	..	44.10	91.22	32.00	37.25	4.00	22.94	48.35	2.10	96.72	2.84	15.20	6.00	131
Shelby	..	54.95	82.47	32.00	37.50	1.70	15.72	31.30	1.98	94.92	2.78	15.86	6.50	143
S. Em. ±	..	3.76	3.13	0.37	1.05	0.38	1.006	3.40	0.072	0.45	0.006	0.419	1.29	8
L.S.D. at 5%	..	11.06	9.33	1.09	3.09	1.119	3.933	10.00	0.212	1.33	0.195	1.233	3.80	23

BEHAVIOUR OF DIFFERENT SOYBEAN VARIETIES

TABLE 2.—GRAIN AND OIL YIELDS OF DIFFERENT SOYBEAN VARIETIES

<i>Treatments</i>		<i>Grain yield (g/plant)</i>		<i>Grain yield (g/ha)</i>		<i>Oil yield (g/ha)</i>	
Lee	..	..	15.38	..	14.92	..	3.33
Wayne	..	..	11.66	..	7.26	..	1.47
Harosoy	..	..	10.11	..	11.59	..	2.51
Hill	..	..	13.49	..	12.96	..	2.72
Hampton	..	..	23.10	..	10.59	..	2.54
Brag	..	..	28.15	..	11.91	..	2.34
Clark-63	..	..	16.18	..	11.04	..	2.36
Shelby	..	..	11.03	..	9.48	..	1.85
S.Em.±	..	..	1.17	..	0.89	..	0.223
L.S.D. at 5%	..	..	3.45	..	2.62	..	0.657

TABLE 3.—GRAIN QUALITY ATTRIBUTES OF DIFFERENT SOYBEAN VARIETIES

<i>Treatments</i>		<i>Oil %</i>		<i>Crude protein %</i>		<i>Mineral matter %</i>		<i>Total uptake of N kg/ha</i>		<i>Total uptake of P kg/ha</i>	
Lee	..	22.10	..	36.95	..	6.41	..	106.17	..	11.26	..
Wayne	..	20.17	..	38.05	..	6.52	..	50.67	..	5.24	..
Harosoy	..	21.65	..	35.55	..	6.24	..	75.06	..	7.43	..
Hampton	..	23.80	..	34.96	..	5.99	..	75.50	..	7.19	..
Hill	..	20.95	..	35.74	..	6.37	..	89.43	..	9.86	..
Bragg	..	19.67	..	38.05	..	6.28	..	87.53	..	7.99	..
Clark-63	..	21.77	..	36.76	..	6.69	..	74.57	..	7.49	..
Shelby	..	19.95	..	36.38	..	6.48	..	68.43	..	6.75	..
S.Em.±	..	1.11	..	0.76	..	0.18	..	6.43	..	0.69	..
L. S. D. at 5%	..	—	..	—	..	—	..	19.07	..	2.03	..