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Effect of inoculation, nitrogen and phosphorus on lentil (*Lens culinaris*)

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A field experiment was conducted at the R.M.P. College, Gurukul-Narsan, Hardwar, during the winter season of 1989–90. The experimental soil was loam in texture, medium in available nitrogen (380 kg N/ha), medium in organic carbon (0.7%), high in available phosphorus (40 kg P/ha) and potassium (370 kg K/ha) and neutral in reaction (pH 6.8). Sixteen treatments consisting of 2 levels of inoculation (uninoculated and inoculated with a rhizobium culture), 2 levels of nitrogen (0 and 20 kg N/ha) and 4 levels of phosphorus (25, 50, 75 and 100 kg P_2O_5/ha) were tried in randomized block design, replicated 3 times. Full quantity of N and P was applied at the time of sowing. The lentil variety 'T 36' was sown in rows at 25 cm apart on 15 October 1989 and was harvested on 15 March 1990.

Most of the root parameters improved significantly by the inoculation. Root length, number of nodules, fresh and dry weights of roots/plant increased significantly by inoculation, which may be ascribed to better nodulation of roots and its culmination in more nitrogen fixation that inturns had a significant effect on the grain yield (Table 1). Maiti *et al.* (1988) also obtained higher grain yield of lentil due to inoculation practice.

Application of 20 kg N/ha influenced the root length, fresh and dry weights of root only at later stages of the growth. Application of 20 kg N/ha resulted in a significant increase in root length at harvest over no application.

Similarly, fresh and dry weights of root at 90 days after sowing and at harvest were also improved significantly with N application, indicating the importance of starter N dose in legumes which had increased the activity of bacteria in the later stages. The grain yield was significantly higher in 20 kg N/ha treatment than the control. Similar results were reported by Mohamed (1978) also.

The response to phosphorus was observed up to 50 kg P_2O_5/ha for root length at harvest and for fresh and dry weights at 90 days and at harvest. Negative response beyond 50 kg P_2O_5/ha indicated that higher level of P was not found useful which might have been due to nutrient imbalance in soil-plant-system. Grain yield of lentil increased significantly up to 50 kg P_2O_5/ha and thereafter decreased significantly. Singh and Singh (1991) also observed similar effect of P fertilization in lentil.

Thus for getting higher yield from the lentil seed may be inoculated with rhizobium culture and crop may be fertilized with 20 kg N and 50 kg P_2O_5/ha.

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Table 1. Effect of inoculation, nitrogen and phosphorus levels on root length, nodulation and yield of lentil

Treatment	Root length (cm)			Nodules/ plant			Fresh weight of root/ plant (mg)			Dry weight of root/plant (mg)			Grain yield (q/ha)
	30 DAS	90 DAS	At harvest	30 DAS	90 DAS	At harvest	30 DAS	90 DAS	At harvest	30 DAS	90 DAS	At harvest	
Rhiobium inoculation													
Uninoculated	6.80	13.26	13.26	11.84	67.99	71.34	35	331	466	11	194	280	18.41
Inoculated	8.20	14.49	13.87	19.60	163.27	175.12	53	365	530	14	226	360	19.55
CD (P = 0.05)	0.93	0.92	0.40	3.93	28.58	51.94	14	28	35	0.91	1.70	20.40	0.45
N (kg/ha)													
0	7.41	13.44	13.24	15.48	103.19	112.92	44	313	471	12	200	300	18.75
20	5.59	14.31	18.88	15.95	128.08	133.55	43	363	525	13	220	340	19.21
CD (P = 0.05)	NS	NS	0.40	NS	NS	NS	NS	28	35	NS	1.70	20.40	0.45
P_2O_5 *(kg/ha)*													
25	7.41	13.66	12.83	13.44	114.46	116.10	45	320	452	12	195	290	16.45
50	7.83	13.94	14.27	17.46	125.30	153.19	50	380	559	13	231	370	20.31
75	7.55	13.80	13.44	15.99	113.02	107.52	40	318	495	13	206	320	20.04
100	7.13	14.10	13.71	15.94	109.74	116.10	40	327	469	13	205	300	19.11
CD (P = 0.05)	NS	NS	0.56	NS	NS	NS	NS	40	50	NS	16.60	23	0.63

DAS, Days after sowing

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Effect of irrigation, nitrogen and ascorbic acid on Indian mustard (*Brassica juncea*)

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The experiment was conducted in split-plot design with 3 replications during the winter season of 1991–92 and 1992–93 at the college agronomy farm, Anand. The treatment comprising combinations of 3 levels of irrigation (I_1, irrigation at node elongation, flowering and pod development; I_2, irrigation at 0.4 IW : CPE; I_3, irrigation at 0.6 IW : CPE) and 2 levels of irrigation depth [50 mm (D_1) and 75 mm (D_2)] were in main treatments. The subplot treatments comprised combinations of 3 levels of nitrogen (N_1, 25 kg; N_2, 50 kg; N_3, 75 kg/ha) and 2 levels of seed soaking (A_0, soaking seeds in distilled water; and A_1, soaking seeds in 25 ppm ascorbic acid). In seed treatment, seeds were soaked in 25 ppm ascorbic acid solution and allowed to absorb moisture for 3 hr. Subsequently, seeds were dried by preparing thin layer on gunny-bag under shade for 8 hr under fan, so that extra moisture could evaporate quickly. In all, the seeds were treated 3 times. The soil of the experimental field was loamy sand with pH 8.4. It was low in total N, medium in available P_2O_5 and high in available K_2O. The FC and PWP were 17.0 and 4.9% respectively. Indian mustard 'GM 1' was sown at 45 cm row distance on 21 October 1991 and 19 October 1992 after applying 50 mm pre-sowing irrigation. Subsequent irrigations were given as per treatments and no common irrigation was given after sowing. A uniform dose of 50 kg P_2O_5 (superphosphate) was applied before sowing in furrows. Nitrogen in the form of urea was applied in 2 equal splits, i.e. 50% at sowing and 50% at the time of first irrigation as per treatment. Irrigation water was measured by cut-throat flume. Irrigation-water depths, i.e. 50 mm and 75 mm, were maintained from first irrigation to last irrigation in

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