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Effect of nitrogen, phosphorus and seed inoculation on cowpea (*Vigna unguiculata*)

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ABSTRACT

A field experiment was conducted during the summer seasons of 1992 and 1993 at Lakhaoti to study the effect of nitrogen, phosphorus and seed inoculation with *Rhizobium* culture on cowpea [*Vigna unguiculata* (L.) Walp.]. Application of 20 kg N/ha or seed inoculation with *Rhizobium* significantly improved the seed yield over control. Combined application of N + seed inoculation further induced significant increase in seed yield over their individual application. Successive increase in phosphorus up to 90 kg P_2O_5/ha significantly increased the seed yield.

Key words: Nitrogen, Phosphorus, Seed inoculation, Cowpea

Cowpea [*Vigna unguiculata* (L. Walp.] is most widely grown pulse-cum-vegetable crop. It contains 24.6% protein and plays an important role in maintaining soil fertility. But, average productivity of the crop is far below the yield levels recorded at research stations. Major hurdles in increasing the productivity is poor soil in which the crop is grown and improper fertilization. Hence, there is a need for increasing crop productivity by improving soil fertility. In addition to nitrogen which is fixed in the soil from the atmosphere by the crop specific *Rhizobium* found in root nodules of this crop, phosphorus is another important element which *inter-alia* enhances the nitrogen fixation capability of the crop. In addition to biologically fixed nitrogen, crop also required N through fertilization to meet its initial requirement. Information on the combined effect of fertilizer nutrient and seed inoculation with *Rhizobium* culture in affecting the productivity of the crop is meagre. In the light of above, the present investigation was carried out.

MATERIALS AND METHODS

A field experiment was conducted in summer of 1992 and 1993 at the experimental farm of A.S. (P.G.) College, Lakhaoti, Bulandshahar, Uttar Pardesh. The soil was sandy loam having pH 8.0, and available N, P_2O_5 and K_2O 178, 29 and 302 kg/ha, respectively. The treatments comprised 6 levels of N and seed inoculation (control, seed inoculation, 20 kg N/ha, 20 kg N/ha + seed

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inoculation, 40 kg N/ha and 40 kg N/ha + seed inoculation) and 4 phosphorus levels (0, 30, 60 and 90 kg P_2O_5/ha). Full doses of N and P were applied at the time of sowing along with K at the rate of 50 kg K_2O/ha. The experiment was laid out in randomized block design replicated three times. Seeds of cowpea 'Pusa Komal' were treated with *Rhizobium* culture prior to sowing and dried under shade. Seeds were sown in furrows 45 cm apart with the help of hand plough on 26 March during both the seasons. The crop received two irrigations during each season beside one pre-sowing irrigation. The plots were kept weed free by manual weeding till grain filling.

RESULTS AND DISCUSSION

Effect of N and seed inoculation

Application of 40 kg N + seed inoculation with *Rhizobium* recorded significantly highest plant height over other treatments. Application of 20 kg N + seed inoculation affected plant height favourably over their individual application and control during both the seasons. Seed inoculation or 20 kg N/ha produced significantly higher number of effective branches, number of nodules/plant and primary root length over control. Combined application of these two treatments caused perceptible increase in these parameters over their individual application. These parameters did not show consistent

Table 1. Effect of nitrogen, phosphorus and seed inoculation on growth of cowpea

Treatment	Plant height at harvest (cm)		Number of effective branches/ plant at harvest		Number of nodules/ plant		Length of primary root (cm)	
	1992	1993	1992	1993	1992	1993	1992	1993
N (kg/ha) + seed incoulation								
Control	84.0	96.0	9.6	6.9	2.4	3.4	13.1	13.8
Seed inoculation alone	85.0	97.2	9.9	7.6	6.7	6.0	14.5	14.3
20 kg N	86.0	96.2	10.1	7.0	7.0	7.4	15.7	13.9
20 kg N + seed inoculatoin	87.9	98.8	10.5	7.8	9.5	10.2	16.2	15.0
40 kg N	89.0	102.0	10.4	7.8	8.0	8.7	14.4	13.9
40 kg N + seed inoculation	91.0	106.0	10.4	7.9	8.4	9.1	15.0	14.8
CD (P = 0.05)	1.8	2.3	0.3	0.09	0.12	0.1	0.3	0.3
P_2O_5 (kg/ha)								
0	85.3	97.0	9.5	6.2	2.9	3.7	14.0	14.0
30	86.6	98.5	9.8	6.9	6.9	7.6	14.1	14.3
60	87.6	98.6	10.2	7.6	8.8	10.4	14.8	14.8
90	90.2	101.3	10.5	8.4	10.0	12.0	15.6	16.8
CD (P = 0.05)	1.2	1.4	0.2	0.6	0.1	0.1	NS	NS

Table 2. Effect of nitrogen, phosphorus and seed inoculation on yield attributes

Treatment	Number of pods/plant		Number of seeds/pod		Seed weight/ plant/(g)		Seed yield (q/ha)		Harvest index (%)	
	1992	1993	1992	1993	1992	1993	1992	1993	1992	1993
N (kg/ha) + seed inoculation										
Control	15.81	22.59	8.07	8.56	8.50	9.60	15.24	18.61	29.05	32.03
Seed inoculation alone	20.65	26.18	8.24	8.80	10.62	13.70	18.29	22.21	29.61	32.48
20 kg N	20.29	27.06	8.19	8.76	10.90	11.96	18.17	22.10	30.05	32.47
20 kg N + seed inoculation	23.57	29.38	8.62	8.30	12.80	14.90	19.87	23.54	30.12	33.49
40 kg N	21.79	30.03	8.55	8.16	13.01	14.70	19.70	23.28	30.06	33.41
40 kg N + seed inoculation	22.92	30.28	8.58	8.20	12.40	14.50	19.85	23.33	30.09	33.37
CD (P = 0.05)	2.28	2.32	0.08	0.22	0.62	0.66	0.25	0.41	NS	NS
P_2O_5 (kg/ha)										
0	16.98	20.33	7.25	7.82	10.10	11.00	17.75	21.26	28.97	31.64
30	20.10	27.87	8.30	0.05	10.50	12.60	18.84	22.76	29.99	32.99
60	22.23	30.23	8.36	9.00	14.40	16.50	19.98	24.01	30.96	33.95
90	24.07	35.22	8.50	10.01	15.90	17.86	20.80	25.00	31.60	34.71
CD (P = 0.05)	1.61	1.64	0.06	0.16	0.63	0.72	0.18	0.29	0.26	0.52

behaviour with further increase in the level of N with and without inoculation (Table 1). Number of pods/plant, number of seeds/pod and seed weight/plant increased significantly due to combined application of 20 kg N/ha + *Rhizobium* inoculation over control and their individual application (Table 2). N application at 40 kg N/ha and 40 kg N/ha + *Rhizobium* inoculation did not improve the yield attributes over 20 kg N/ha + seed inoculation. This increase in yield attributes may be ascribed to favourable effect of nitrogen on vegetative growth. Application of 20 kg N/ha or seed inoculation recorded significantly higher seed yield than the control. Seed inoculation + 20 kg N/ha yielded significantly more than their individual application and control but was on par with that of 40 kg N/ha and 40 kg N/ha + seed inoculation. This yield behaviour may be due to favourbale effect of treatment on yield attributes.

Effect of phosphorus

Application of phosphorus at 90 kg P_2O_5/ha recorded significantly higher plant height, number of effective branches/plant and number of nodules/plant than 30 and 60 kg P_2O_5, which in turn were superior to control during both the crop seasons. In both the years, application of P facilitated better root development, but the results were not significant. Number of pods/plant, number of seeds/pod, seed weight/plant, seed yield and harvest index recorded perceptible increase with successive increase in P levels up to 90 kg P_2O_5/ha during both the crop seasons. The maximum seed yield of 20.80 and 25.00 q/ha was recorded with 90 kg P_2O_5/ha in 1992 and 1993 respectively. Favourable effects of P on yield attributes and seed yield may be ascribed to its role in the constitution of ribonucleic acid, deoxyribonucleic acid and ATP which regulate vital metabolic processes in the plant, helping in root formation, nitrogen fixation and finally in crop yield. Similar results have also been reported by Dixit and Saini. (1987)

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