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EFFECT OF SOIL AND FOLIAR APPLICATION OF N AND P ON THE YIELD AND QUALITY OF BLACKGRAM *(VIGNA MUNGO* (L) HEPPER)

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Blackgram is cultivated extensively in the rice fallows of the Onattukara tract of Kerala during the third crop season. But the average yield of the crop is very low due to the poor fertilizer management practices. More recently, fertilization of legumes with phosphorus and/or nitrogen has made great contribution to the technology of crop production. Moreover, foliar application of N and P has been found to favour early maturing of crops under rainfed conditions when moisture is a limiting factor. So the present study was undertaken to evaluate the comparative efficiency of soil and foliar application of N, P and their combination on the growth, yield and quality of blackgram and to work out the cost benefit ratio as influenced by different methods of fertilizer application.

Materials and Methods

The experiment was conducted in the summer rice fallows of the Rice Research Station, Kayamkulam during 1981-82 to find out the comparative efficiency of soil and foliar application of N, P and their combination on the growth, yield and quality of blackgram. The soil was sandy loam in texture containing on an average 1260 kg total N, 45 kg P_2O_5 and 63 kg K_2O per hectare, and pH of 5.3. The experiment was laid out in a randomised block design with fifteen treatments replicated thrice. The treatments were as follows.

T_1 N full basal through soil as urea (20 kg N/ha, as per the Package of Practices Recommendations of Kerala Agricultural University, 1980)

T_2 1/2 N basal through soil and 1/2 N as foliar spray at flowering

T_3 1/2 N basal through soil and 1/2 N as foliar spray in two equal split doses, at the vegetative phase and at flowering

T_4 1/3 basal through soil and 2/3 N as foliar spray in two equal split doses, at the vegetative phase and at flowering

T_5 1/2 N basal through soil and 1/4 N as foliar spray at flowering

T_6 P full basal through soil as single superphosphate (30 kg P_2O_5/ha, as per the Package of Practices Recommendations of Kerala Agricultural University, 1980)

T_7 1/2 P basal through soil and 1/2 P as foliar spray at flowering

T_8 1/2 P basal through soil and 1/2 P as foliar spray in two equal split doses, at the vegetative phase and at flowering

T_9 1/3 P basal through soil and 2/3 P as foliar spray in two equal split doses, at the vegetative phase and at flowering

T_{10} 1/2 P basal through soil and 1/4 P as foliar spray at flowering

T_{11} N and P full basal through soil as diammonium phosphate and urea (20 kg N/ha and 30 kg P_2O_5/ha)

T_{12} 1/2 N + 1/2 P basal and 1/2 N + 1/2 P as foliar spray at flowering

T_{13} 1/2 N + 1/2 P basal through soil and 1/2 N + 1/2 P as foliar spray in two equal split doses, at the vegetative phase and at flowering

T_{14} 1/3 N + 1/3 P as basal through soil and 2/3 N + 2/3 P in two equal split doses as foliar spray at the vegetative phase and at flowering

T_{15} 1/2 N + 1/2 P as basal through soil and 1/4 N + 1/4 P as foliar spray at flowering

The blackgram variety T9 evolved from C. Z. Azad University of Agricultural Science, Kanpur, was used for the study. Lime at the rate of 400 kg/ha was applied at the time of land preparation. Urea, superphosphate, diammonium phosphate and muriate of potash were the fertilizers used for the study. Fresh urea solution of 2 per cent concentration, superphosphate solution of 6.25 per cent concentration and diammonium phosphate solution of 2 per cent concentration were used for foliar spray.

Rhizobium treated seeds were dibbled at a spacing of 10 cm in shallow furrows taken at a spacing of 20 cm. Uniform cultural practices were followed for all the treatments. The crop was harvested by picking the mature pods thrice and duration of the crop was seventy nine days.

The data relating to various yield attributes were collected from a sample of ten plants in the net plot. Nitrogen content was determined by modified micro-kjeldahl method (Jackson, 1958) and crude protein per cent was worked out by multiplying the nitrogen content by the factor 6.25.

Results and Discussion

The mean values of the yield attributes, protein content and protein yield and economics of fertilizer application are presented in Table 1 and 2.

Yield and yield attributes

Yield attributing characters like the number of pods per plant, seed yield per plant and hundred seed weight were significantly influenced by the treatments. It was found that even though N and P combinations recorded maximum value in pod number, application of phosphorus alone also had significant effect on this character. This may be due to the indirect effect of phosphorus on pod development by enhancing the nodulation of the plants which in turn might have fixed adequate quantity of nitrogen. Regarding the method of application, applying the nutrients partly through soil and partly through foliage was found to be the best one.

Table 1

Yield and quality characteristics of blackgram as influenced by different treatments

Treat-ments	Grain yield (kg/ha)	No. of pods/ plant	Seed yield/ plant (g)	Hundred seed wt. (g)	Total dry-matter yield (kg/ha)	Protein content of grain (per cent)	Grain protein yield (kg/ha)
T_1	688	8.68	2.38	3.74	2245	17.02	113.0
T_2	978	13.70	3.06	3.95	3193	24.17	237.1
T_3	1115	12.57	2.92	3.78	3467	24.36	269.0
T_4	1257	19.3C)	3.93	3.97	3748	24.85	312.5
T_5	1169	16.54	3.08	3.95	3774	23.57	279.3
T_6	882	11.77	2.01	3.68	2444	14.94	134.7
T_7	1154	18.57	4.67	4.04	3695	21.81	256.7
T_8	1252	19.90	4.64	4.01	3682	23.92	298.3
T_9	975	12.74	2.79	3.86	3516	24.29	239.4
T_{10}	959	11.77	2.71	3.89	2897	23.19	222.4
T_{11}	841	10.17	2.70	3.78	2434	21.46	180.4
T_{12}	1036	13.51	3.81	4.01	3100	25.11	259.3
T_{13}	1407	30.92	5.15	4.02	3794	25.19	354.4
T_{14}	1631	21.11	4.92	4.04	4742	29.90	481.9
V	1191	15.65	4.12	4.01	3222	24.98	297.1
CD(0.05)	276.51	7.15	1.56	0.25	1254.82	4.69	66.22

Table 2

Economics of blackgram grain production under different methods of application of N and P

Treat-ments	Additional cost of the treatment	Total cost of production* Rs.	Yield of grain kg/ha	Value of grain Rs.	Yield of bhusa kg/ha	Value of bhusa Rs.	Total value of produce Rs.	Net profit Rs.
T_1	92.75	1724	688	2064	1303	130.30	2194	470
T_2	95.68	1727	978	2934	1858	185.80	3120	1392
T_3	96.68	1728	1115	3345	2054	205.40	3550	1822
T_4	96.68	1728	1257	3771	2005	200.50	3972	2244
T_5	71.53	1703	1169	3507	2163	276.30	2723	1020
T_6	103.40	1735	882	2646	1299	129.90	2776	1041
T_7	106.30	1740	1154	3462	2173	217.30	3679	1942
T_8	109.30	1741	1252	3756	1866	186.60	3943	1202
T_9	109.30	1741	875	2925	2202	220.20	3145	1405
T_{10}	80.50	1712	959	2877	1678	167.80	3045	1333
T_{11}	273.38	1905	841	2523	1343	134.30	2157	753
T_{12}	276.20	1908	1036	3108	1777	177.70	3286	1378
T_{13}	279.20	1911	1407	4221	2284	228.50	4449	2539
T_{14}	279.20	1911	1631	4893	2653	265.30	5158	3248
T_{15}	208.00	1839	1191	3573	1719	171.90	4745	2906

*Cost of production excluding the treatments = Rs 1631.31
Cost of 1 kg N = Rs 4.45
Cost of 1 kg P_2O_5 = Rs 3.44

Price of 1 kg grain = Rs 3.00
Price of 1 kg bhusa = Rs 0.10

Results showed that the application of nitrogen or phosphorus partly through soil and partly through foliage gave significantly higher seed yield per plant although their combination recorded the maximum value. Small amounts of nitrogen and phosphorus given might have enhanced nodulation and nitrogen fixation thereby increasing seed yield.

There was significant difference in hundred seed weight due to treatments. Application of nutrients (nitrogen and phosphorus) either alone or in combination through the leaves at the later stages of crop growth was effective in increasing the hundred seed weight.

Grain yield was significantly influenced by the treatments and combined application of N and P partly through soil and partly through foliage at different growth stages gave the highest value. Yield contributing characters like number of pods per plant, S33d yield per plant and hundred seed weight were also higher for these treatments which might have led to the higher grain yield in them. Similar significant effects of combined application of N and P on grain yield was reported in blackgram by Ramaswamy and Ramaiah (1980) and Subramonian and Palaniappan (1980).

Significant and positive correlations were also observed between grain yield and yield contributing characters like number of pods per plant, seed yield per plant and hundred seed weight. Bhusa yield was not significantly influenced by the treatments.

Total dry matter yield varied significantly due to treatments and the maximum yield was recorded by the treatment in which both nitrogen and phosphorus were given 1/3 through soils as basal dose and 2/3 in two equal split doses through foliage. This may be due to the significant effect of this treatment on grain yield and yield promoting characters.

In the case of protein content of grain and grain protein yield also, combined application of N and *P* was superior to the individual effect of each nutrient. Regarding the method of application, applying the nutrients partly through soil and partly through foliage was the best one.

Combined application of N and P, 1/3 through soil as basal dose and 2/3 jn two equal split doses through the foliage alone was significant in increasing the protein content of grain and grain protein yield. Higher protein content of grain may bo due to the higher nitrogen content in them. Similar results were obtained by Singh *et al.* (1977) in moong (*Phaseolus aureus)* and Agarwa! and Narang (1975) in soybean. But the treatments did not have any significant effect on the protein content of bhusa.

Economics of fertilizer application

Maximum net profit of Rs 3254.80 per hectare was obtained in the treatment in which both nitrogen and phosphorus were given 1/3 through soil as basal dose and 2/3 in two equal split doses through the foliage at the vegetative phase and at flowering. The lowest net profit of Rs 470.25 per hectare was obtained in the treatment in which nitrogen alone was given in a single basal dose. The treatments receiving either N alone or P alone gave comparatively lower net profit than their combined application. Regarding the method of application, applying the nutrients through soil in a single basal dose was the least economical treatment compared to its application partly through soil and partly through foliage at different growth stages thus emphasising the favourable effect of applying the nutrients partly through soil and partly through foliage on the economics of fertilizer application.

Summary

A field experiment conducted during the third crop season of 1981—'82 in the rice fallows of the Rice Research Station, Kayamkulam, to study the comparative efficiency of soils as well as foliar application of nitrogen, phosphorus and their combination on the growth, yield and quality of blackgram revealed that the grain yield was significantly increased by the combined application of nitrogen and phosphorus partly through soil and partly through foliage. The maximum grain yield (1631 kg/ha) and net profit (Rs. 3254.80) were recorded by the treatment in which both nitrogen and phosphorus (20 kg N and 30 kg P_2O_5/ha) were given 1/3 through soil as basal dose and 2/3 in two equal split doses through the foliage, at the vegetative phase and at flowering. Protein content of grain and grain protein yield were also significantly influenced by the treatments receiving both nitrogen and phosphorus partly through soil and partly through foliage.

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References

Agarwai, S. K. and Narang, R. S. 1975. Effect of levels of phosphorus and nitrogen on soybean varieties. *Haryana agric. Univ. J, Res.* 5 (4): 363-468

Jackson, M. L. 1958. *Soil Chemical Analysis.* Prentice-Hall Inc, U. S. A.

Ramaswamy, S. and Ramaiah, S. 1980. Effect of foliar application of diammonium phosphate on growth and yield of blackgram. *Madras agric. J.* 67 (6): 366-268

Singh, T., Agarwal, S. K. and Singh, K. P. 1977. Effect of phosphorus and nitrogen levels on the grain yield and protein content of moong *(Phaseolus aureus* Roxb) varieties. *Haryana agric. Univ. J. Res.* 5 (3) 231-235.

Subramonian, A. and Palaniappan, S. P. 1980. Effect of method of planting, planting density and phosphorus fertilization on yield of blackgram in irrigated system. *Madras agric. J.* 68 (2): 96-98