

EFFECT OF LIME, PHOSPHORUS AND RHIZOBIUM INOCULATION ON THE GROWTH AND YIELD OF COWPEA*

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Cowpea is an important crop of Kerala both as a vegetable and as a pulse. Being a legume, it increases the fertility of the soil by virtue of its capacity for symbiotic nitrogen fixation. The red loam soil of Kerala is fairly acidic {pH 4.5-5.0}, high in phosphorus fixation and poor in rhizobium strains. Near neutral soil reaction, high levels of available calcium and phosphorus as well as the presence of ideal strains of rhizobium in the soil are known to be some of the major factors essential for the proper growth and nodulation of cowpea (Bagyaraj and Hedge, 1978). Therefore an experiment was conducted to study the effects of liming, phosphorus fertilisation and rhizobium inoculation on the growth, nodulation and yield of cowpea grown in the red loam soil of Kerala.

Materials and Methods

A field experiment was conducted at the College of Agriculture, Vellayani, Kerala during September–November, 1979. The trial was laid out as a $3 \times 3 \times 2$ factorial experiment in RED with three replications. The treatments were combinations of three levels of lime (0, 300, and 600 kg/ha), phosphorus (0, 30, and 60 kg P_2O_5 /ha) with and without rhizobium inoculation. A bushy, high yielding, dual purpose cowpea variety, *Kanakamani* was used as the test variety.

All the plots received a uniform application of farm yard manure at 5 tons/ha, nitrogen at 10 kg/ha and potash at 10 kg/ha. A buffer strip of 75 cm width was left between plots to prevent the migration of rhizobium between adjacent plots. Burnt lime was used as the liming material. To plots which received no phosphorus, nitrogen was applied as urea. In the other plots, N was applied in the form of diammonium phosphate (18% N, 46% P_2O_5). In such cases, after reckoning the quantity of phosphorus supplied by DAP, the balance amount of phosphorus was applied as single superphosphate. The rhizobium culture used for seed inoculation was the peat based culture distributed by the State Department of Agriculture for the inoculation of cowpea seeds. Cultural practices like irrigation, weeding, plant protection etc were carried out uniformly in all the plots.

Observations on plant height, number of leaves and branches per plant were recorded for ten randomly selected plants in each plot at the flowering stage (45 days after sowing). Also, two plants were uprooted carefully from each plot at this stage and the dry weight of nodules per plant was recorded. Mature pods were collected from 35 plants in the net plot. The number of pods per plant, dry weight of pods per plant, weight of 100 seeds, dry weight, of seeds per ha and total dry matter yield per ha were recorded after the harvest of the crop.

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Results and Discussion

The marginal mean values of the growth and yield characters studied are presented in Table 1.

The individual treatments or their combinations had no significant influence on the vegetative characters or total dry matter accumulation by the crop. Similarly, the weight of root nodules was not affected by any of the treatments.

Lime application increased the seed yield of the crop significantly. It also produced significant increases in the yield components like number of pods, weight of pods and 100-seed weight. The number of pods per plant, dry weight of pods per plant and the yield of seeds per hectare were highest in plots which received lime at 300 kg/ha. The effect of lime applied at 600 kg/ha was only marginal and was not significant statistically. However, both the levels of lime produced similar 100 seed weight which was superior to control. Yield and yield attributes remained unaffected by phosphorus and rhizobium.

Lime is known to favour plant growth by its nutritional involvement directly as well as by its effect in maintaining a favourable cationic environment in the soil, indirectly. But in the present study, lime produced no marked effect on the vegetative growth of the plant. This must be because, the effect of calcium on plant growth is mainly indirect through its effect on soil conditions. According to Puh (1953), the response of legumes to lime depends mainly on the fertility status of the soil rather than pH the response being greater in infertile soils. Further, cowpea is a species well adapted for growth on acid soils (Sanchez, 1976). In the present case, the soil of the experimental area had an available nitrogen content of 275 kg/ha (alkaline KMnO_4 method) and further, each plot received nitrogen at 10 kg/ha. Under such conditions of liberal nitrogen availability, it is but natural that the levels of lime failed to manifest itself on external growth characters. This is in agreement with the results obtained by Kurian (1979) in a similar study on soybean.

Lime application has however enabled the plant to flower more profusely, produce more pods and thus result in higher yields. The beneficial effects of lime on the 100 seed weight is noteworthy. Corroboratory results have been obtained by Tajuddin (1970). Lime is not seen to have influenced the nodulation of cowpea. This may be because, the original soil pH of 4.9 and the exchangeable calcium content of 1.54 me/100 g soil were sufficiently favourable for the nodulation of the crop. This conforms to the reports of Rajagopalan and Sadasivan (1964) that pH level as low as 4.0 is suitable for the growth of tropical legumes, the most favourable pH being 5.0.

The application of phosphorus exerted no significant favourable effect on the growth, nodulation or yield of cowpea. The soil of the experimental site originally contained 0.09% total P_2O_5 and 35 kg/ha available P_2O_5 (Bray No. 2 method). The response of cowpea to phosphorus is decided by the available P_2O_5 status of the soil, the response being poor in soils fairly high in available P (Singh and Sexena, 1977). Besides, legumes are known to possess the capacity

Table 1

Growth and yield characters of cowpea as influenced by lime, phosphorus and rhizobium inoculation

Treatment		Height of plant at flowering (cm)	No. of leaves/ plant at flowering	No. of branches/ plant at flowering	Weight of nodules/ plant at flowering (mg)	Dry matter (kg/ha)	No. of pods/ plant	Weight of pods/ plant (g)	Seed yield (kg/ha)	Weight of 100 seeds (s)
Lime (kg/ha)	0	40.1	8.01	0.44	84	3118	122.9	6.70	780	9.33
	300	42.7	8.82	0.87	114	3504	149.4	8.32	970	9.64
	600	42.6	8.33	0.63	82	3476	138.1	8.09	897	9.64
P ₂ O ₅ (kg/ha)	0	40.7	8.11	0.52	80	3095	131.6	7.29	849	9.54
	30	41.3	8.13	0.50	88	3242	131.9	7.26	843	9.59
	60	43.4	8.92	0.92	112	3761	146.8	8.55	954	9.47
Rhizobium	Untreated	41.5	8.08	0.53	91	3171	136.7	7.75	872	9.44
	Treated	42.2	8.70	0.76	96	3561	136.9	7.65	892	9.53
CD (005)	Lime	—	—	—	—	—	18.6	1.41	128	0.27
SEm (+)	Lime	1.24	0.39	0.13	1.82	43.04	6.43	17.15	9.31	0.09
	P ₂ O ₅	1.24	0.39	0.13	1.82	43.04	6.43	17.15	9.31	0.09
	Rhizobium	1.01	0.33	0.11	1.49	35.14	5.25	14.00	7.60	0.08

to utilise even the unavailable forms of phosphorus present in the soil. Therefore it is to be surmised that the soil contained sufficient quantities of this element for the normal nutrition of the plants.

Rhizobium inoculation also did not influence any of the characters studied. This is in conformity with the observations of Kurian (1979) on soybean grown at Trichur, Kerala. It is to be assumed that the rhizobium culture currently distributed for inoculating cowpea seeds is not efficient in improving the growth, yield or the nitrogen fixation by cowpea under Vellayani conditions. This points to the necessity for conducting detailed experiments to screen out rhizobium strains capable of beneficial symbiosis with cowpea in such soils.

Summary

An experiment to study the effects of lime, phosphorus and rhizobium inoculation on the growth and yield of cowpea was conducted at the College of Agriculture, Vellayani during 1979. About 24% increase in the yield of cowpea could be obtained by the application of lime at 300 kg/ha. Phosphorus application or seed inoculation with rhizobium culture did not produce any beneficial effect on the growth, nodulation or yield of cowpea under Vellayani conditions.

സംഗ്രഹം

ഹെക്ടറിന് 300 കി.ഗ്രാം എന്ന തോതിൽ കുമ്മായം ചേർക്കുന്നതുകൊണ്ട് വൻപയറിന്റെ ഉൽപാദനത്തിൽ ഏകദേശം 24 ശതമാനം വർദ്ധനവുണ്ടാകുന്നതായി 1979-ൽ വെള്ളായണി കാർഷിക കോളേജിൽ വെച്ച് നടത്തിയ ഒരു പഠനത്തിൽ കാണപ്പെട്ടു. എന്നാൽ അത്തരം മണ്ണിൽ ഭാവകവളം ചേർക്കുന്നതോ, ഇപ്പോൾ ലഭിക്കുന്ന റൈസോബിയം കൾച്ചർ പുരട്ടി വിത്ത് വിതയ്ക്കുന്നതോ, ചെടിയുടെ വളർച്ചയോ ഉൽപാദനമോ വർദ്ധിപ്പിക്കാൻ സഹായിക്കുന്നില്ലെന്നും തെളിയിക്കപ്പെട്ടു.

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