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The Influence of Phosphate Fertilisation on Legumes

by

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Introduction: Leguminous crops require larger quantities of P than all other cultivated crops. The rhizobia in the soil also require more P for the synthesis of body cells. Therefore when a leguminous crop is fertilised with P, it serves the needs of both and the association between the host and the symbiont becomes more effective leading to the maximum fixation of atmospheric N under favourable conditions. This property of leguminous crops is widely employed in Agriculture to enrich the soil. A uniform recommendation of P is not possible for a particular crop under different soil conditions. The present investigation was taken up with a view to fix the effective dose of P for sannhemp in the red soils of Coimbatore, Madras State.

Review of Literature: Truesdell (1917) reported that legumes and rhizobia have a high content of P and so, additional supplies of this element enhance the growth of both the host and the symbiont. High accumulations of N and protein were recorded by Mc Taggart (1921) and Parr and Sen (1948) respectively in legumes treated with P. According to Russel (1950) plants with insufficient supply of P will have a stunted root system and even more stunted leaf and stem. Phosphate fertilisation of legumes was recommended by Sen and Rao (1953) as a method of building up soil fertility, since it increases the organic matter and nitrogen content of the soil. Vyas and Desai (1953) recorded increased number and size of the nodules and N content of the plant by the application of P. Vyas (1953) reported a higher content of soil nitrogen as the result of P fertilisation.

Material and Methods: The trial was conducted in pot culture. The typical red soils of Coimbatore was taken for the trial. The soil analysed 0.022 per cent of total P. The available P was estimated at 18 kg/ha. A basal dressing of 3.5 tonnes of cattle manure/ha was given. Phosphrus was tried at two doses, viz. 17 and 34 kg/ha in the form of superphosphate, the entire quantity being applied as basal dose.

Sannhemp (*Crotalaria juncea*), a popular green manure and fodder crop was selected for the study. The seeds were sown in tens. Germination count was taken and on the tenth day the plants were thinned to three. The height of the plants was recorded at intervals of five days. Harvest was done on the thirtieth day and on the fiftieth day when the plants were in the flowering

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stage. The length of the root, green and dry weight of the shoot and root, number of nodules and the weight of the nodules were recorded. The roots, nodules, shoot and the soil were analysed for the N content.

Results and Discussion: 1. *Germination of seeds:* Phosphorus had no significant effect on the germination of seeds.

2. *Growth and Yield:* Application of P markedly increased the plant height at 34 kg level. The influnce of different levels was not striking till the 25th day of sowing. The higher level of P resulted in increased height and this trend was maintained till flowering. In the light of the possible fixation of P and its utilisation by micro-organisms it was inferred that at the lower level, phosphorus would have got immobilised.

The dry weight of the shoot was markedly influenced by P. The 34 kg dose showed strikingly superior results at flowering, while on the 30th day the effect was not clearly brought out. The finding on the increased dry matter production of legumes as a result of P fertilisation was confirmed in the trial.

3. *Growth of Root:* Phosphorus did not influence the root length at any of the levels. But the 34 kg level gave appreciable increase in the dry weight of the root. The result was in conformity with the generally accepted theory that phosphorus increases the root system of plants.

4. *Nodulation:* Phosphorus had a highly significant influence on the production of nodules. The higher dose was superior over the control producing 46% more over the control. The lower dose also produced numerically more nodules. However, the weight of nodules did not show any appreciable difference between the two levels tried.

5. *Nitrogen content:* The nitrogen content of the shoot, root or nodules did not show any marked change due to the application of P.

6. *Total Nitrogen per Plant:* The advantage of application of P to legumes were clearly brought out by the 34 kg dose.

The effect of phosphorus on the different plant characters is presented in Table 1.

TABLE 1

Plant characters	Stages (days)	Levels of phosphorus P_0	P_1	P_2	Mean	SE_0	CD (P=0.05)
Plant height in cm	15	16.5	14.3	15.3	15.35		
	20	20.1	18.7	20.5	19.74		
						0.892	1.22
	25	26.7	27.2	30.2	28:03		
	30	34.9	35.4	42.4	47.58		
	Mean	24.55	23.90	27.10			

TABLE 1 *(Continued)*

Plant characters	Stages (days)	Levels of phosphorus P_0	P_1	P_2	Mean	SE_D	CD (P=0.05)
Dry weight of the shoot in g (mean of stages of harvest)		8.58	8.13	10.56	...	0.61	1.21
No. of nodules per pot (mean of stages of harvest)		165	188	241	...	20.0	40.0
Total nitrogen per plant at flowering in mg		88	92	116	...	7.7	16.32
Nitrogen fixation per pot in mg		335 9	389.6	449.8	...	30.2	64.02

The increase in the nitrogen per plant at 34 kg level over the next lower dose of P was 26%.

7. *Nitrogen Fixation:* Application of P increased N fixation. At the higher dose, fixation was amounting to 450 mg / plot. This value, when converted to the hectare based on the weight of the soil, works out to about 127.5 kg. The lower dose also resulted in slight increase in the N fixation.

Summary: A trial was undertaken in the red soils of Coimbatore to fix the effective dose of P and to study the N fixation as influenced by P application for sannhemp. Phosphorus was applied in the form of superphosphate at 17 and 34 kg of P_2O_5/ha. Observations on the growth of plants and nodules were recorded and the soil, shoot, root and nodules were analysed for N content.

The studies revealed that P did not influence the germination of seeds. Application at 34 kg/ha increased the plant height and the dry weight. Phosphate application at 34 kg/ha also resulted in increasing the number of nodules, N content of plants and N fixation. The lower dose did not have any significant influence on the characters studied.

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