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Studies on the Effect of Rhizobium on the Progressive Changes of Nutrients, Yield and Quality of Groundnut (Pol 1) in Two Red Soils of Tamil Nadu

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ABSTRACT

Studies on the effect of *Rhizobium* on groundnut in calcareous and non-calcareous red soils of Tamil Nadu and its varied influences on groundnut crop revealed that the effect of rhizobium on available nitrogen, potassium and calcium status of the soil was non-significant whereas *Rhizobium* application increased the availablity of phosphorus and magnesium to groundnut crop. A linear increase in oil content, protein content and nodulation had also been observed with *Rhizobium* application. *Rhizobium* inoculum did not have any effect on kernel yield.

INTRODUCTION

In scientific and intensive agriculture, *Rhizobium* play a vital role because of their ability to fix atmospheric nitrogen in symbiosis with host plants and this contributes to the nourishment of the plants and during and after their death they enrich the soil with combined forms of nitrogen. In this context many methods have been proposed for the use of rhizobial cultures and pelleting of seeds had been reported to be favourable both for survival (Roughley, 1970) and effectiveness (Vincent, 1954) of the added Rhizobia. Moreover it makes the nutrients available very near the root zone to tide over initial nutritional phase of the growing crop (Bergersen *et al.*, 1958). Hence pelleting of seeds before sowing offers good scope in improving nitrogen fixation and consequently for enhancing the yield of legumes. Groundnut is one of the most important leguminous oilseed crop and hence use of *Rhizobium* can be expected to be of much use in increasing the yield and quality.

MATERIALS AND METHODS

A pot culture experiment was carried out with two red soils (Calcareous and non-calcareous) and POL 1

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groundnut as the test crop. The treatment details were as follows :

Soils : 2; Non-calcareous red (NC) and Calcareous red (C)

Replications : 2

Treatments : 12

Magnesium : 6 levels, 0, 30, 60, 90, 120 and 150 kg/ha as $MgSO_4$

Rhizobium : 2 levels, Non-inoculated (NR) and inoculated (R)

Non-calcaerous			Calcareous			
NC	NR	Mg_0	C	NR	Mg_0	Replicated for two times
NC	NR	Mg_1	C	NR	Mg_1	
NC	NR	Mg_2	C	NR	Mg_2	
NC	NR	Mg_3	C	NR	Mg_3	
NC	NR	Mg_4	C	NR	Mg_4	
NC	NR	Mg_5	C	NR	Mg_5	
NC	R	Mg_0	C	R	Mg_0	
NC	R	Mg_1	C	R	Mg_1	
NC	R	Mg_2	C	R	Mg_2	
NC	R	Mg_3	C	R	Mg_3	
NC	R	Mg_4	C	R	Mg_4	
NC	R	Mg_5	C	R	Mg_5	

Twentyfive kilograms of nitrogen, 50 kg of P_2O_5 and 75 kg of K_2O per hectare were applied in the form of ammonium sulphate, mono-ammonium phosphate and potassium chloride respectively. Plant samples were collected at reproductive and post-harvest stages and analysed for nitrogen, phosphorus, potassium, calcium and magnesium using micro-kjeldahl method, vanado-molybdo phosphoric acid method flame photometric method and versenate titration method respectively. Soil samples were collected at 4 stages *viz.*, pre-sowing, vegetative, reproductive and post-harvest stages and analysed for nitrogen, phosphorus, potassium calcium, magnesium, organic carbon and total nitrogen using Subbiah and Asija's method, Olsen's method, flame photometric method, versenate titration method, Walkley-Black method and macro-kjeldahl method respectively.

RESULTS AND DISCUSSION

The data obtained have been statistically scrutinized and the results are given below and discussed.

Effect of *Rhizobium* on availability of nitrogen and calcium was not significant. The nitrogen applied at the time of sowing appears to have been immobilized by the soil microflora which later gets nitrified increasing the available nitrogen status at post-harvest stage. Effect of *Rhizobium* on the availability of calcium was not significant because this may be either due to general antagonism between the cations or due to the need of magnesium rather than calcium by *Rhizobium*.

Potassium also was least affected by the incorporation of *Rhizobium* in groundnut. Similar rusults with regard to effect of *Rhizobium* on availability

of nitrogen, potassium and calcium have been reported by Rani Perumal (1972).

Rhizobium innoculation seemed to be beneficial for increasing phosphorus availability. This agreed with the finding of Swaby and Joan Sperber (1958) who reported that increased phosphorus content was much more direct by causing greater solubility of phosphorus due to microbial production of organic acids.

There was a reduction in magnesium availability irrespective of the soil, with increase in calcium availability. This may be either due to the general antagonism between the cations or due to the increased assimilation of magnesium rather than calcium by *Rhizobium*. Such a view has been proposed by Norris (1958) and Holding and King (1963).

Rhizobium on magnesium availability

R_0	R_1	SE_D	CD (P = 0.01)
3.30	3.38	0.02	0.05

Conclusion: R_1 R_0

The present investigation has brought out the fact that nitrogen uptake is primarily a function of rhizobial activity.

Rhizobium on nitrogen uptake

R_0	R_1	SE_D	CD (P = 0.01)
148.4	107.7	13.8	38.04

Conclusion: R_0 R_1

Rhizobial inoculation may be benefical to the extent of more phosphorus and potassium uptake, eventhough the influence is limited by lack of statistical significance.

Rhizobium on phosphorus uptake

R_0	R_1	SE_D	CD (P = 0.01)
12.46	15.70	1.52	4.19

Conclusion: R_1 R_0

Rhizobium on potassium uptake

R_0	R_1	SE_D	CD (P = 0.01)
86.56	92.39	6.43	16.55

Conclusion: R_1 R_0

Findings of Hamdi *et al.* (1966) and Rani Perumal (1972) lend support to the present findings. *Rhizobium* inoculum has got considerable effect on magnesium uptake. This has been enunciated by Hampton *et al.* (1953) and Rani Perumal (1972).

Rhizobium on magnesium uptake

R_0	R_1	SD_D	CD (P = 0.01)
126.5	169.00	11.25	28.99

Conclusion: R_1 R_0

The findings revealed that rhizobial incorporation had resulted in increased oil content. The view has been corroborated by Arora *et al*. (1971). A linear increase in protein content with rhizobium had also been noted in the present work. It is an undisputed observation that inoculation increased the nodulation.

Rhizobium on oil content

R_0	R_1	SE_D	CD (P = 0.01)
45.83	47.25	0.28	0.77

Conclusion: R_1 R_0

Rhizobium on nodule number

R_0	R_1	SE_D	CD (P = 0.01)
77.2	99.2	2.20	5.75

Conclusion: R_1 R_0

Rhizobium inoculation did not have any significant effect on kernel yield of groundnut grown in red soils. Probably the variations in soil conditions may be the answer for the differential behaviour now obtained in the study. With reference to use of *Rhizobium*, thepresent study indicated that non-calcareous soil is superior and best suited over calcareous soil in view of more uptake of nitrogen, potassium and calcium, and in increasing the quality aspects like oil and protein contents. *Rhizobium* had beneficial effects on the quality of groundnut and on uptake of nutrients.

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