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EFFECT OF PHOPHATIC FERTILIZER APPLICATION ON VESICULAR-ARBUSCULAR MYCORRHIZAL INFECTION IN COWPEA

Plants with vesicular-arbuscular mycorrhizal association are capable of increased absorption of many nutrient elements especially phosphorus from the soil (Mosse, 1957; Bowen and Mosse, 1969; Ross and Harper, 1970). However, the tropical soils are generally P-fixing or P-deficient and hence, adequate phosphate fertilization is often necessary to get a good crop yield. In the present investigation, the effect of such application of phosphatic fertilizer on VA-mycorrhizal infection in cowpea was studied.

A pot culture experiment was conducted under aseptic condition using the cowpea variety C 152 obtained from the Regional Agricultural Research Staion of the Kerala Agricultural University at Pilicode. The experiment was laid out in completely randomised design with three replications each. The potting material consisted of washed river sand sterilized in an autoclave at 121°C for 2 hours. There were three mycorrhizal treatments designated as MS, ML and M- corresponding to (1) inoculation with a standard culture of VA-mycorrhiza *Glomus microcarpus,* (2) a local culture of VA-mycorrhiza *Glomus* sp. and (3) without any mycorrhizal inoculation, respectively. The mycorrhizal inoculum was mass produced aseptically in Sudan grass *(Sorghum vulgare)*. The inoculum consisted of 50 g of infected roots of Sudan grass cut into small bits of approximately 1 cm in length, along with the adhering soil particles and spores of VA-mycorrhiza. The inoculum was placed at the centre of each pot at a depth of about 5 cm and covered with a thin layer of sterilized sand over which the cowpea seeds were sown after surface sterilization with 0.1% mercuric chloride solution. The two *Rhizobium* treatments were R+ and R- corresponing to inoculation with an appropriate *Rhizobium* culture and without any *Rhizobium* respectively. There were three phosphate treatments consisting of rockphosphate (RP) and superphosphate (SP) at the rate of 30 kg P_2O_5/ha and without any phosphate application (P-). Muriate of potash was added uniformly to all pots at the rate of 10 kg K_2O/ha. The plants were irrigated regularly with sterilized distilled water and twice a week with a modified phosphate free quarter strength plant nutrient solution of the composition, 0.0745 g KC1, 0.344 g $CaSO_4$, 0.246 g $MgSO_4$ and 1000 ml distilled water. An aliquot of 0.5 ml of the trace element solution 0.78 g $CuSO_4$, 2.22 g $ZnSO_4$, 2.03 g $MnSO_4$, 0.001 g sodium molybdate, 1.43 g boric acid, 1000 ml distilled water was added to 1000 ml of the macronutrient solution prior to sterilization in an autoclave at 121°C for 20 min. This was diluted four times with sterilized distilled water whenever necessary for preparing the quarter strength plant nutrient solution.

Data on nodule number, mycorrhizal infection and fresh and dry weight of plants were taken on 45th day of plant growth. The mycorrhizal index was calculated by observing one hundred randomly selected trypan blue stained (Phillips and Hayman, 1970) root bits of approximately 1 cm in length from each replication.

The number of nodules formed

Table 1. Effect of phosphatic fertilizer application on VA-mycorrhizal infection and plant growth in cowpea*

Treatment combination	Nodule number	Mycorrhizal index	Plant fresh weight (g)	Plant dry weight (g)
MS R+ RP	14.37(3.92)	8.17	3.20	3.50(2.12)
MS R+ SP	27.72(5.36)	5.67	3.02	2.57(1.88)
MS R+ P-	20.62(4.65)	3.67	1.37	1.49(1.57)
MS R- RP	0.00(1.00)	3.17	1.63	3.25(2.60)
MS R- SP	0.46(1.21)	3.17	1.42	2.63(1.90)
MS R- P-	0.46(1.21)	1.67	0.74	1.64(1.62)
ML R+ RP	11.04(3.47)	4.33	1.69	2.83(1.96)
ML R+ SP	13.52(3.81)	4.56	2.50	1.85(1.67)
ML R+ P-	22.81(4.88)	2.83	0.93	0.98(1.39)
ML R- RP	0.46(1.21)	2.50	0.83	2.22(1.79)
ML R- SP	0.00(1.00)	2.67	0.52	2.70(1.75)
ML R- P-	0.46(1.21)	1.83	0.50	1.59(1.61)
M- R+ RP	4.76(2.40)	2.67	0.86	0.01(1.00)
M- R- SP	13.98(3.87)	3.17	1.03	0.01(1.00)
M- R+ P-	13.14(3.76)	2.67	0.68	0.02(1.01)
M- R- RP	0.17(1.08)	1.67	0.68	0.01(1.00)
M- R- SP	0.14(1.07)	1.83	0.70	0.00(1.00)
M- R- P-	0.17(1.08)	2.17	0.50	0.01(1.00)
CD (0.05)	0.93	1.35	0.58	0.20

* Mean of three replications on 45th day

Figures in parentheses are after $\sqrt{x+1}$ transformation

was significantly high in all *Rhizobium* inoculated treatments. This was maximum in the treatment combination consisting of *Rhizobium* inoculation, standard culture of VA-mycorrhiza (*Glomus microcarpus*) and the application of superphosphate. In this treatment (MS R+ SP) 27.72 nodules were formed per plant (Table 1). However, the fresh and dry weight of plants, 8.17 g and 3.20 g respectively and the mean mycorrhizal index of 3.50 were maximum in the MS R+ RP treatment involving rockphosphate application. These were significantly higher than the control and various other treatments except the MS R+ SP for plant dry weight and MS R- RP and ML R+ RP treatments for mean mycorrhizal infection.

The extent of mycorrhizal infection was significantly increased in different treatments involving mycorrhizal inoculation and phosphate application either in the form of rockphosphate or superphosphate. Such beneficial effects of phosphate fertilizer application on mycorrhizal infection are reported ear-

Her in many other crops such as maize (Murdoch *et al.*, 1967), clover, *Stylosanthes* and centrosema (Mosse *et al.*, 1976) and chick pea (Jalali and Thareja, 1985). However, between the two phosphate treatments such an effect was found more pronounced with the use of rock-phosphate. Thus it may be concluded that the application of low levels of phosphatic fertilizer preferably in the form of rockphosphate to soils which are generally P-fixing or P-deficient will be beneficial in enhancing the mycorrhizal infection in crop plants.

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