RESEARCH ARTICLE

Application of Microbial Inoculant strains to *Cajanus cajan*

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ABSTRACT

'Microbial inoculants' containing live or latent cells of efficient strains of nitrogen fixing, microorganism used for application to seed and seedling plants. Soils are composting areas with the objectives of increasing the number of such microorganisms. Microbial processes are not only quick but consume relatively less energy than industrial process. In present study, application of different strains of biofertiliser to *Cajanuscajan* . Wild strain is collected from the root nodules of plant. Both the strains wild and metallic are developed in Norris and Date medium. Individual application of these fertilisers shows less growth as comparative the combination of the all metallic strains except in cadmium strain. Very less growth was obtained while using Cd-t strain. Cu-t strain shows maximum growth than Zn-t and Wild strains.

Keywords: *Rhizobium*, metal strain, biofertiliser, *Cajanus cajan*

INTRODUCTION

High concentrations of copper inhibits growth of microorganisms and also become toxic to plants where as copper deficient plants bear smaller nodules and incorporate carbon slowely to amino acids (Gachter *et al.,*1973). The first scientist Raulin (1969) who reported the essentiality of Zn for plants. Zinc is an essential element for an organism because of its central role as enzyme co-factor in many metabolic processes (Evans and Sorger, 1966). Cadmium is non-essential and extremely toxic, by substituting for zinc in enzyme system it poisons to important metabolic processes.

Microorganisms develop more resistance to heavy metals and adapt particular condition containing toxic metal in their media. Among metals copper and zinc are considered to be essential for the growth and yield of crop plants. In the context, the application of both essential and non-essential heavy metals are taken into account through the organism which improved the soil fertility, integrated plant nutrient supply system and yield of crops.

MATERIAL AND METHODS

Collection and Isolation of *Rhizobium* (W-t): The *Rhizobium* was isolated from the root nodule of *Cajanuscajan* (Aasha) the field Nagpur. After selection, wash the nodules and immerse undamaged nodule in 95% ethanol for 5-10 seconds; then rinse it in sterile water. Sterilise nodule surface by acidified mercuric chloride solution (0.1 % w/v) again rinse 5-6 times in sterile water

Preparation of Heavy metal strain (Cu-t, Zn-t and Cd-t): The culture media with Copper, Zinc and Cadmium of different dilution of stock were made separately and growth of *Rhizobium* was determined and observed microscopically and by using spectrophotometer. After about 35 generations adapted metal tolerant strain at Cu-t o.25 Zn-t 0.18 and Cd- t 0.35 were obtained.

***Field application of Wild and Metal strain of Biofertilisers*:** Field experiment was conducted by giving four treatments replicated in thrice (as shown in table) as per Factorial Randomised Block Designed (FRBD). The biofertilisers in liquid form were inoculated 1ml/seedling plant. The biofertilisers in liquid form were inoculated 1ml/plant.

Treatments

No treatment = T
Treatment with W-t strain of *Rhizobium* = T1
Treatment with Cu-t 0.25 strain of*Rhizobium* = T2
Treatment with Zn-t 0.18 strain of *Rhizobium* = T3
Treatment with Cd-t 0.35 strain of *Rhizobium* = T4
Treatment with (T2+T3+T4) = T5

RESULTS AND DISCUSSION

Heavy metal toxicity to microorganisms:

The metallic strain were obtained as Cu-t 0.25, Zn-t 0.18 and Cd-t 0.35.The increase in number and dry weight of nodules and grain yields of lentil when seeds were soaked in 0.35 percent copper sulphate prior to *Rhizobium* inoculation (Khurana *et al.*, 1976). Zinc deficiency decreased shoot weights, nodule weights and the amounts of N_2 - fixed (Demeterio et al., 1972). It can be recovered by a spray of 0.5 percent of w/v $ZnSO_4$, the balanced P (25-50 ppm) and also reported that the tolerance of bacteria to Cd was appearently species specific in sensitivity to Cd.

Cajanuscajan (Tur)

Effect of wild strain of *Rhizobium sp.* on *Cajanuscajan*

The wild strains of and *Rhizobium* used the biofertilisers. Table shows that the plant height 165-170 cm, 14-16 branches/plant with yield 142- 150 gm/plant, having 11-12.40 gm/100 seeds test weight obtained. This crop responded favourably to nitrogen and *Rhizobium* inoculation in a variety of ICPL 87 during 1992 to 1993 treatment with 15 kg N/ha and *Rhizobium* inoculation gave significantly higher yields than the control (Singh et al, 1998).

Effect of copper strain (Cu-t) of *Rhizobium* sp. on *Cajanuscajan*

Using this strain of Microbial inoculant plant height obtained. Slightly higher height 173-178 cm, 16-18 branches yield 148-160 with 13.15 gm/100 seeds were obtained. Copper is one of the few metallic element which occur in nature (Massey, 1973). It is an important element for all forms as like participation in a number of biochemical reactions (Maelstrom and Neailands, 1964).

Effect of zinc strain (Zn-t) of *Rhizobium sp.* on *Cajanuscajan*

Like copper strain similar treatment were obtained given when using the zinc strains of *Rhizobium* sp. as the biofertiliser. The maximum height 170-175 cm, 15-18 branches with yield 145-160 gm/plant and 11.52 gm/100 seeds were obtained. Similar results obtained by Saharawat et al. (1998) that the uptake of Zn significantly increased only with the smallest rate of P application.

Effect of cadmium strain (Cd-t) of *Rhizobium sp.* on *Cajanuscajan*

Using cadmium strain of dual application of *Rhizobium sp.* of thebiofertiliser theplant height160-165 cm, 12-16 branches with grain yield 140-145 gm/plant and having test weight 10-12 gm/100 seed were obtained.

Table 1: Effect of Wild and metallic strain of *Rhizobium* on *Cajanuscajan*(Tur-plant)

Treatment	T (No treat)	T1 (W-t)	T2 (Cu-t)	T3 (Zn-t)	T4 (Cd-t)	T5 (T2+T3+T4)
Plant height(cm)	145-150	165-170	173-178	170-175	160-165	175-185
No. branches/plant	10-12	14-16	16-18	15-18	12-16	18-20
Grain wt./plant (gm)	130-135	142-150	148-160	145-160	140-145	155-165
Test weight/ 100 seeds (gm)	8.5-9.0	11.12-12.40	13.15	11.52	10-12	13.65

Maize crop in Cd-enriched sludge/compost amended soils did not show any toxic influenced even at highest doses at 224 t/ha in any soil types (Ramachandran and D'souza, 1999).

Effect of mixed metallic strains of (Cu-t, Zn-t and Cd-t) *Rhizobium sp.*on*Cajanuscajan*

In this all mixed strains Cu, Zn and Cd of *Rhizobium* sp. used as biofertilisers. The plant height 175-185cm, 18-20 branches, yield 155-165gm/plant and test weight 13.65 gm/100 seeds were obtained. The application of inoculant increased the macronutrients N,P,K and micronutrient Cu, Zn, Mn and Fe contents in Paddy grain yield (Ramani and Pillai, 1992).

CONCLUSION

From the above study the maximum growth and yield of plant is observed due to the combination of all metallic strain than the individual inoculation. The metallic strain improved growth of plant and fertility of soil. While single individual application shows that the Cu and zinc shows significantly more beneficial than Cd and w strain of Rhizobium. Study of Cd strain shows the adverse effect on *Cajanuscajan*

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