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Studies On The Influence Of Bioinoculant Consortium On Chillies And Its Effects On Soil Health Management

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Abstract: Chilli is one of the important commercial crops and plays vital role in trade for foreign exchange. Now a days, we are dumping much of chemical fertilizers for higher yield and huge amount of chemicals like fungicides, pesticides for the crop protection in vegetable crop. Biofertilizers are carrier based preparations containing beneficial microorganisms in a viable state intended for seed or soil application and designed to improve soil fertility and to help plant growth by increasing the number and biological activity of desired microorganisms in the root environment. If we prolong some more years by using chemical in cultivation there might be a permanent decline in soil health (fertility). This study clearly indicated that the effect of bioinoculation with consortium *Viz., Trichoderma viridae + Pseudomonas fluorescence + Azotobacter chroococcum* was much better when compared to dual and single inoculation which enhanced the growth and yield parameters when compared to control thereby improving the soil health. And it is also an excellent remedy for short period reclamation of unfertile soil by prolonged use of biofertilizer.

Key words: Bioinoculant Consortium, *Trichoderma viridae*, *Pseudomonas fluorescence* and *Azotobacter chroococcum*.

1. Introduction

Biofertilizers are products of selected beneficial and live microorganisms, which help to improve plant growth and productivity mainly through supply of plant nutrients. Biofertilizers are also known as microbial inoculants or bio inoculants. Biofertilizers have come to stay in Indian agriculture since last three decades in view of their cost effectiveness, contribution to crop productivity, soil sustainability and eco friendly characters¹. Marginal farmers in India cannot afford the chemical fertilizers but the use of biofertilizers is affordable and economical for wide variety of crops such as cereals, millets, oil seeds, spices, vegetables, fruits and plantation crops².

Chilli (*Capsicum annum* L.) seedlings were inoculated as single, dual and as consortium of bioinoculants *viz., Trichoderma viridae, Pseudomonas fluorescence* and *Azotobacter chroococcum* through seed treatment, seedlings dipping and soil application with lignite as carrier³. The experiment was conducted in the pot culture yard of the Department of Agricultural Microbiology, Annamalai University. Plants were observed biometrically and observations were recorded. This study clearly indicated that the effect of bioinoculation with consortium was better when compared to dual and single inoculation which enhanced the growth and yield parameters when compared to control.

2. Materials And Methods

Culture Collection

The bioinoculants were obtained from the culture collection centre of the Department of Agricultural Microbiology, Faculty of Agriculture, Annamalai University.

Purification and Maintenance of Cultures

Trichoderma viridae, *Pseudomonas fluorescence* and *Azotobacter chroococcum* were purified by streak plate method on kings 'B', molasses yeast and Walksman base 77 medium respectively. Individual colonies were streaked and respective slants were stored in refrigerator at 4°C for further studies.

Compatibility test of Bioinoculants

Trichoderma viridae, *Pseudomonas fluorescence* and *Azotobacter chroococcum* were tested for compatibility by cross streak assay in nutrient agar medium it is sterilized and poured into sterile Petri plates and allowed for solidification. To test the compatibility of *Azotobacter chroococcum* with other cultures, the *Azotobacter chroococcum* was streaked as a strip at one end of the plate and inoculated for 24 hours to form a thick growth.

The test cultures of *Trichoderma viridae* and *Pseudomonas fluorescence* were streaked perpendicular to *Azotobacter chroococcum* growth. The plates were incubated for 48 hours and observed for the growth of *Azotobacter* and *Pseudomonas*.

Studies on the effect of bioinoculants as single, dual and consortium on the growth and yield of chillies in pot culture experiment

A pot culture experiment was conducted during Kharif (July- September, 2009) season in the pot culture yard of the Department of Agricultural Microbiology, Faculty of Agriculture, Annamalai University, Annamalai Nagar. The annual mean minimum and maximum temperature of the pot culture yard is 25°C and 39°C, respectively and the mean highest and lowest relative humidity was 96 and 78 per cent respectively. The mean annual rainfall of this area is 1500 mm. The physico-chemical properties of the pot soil were analyzed.

The bioinoculants *Trichoderma viridae*, *Pseudomonas fluorescence* and *Azotobacter chroococcum* were prepared in single, dual and consortium and used in this study.

Preparation of pots and seed inoculation

The cement pots of size 1'x 2'x 2' filled with land soil and sand in the ratio of 1:1. The seeds of chillies was surface sterilized with 80 percent ethanol and 0.1 per cent mercuric chloride and washed with sterile distilled water for 3 to 4 times. The seeds were mixed with carrier based bioinoculants as single, dual and consortium of organisms separately having a cell load of 1×10^9 cfu ml⁻¹ and shade dried for 30 min. After shade drying, the seeds were sown at 25 seeds per pot and finally five seeds were maintained. A control pot without inoculation was also maintained. The experiment was conducted in completely randomized block (CRD) design with three replications. The treatments are as follows.

Biometric observations

Biometric observations from the pot culture of chillies like Plant height, Germination percentage, Vigour index, and fruit yield were recorded.

Plant height

Plant height was recorded from the ground level to the tip of terminal bud and expressed in cm.

Germination Percentage

Germination percentage was computed by recording total number of chilli plants germinated against number of seeds sown in each pot on seventh day after sowing.

Vigour Index

Vigour index was computed on 15 DAS using the following procedure suggested by Abdul Balli and Anderson (1973).

Vigour Index = Germination percentage x Shoot length.

Number of fruits / plants

Number of fruits can be counted value is recorded as number of fruits per plant.

Statistical analysis

Statistical analysis was done according to the standardized statistical methods.

Earthworm population

Earthworm presence indicates the fertility of the soil. It was estimated by counting the number of worms/sq m in the pot.

Nutrient Status

The micro and macro nutrient status was estimated based on lab analysis of soil in the pot.

Presence of Beneficial Microorganisms

It is estimated by the Serial dilution and agar plating technique and Conn's direct microscopic count method.

3. Results And Discussions

In general biofertilizer inoculation considerably increased the seedling root length, shoot length, and Number of fruits/plant of chillies, highest root length, shoot length, germination rate were recorded in the plants inoculated with bioinoculant consortium. This was closely followed by dual inoculants and single inoculation, the lowest plant height and root length was recorded in the control.

The present study was under taken to assess the effect of the mixed inoculants of *Trichoderma viridae*, *Pseudomonas fluorescense* and *Azotobacter chroococcum* on the growth, soil fertility and yield of chillies. The compatibility of the inoculants *Trichoderma viridae*, *Pseudomonas fluorescense* and *Azotobacter chroococcum* was tested through cross streak plate assay. The inoculants were found to be compatible with each other and were able to grow simultaneously without any inhibition in growth.

This suggests the possibility of substitution of chemical fertilizers by the consortium of bioinoculants thereby reducing the input cost. The inoculation of groundnut with PGPR like *Bacillus sp.* and *Pseudomonas fluorescense* enhanced the growth and yield. Consortium inoculation increased the population of total microbes over uninoculated control indicating the ability of the introduced microorganisms to establish them in the rhizosphere^{4,5}.

The results of the present study clearly indicate the inoculation of the microbes were highly beneficial for enhancing the yield besides effecting a reduction in the cost of inorganic fertilizers and also significantly increases the soil fertility, soil beneficial microbes, and decreases the rate of diseases incidence.

4. References

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