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Combine effect of *Beijerinckia indica* and *Burkholderia territorii* on growth attributes of mango grafts

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Abstract

The field experiment has been conducted for three years to study the combine effect of free living nitrogen fixers such as *Beijerinckia indica* and phosphate solubilizers such *Burkholderia territorii* on growth attributes of Mango grafts. These biofertilizers mixed in a potting mixture significantly shows higher improvement in growth components such as graft survival, number of leaves, number of shoot, height, girth and root length of the mango grafts. The bacterial population was significantly higher in combine treatments of bioinoculants and also shows positive correlation with total nitrogen, total Phosphorous and growth attributes of the Mango graft.

Keywords: Mango grafts, bioinoculants, *Beijerinckia indica*, *Burkholderia territorii*, trichoderma, bacteria, growth attributes

Introduction

The beneficial microorganism plays an important role in making available nutrients to the plants. The bacteria such as *Beijerinckia indica* and *Burkholderia territorii* are the important beneficial microorganisms important for the soil fertility and plant growth. *Beijerinckia indica* is a nitrogen-fixing bacterium, meaning it can convert atmospheric nitrogen into a usable form for plants, primarily ammonia. This process is crucial for soil fertility and plant growth. (Becking H.J, 1961) ^[1] Whereas the *Burkholderia territorii* can act as a phosphate solubilizer, meaning it can convert insoluble phosphate into a soluble form accessible to plants. This process involves the bacteria secreting organic acids, which lower the pH and dissolve insoluble phosphate compounds. Both the strain of bacterium have been isolated in the konkan region from the rhizosphere of mango plant. The biofertilizers of these strain has been prepared and the study was carried out to see the combine effect of these biofertilizers on the growth attributes of Mango graft, microbes and nutrient content of the potting mixture under nursery condition in konkan region of Maharashtra.

Materials and methods

The experiment has been conducted for the consecutive three years at Regional fruit Research station, Vengurla from 2021-22 to 2023-24. The experiment was laid in Randomized Block Design (RBD) with three replications and nine treatments. The fresh Mango stone were sown in Polybags of size 6 x 9 inch filled with different media treatments in the month of May (third week) and grafting was done in the first week of June. After grafting, 100 successful grafts per treatment per replication were selected and for three replications total 2700 Nos. of grafts were selected for experimentation. The uniform package of practices were followed for all treatments including fertilizer application through potting media with 19:19:19 @ 2 gm, plant protection measure and application of water, regular removal of sprouts below graft union etc. The bioinoculants such as *Beijerinckia indica* and *Burkholderia territorii* is prepared by using local strain isolated from mango plant. The estimation of microbes and soil analysis has done at initial stage and final stage (After one year of the mango graft) by serial dilution plate count technique and soil standard techniques respectively.

Result and Discussion

The *Beijerinckia indica* and *Burkholderia territorii* are the beneficial microorganisms

isolated from the *rhizosphere* of mango in konkan region. The *Beijerinckia indica* is a nitrogen fixing bacteria ideally suitable for acidic soil of konkan region. Whereas the *Burkholderia territorii* is a phosphate solubilizing bacteria plays an important role in phosphate solubilization. The present study was conducted at RFRS, Vengurla for consecutive three years to know the combine effect of *Beijerinckia indica* and *Burkholderia territorii* on growth attributes of mango grafts. Results of present research revealed that the combine application (T5 and T9) of *Beijerinckia indica* and *Burkholderia territorii* in a potting mixture shows significant improvement in the total bacterial population and the nutrient content such as total nitrogen and total Phosphorous as compared to control.(Table no.2). The significant improvement also appear in the growth components of one year mango grafts such as graft survival, number of leaves, number of shoot, height, girth as well as root length of the graft as compared to potting mixture alone. (Table no.1). There was positive correlation between the total bacterial population and growth attributes of the

mango graft (Table no.3) which clearly proves that the more addition of these bacterial population such as *Beijerinckia indica* and *Burkholderia territorii* in the form of biofertilizers increases the beneficial bacterial population in the *rhizosphere* of mango crop. The increased population of these nitrogen fixing and phosphate solubilizing bacteria increases the activity of these bacteria which directly increases the nutrient contents such total nitrogen and total phosphorous in the potting mixture. The mango graft absorb more of these available nutrients in the potting mixture and shows the improvement in the growth of the mango grafts. This has been supported by Hernandez A.Y.*et al* 2023 and The Hernandez A.Y. found increase in growth attributes of pepper due to inoculation of *Beijerinckia indica*. This has been also supported by Chanyarat P.L *et al.* 2014 ^[2] who found increased in length and the biomass of root and shoot of sugarcane plantlets due to inoculation of *Burkholderia territorii*. This clearly proves that the both the beneficial bacteria support the growth of mango grafts.

Table 1: Effects of different bio-inoculants on growth parameters of the one year mango grafts. (Pooled Mean of three years)

Tr. No.	Treatments	Grafts Survival (%)	No. of leaves	No. of shoot	Height of the plant (cm)	Girth of the plant (mm)	Root length of the plant (cm)
T ₁	Potting mixture alone	53.67	25.95	1.19	44.06	13.01	28.48
T ₂	Potting mixture + <i>Beijerinckia</i> 50 g	60.33	34.35	1.47	53.39	13.35	32.99
T ₃	Potting mixture + PSB 50 g	58.62	30.99	1.35	50.14	13.30	34.86
T ₄	Potting mixture + Talc based <i>Trichoderma</i> 50 g	55.36	27.34	1.22	46.03	13.07	29.34
T ₅	Potting mixture + <i>Beijerinckia</i> 50g 50 g +PSB 50 g + Talc based <i>Trichoderma</i> 50 g	61.53	37.15	1.57	60.85	14.03	37.49
T ₆	T ₂ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	59.33	33.68	1.46	52.81	13.37	34.69
T ₇	T ₃ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	58.25	29.54	1.33	48.93	13.34	35.54
T ₈	T ₄ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	55.22	27.49	1.23	45.92	13.04	29.74
T ₉	T ₅ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	62.76	36.70	1.55	61.25	14.01	38.81
	SE.+.	1.26	1.01	0.02	0.77	0.13	0.73
	C.D.@5%	3.78	3.04	0.08	2.30	0.38	2.20

Table 2: Effects of different bio-inoculants on bacterial and nutrient status of the one year mango grafts. (Pooled Mean of three years)

Tr. No.	Treatments	Bacterial population X 10 ⁶	Total N (%)	Total P (%)
T ₁	Potting mixture alone	38.00	1.13	0.78
T ₂	Potting mixture + <i>Beijerinckia</i> 50g	61.00	1.25	0.78
T ₃	Potting mixture + PSB 50g	56.00	1.14	0.91
T ₄	Potting mixture + Talc based <i>Trichoderma</i> 50g	37.00	1.13	0.78
T ₅	Potting mixture + <i>Beijerinckia</i> 50g 50g +PSB 50g + Talc based <i>Trichoderma</i> 50g	72.00	1.22	0.87
T ₆	T ₂ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	57.00	1.25	0.78
T ₇	T ₃ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	53.00	1.14	0.91
T ₈	T ₄ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	36.00	1.13	0.78
T ₉	T ₅ + Spraying of <i>Trichoderma</i> (Spore formulation) 3 times at 2 months interval @ 1g/10 L	73.00	1.22	0.88
	SE.+.	1.44	0.005	0.006
	C.D.@5%	4.31	0.02	0.02

Table 3: Correlation co-efficient among the Microbial, Nutrients and growth components of the Mango crop.

Sr. No.	Characters	Total N	Total P	% Graft survival	No of leaves	No of shoot	Height of the plant	Girth of the plant	Root length of the plant
1.	Bacteria	0.74*	0.65*	0.98*	0.96*	0.97*	0.96*	0.93*	0.93*

Conclusion

It is thus concluded that the combine application of

Beijerinckia indica and *Burkholderia territorii* in the form of biofertilizers significantly add the bacterial population

and increases the nutrient content such as nitrogen and phosphorous of the potting mixture which further improve the growth attributes of Mango grafts.

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