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Research Note

Effect of rhizobacteria on wilt suppression, growth promotion and yield of coriander and fennel

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ABSTRACT: A study was carried out to demonstrate the use of rhizobacteria and its effect on disease suppression, growth promotion and yield of coriander and fennel at Raigarh, Chhattisgarh, India. The use of rhizobacteria strains FK-14 (*Pseudomonas putida*) and FL–18 (*Macrobacterium paraxidum*) as seed and soil application resulted in minimum wilt incidence (13.83 and 13.63%, respectively), maximum mean plant height (84.03 cm and 84.39 cm, respectively), weight of 1000 seeds (18.30 g and 18.53 g, respectively), and seed yield (8.75 q ha^{-1} and 9.95 q ha^{-1}, respectively) in coriander crop. In fennel crop also, seed and soil application of both the strains of rhizobacteria resulted in higher mean plant height (106.1 cm and 105.3 cm, respectively), weight of 1000 seeds (11.30 g and 11.50 g, respectively) and seed yield (9.5 q ha^{-1} and 9.6 q ha^{-1}, respectively), compared to other treatments. The application of these two rhizobacteria as seed and soil application was found to be significantly superior to their exclusive application and that of other agents like *Trichoderma*.

KEY WORDS: Rhizobacteria, *Pseudomonas putida, Macrobacterium paraxidum*, coriander, fennel, wilt, growth promotion

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INTRODUCTION

Although fungicides and growth promoting hormones offer certain degree of effectiveness in agriculture crops, often their efficacy is low over the season due to their persistence. The application of fungicides may give effective protection for up to 20-25 days and adversely affect the beneficial rhizosphere microorganisms (Devi and Prasad, 2009). The plant growth promoting rhizobacteria (PGPR) are a group of rhizobacteria found in rhizosphere in soil that colonize plant roots, increase plant growth and crop yield and also offer an attractive alternative for disease management. Coriander leaves and seeds are used as spices and condiments across the country (Sharma *et al*., 2001). Similarly, fennel leaves are also used as a leafy vegetable in some parts and seeds as mouth freshener all over the country (Arya, 2000). Use of fungicides in these crops should be avoided because of residue problem. In Chhattisgarh and other parts of the country, information regarding use of rhizobacteria for the management of diseases and their ability for plant growth promotion on coriander and fennel crops is very meager. Therefore, a study on suppression of wilt and PGPR activity of rhizobacteria on coriander and fennel was carried out under field conditions.

The trial was conducted at Indira Gandhi Agricultural University, Regional Agricultural Research Station, Boirdadar Farm, Raigarh, during 2007-08 and 2008-09 on coriander and fennel crops. The plot size of coriander and fennel was 4x2.7 m in a randomized block design (RBD) and both the crops were sown during the last week of October in both the years and each treatment was replicated three times. All the packages and practices were followed as per the guidelines given by AICRP on spices for good crop growth. The rhizobacteria strains FK-14 (*Pseudomonas putida*), FL-18 (*Macrobacterium paraxidum*) and *Trichoderma* (MTCC- 5179) were supplied by the Project Coordinator, All India Coordinated Research Project on Spices, Calicut, Kerala, for the study. The rhizobacteria strains were applied as seed and soil application, while *Trichoderma* was applied as soil application only (Anonymous, 2007). The bioagents were applied as seed treatment@5g kg^{-1} of seed as recommended. However, the application rate for soil application was 2.5 kg ha^{-1}. Talc-based formulation was prepared and applied as per method of Jeyarajan *et al*. (1993), and soil application was given at the time of sowing once in both the crops. The data on plant height was taken in 20 randomly selected plants in both the crops at the time of maximum flowering stage.

Table 1. Effect of rhizobacteria on wilt incidence, growth and yield of coriander crop

Treatments	Plant height (cm)			Seed yield q ha^{-1}			Seed weight (per 1000 seed in g)	Wilt incidence (%)
	2007–08	2008–09	Pooled	2007–08	2008–09	Pooled		
Rhizobacteria FK 14 (Seed treatment)	60.83	86.73	73.78^{c}	6.7	7.0	6.85^{d}	15.43^{b}	21.28^{b}
Rhizobacteria FK 14 (seed+soil application)	72.50	95.57	84.03^{a}	8.2	9.3	8.75^{b}	18.30^{a}	13.80^{d}
Rhizobacteria FL 18 (seed treatment)	61.60	89.55	75.57^{b}	6.8	8.3	7.55^{c}	15.33^{b}	22.60^{b}
Rhizobacteria FL 18 (seed+soil application)	71.13	97.66	84.39^{a}	8.8	11.1	9.95^{a}	18.55^{a}	13.63^{d}
Rhizobacteria FK 14 + FL l8 (Seed treatment)	61.10	87.19	74.39^{b}	6.6	8.3	7.45^{c}	15.83^{b}	22.40^{b}
Rhizobacteria FK 14+FL 18 (seed+soil application)	69.76	85.66	77.71^{b}	7.9	7.4	7.65^{c}	17.99^{a}	17.73^{c}
Trichoderma (MTCC 5179) as soil application	68.53	88.42	78.47^{b}	7.8	8.3	8.05^{b}	17.83^{a}	16.42^{c}
Control (No treatment)	57.46	80.08	68.77^{d}	5.0	5.1	5.05^{e}	13.21^{c}	39.46^{a}
SEM±	0.73	2.1	1.54	0.37	1.11	0.35	0.47	0.79
CD at 5%	2.13	6.6	4.37	0.77	3.10	0.98	1.33	2.30

Table 2. Effect of rhizobacteria on growth and yield of fennel crop

Treatments	Plant height (cm)			Seed yield (q ha^{-1})			Seed weight (per 1000 seeds in g)
	2007–08	2008–09	Pooled	2007–08	2008–09	Pooled	
Rhizobacteria FK 14 (seed treatment)	101.1	96.1	98.6^{c}	8.7	6.4	7.6^{c}	9.10^{b}
Rhizobacteria FK 14 (seed+ soil application)	108.9	103.4	106.1^{a}	10.3	8.8	9.5^{a}	11.30^{a}
Rhizobacteria FL 18 (seed treatment)	104.3	94.5	99.4^{c}	9.2	7.0	8.1^{b}	9.50^{b}
Rhizobacteria FL 18 (seed + soil application)	106.3	104.3	105.3^{a}	10.1	9.1	9.6^{a}	11.50^{a}
Rhizobacteria FK 14 + FL l8 (seed treatment)	104.4	98.6	101.5^{b}	8.9	6.7	7.8^{c}	9.0^{b}
Rhizobacteria FK 14 + FL 18 (seed + Soil application)	103.6	99.2	101.4^{b}	9.8	7.0	8.4^{b}	10.70^{a}
Trichoderma (MTCC 5179) as soil application	103.7	98.1	100.9^{b}	8.7	6.9	7.8^{c}	10.4^{a}
Control(no treatment)	97.4	92.5	99.5^{c}	7.8	6.1	6.9^{c}	7.1^{c}
SEM±	0.92	0.54	0.93	0.38	0.56	0.32	0.28
CD at 5%	2.85	1.58	2.73	1.12	1.59	0.92	0.83

Observations on the incidence of wilt disease of coriander were taken 15 days before harvesting and its incidence (%) was calculated as follows:

Per cent disease incidence = Y / X x 100, where Y = no. of diseased plants, and X = total no. of plants.

The results (Table 1) revealed that both the strains of rhizobacteria and *Trichoderma* increased the plant height, 1000 seed weight, and seed yield and reduced the wilt incidence in coriander as compared to control plot. The maximum average plant height was observed in rhizobacteria FK–14 (84.03cm) and FL–18 (84.39cm) applied plot as seed and soil application.

Similarly, the average maximum 1000 seed weight (18.30 and 18.55g) and maximum average seed yield (8.75 and 9.95 q ha^{-1}) were found in the treatments where FK 14 and FK 18 were applied as seed + soil application. Minimum wilt disease incidence (13.80 and 13. 63 per cent) was also found in the same treatments as compared control (39.46%). However, both the treatments were statistically on par regarding growth and yield attributes, seed yield and disease incidence. Fennel crop also responded with similar trends (Table 2) to the application of FK 14 and FK 18 strains of rhizobacteria, which resulted in higher plant height (106.1 and 105.3 cm), 1000 seed weight (11.3 and 11.5 g) and maximum seed yield (9.5 and 9.6 q ha^{-1}), respectively, compared to other treatments. Similar results were also reported in different crops on the positive effect of rhizobacteria on growth promotion, disease management and yield by Usha Rani *et al.* (2009) on tomato, Kloepper *et al.* (1980) on potato, Sulsow *et al.* (1982) in sugar beet and Ramamoorthi *et al.* (2002) in tomato and hot pepper.

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