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Research Note

Field efficacy of *Trichoderma harzianum* application on wilt disease of cumin caused by *Fusarium oxysporum* f. sp. *cumini*

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ABSTRACT: **An experiment was conducted to assess the efficacy of a *Trichoderma harzianum* formulation on the wilt disease of cumin caused by *Fusarium oxysporum* f. sp. *cumini* and crop yield. The results showed that in *Trichoderma* seed treatment plots, per cent wilt disease was 9.2 to 23.8 and 8.5 to 21.4 compared to 68.3 and 69.67 in control during first and second years of experiment, respectively. In *Trichoderma* treatment the yield recorded was 6.17 to 6.73 and 6.33 to 6.89 q / ha compared to 4.39 and 4.73 q / ha in untreated control during first and second years of experiment, respectively. The application also did not lead to any phytotoxic symptoms on the host plants.**

KEY WORDS: Biological control, cumin, *Fusarium* wilt disease, phytotoxicity, *Trichoderma harzianum*

Cumin (*Cuminum cyminum* L.) is a herbaceous annual plant cultivated for the production of dry ripe fruits. India is the largest producer and consumer of cumin seeds in the world and cumin is almost exclusively cultivated in Rajasthan and Gujarat. India exports cumin seeds, powder, oleoresins of cumin seeds and cumin seed oil to many countries. Cumin cultivation is affected by different pathogens, which lead to decline in quantitative and qualitative yield. Significant losses in cumin yield are attributed to the *Fusarium* wilt disease caused by *Fusarium oxysporum* f. sp. *cumini* (Dange *et al.*, 1992). Traditional control measures for *Fusarium* wilt disease include crop rotation, pre-sowing treatments for the seeds with certain chemical fungicides (Champawat, 1992) and cultural practices (Champawat and Pathak, 1990) or soil fumigation.

One of the other approaches, which are progressively being developed in compliance with sustainable environment issues during recent years, is biological control (Patel and Patel, 1998). Initial screenings of different biocontrol agents such as fungal (*Trichoderma harzianum*, *T. hamatum*, and *T. viride*) and bacterial antagonists (*Bacillus subtilis*) as pre-sowing treatments of cumin seeds with their suspensions showed up to 47 percent reduction in the wilt disease incidence (Tawfik and Allam, 2004). The objective of the present study was to demonstrate the effect of application of a formulation of *Trichoderma harzianum* (NBRI 1055)

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on the suppression of *Fusarium* wilt disease of cumin under field conditions and to see whether the application of *Trichoderma* formulation leads to any phytotoxicity symptoms.

The culture of *T. harzianum* strain NBRI 1055 (MTCC 3241) was isolated from the field soil of the National Botanical Research Institute, Lucknow, India. The experiments were carried out in a naturally infested production field. Gujarat-1, a variety of cumin highly susceptible to *Fusarium* wilt pathogen, was provided by Gujarat, State Fertilizer and Chemicals Pvt. Ltd, Gujarat, for field trials. The field trial was for two consecutive cropping seasons at Banthra Research Centre of National Botanical Research Institute, Lucknow. The experiments were started in November of each cropping season, *i. e.*, 2003-2004 and 2004-2005 and the harvesting was done in the last week of March. The plots were laid out in a randomized block design having four treatments and three replications. The plot size was 5 x 4 m^2 and plant-to-plant and row-to-row distance was maintained at 15 and 25 cm, respectively.

The seeds of cumin were treated with the formulation of *T. harzianum* @ 10g / kg seed. For seed treatment, the seeds were surface-sterilized with mercuric chloride (0.02%) for 5 minutes and rinsed three times in sterile distilled water. The seeds were coated with gum arabica (2%) as an adhesive and uniformly coated with *Trichoderma* formulation by hand and kept for air-drying for 30 minutes under shade. In furrow treatment (soil application), the formulation of *Trichoderma* was applied in the furrows @ 2.5 kg / ha. In another treatment, the seeds were treated with 0.2% suspension of carbendazim. In control plants, no formulation or fungicide was applied. The wilt disease scoring was done using the scoring scale (1 = no infection, 2 = 0.1-5.0% infection, 3 = 5.1-15.0%, 4 = 15.1-50.0% infection and 5 = 50.1-100.0% infection) developed by Loffler *et al.* (1997). The population of arbuscular mycorrhiza in the rhizosphere of cumin was counted by following the methods of Gerdemann and Nicholson (1963). The crop yield was recorded and converted to hectare basis. Ten cumin plants from each treatment were randomly selected for qualitative phytotoxicity symptoms such as injury on leaf tips and leaf surface, wilting, vein clearing, necrosis, epinasty and hyponasty which were recorded as per the manual for testing the phytotoxicity of pesticides. Statistical analysis was done by one-way ANOVA as described by Panse and Sukhatme (1967).

A significant reduction in the percentage of infection (Table 1) with the *Fusarium* wilt was observed in both experimental years as a result of seed treatment. The reduction in disease incidence was more in seed treatment (86.53%) than in furrow treatment with *T. harzianum* (65.15%) and carbendazim treatment (56.52%). The increase in crop yield showed significant enhancement in the plants treated with *T. harzianum* formulation in comparison to control. The increase in crop yield over control was 53.33 and 45.67% in the *Trichoderma* seed treated plants during the first and second year experiments. The treated plants did not show any adverse effects of *T. harzianum* application and no phytotoxic symptoms. The application of *T. harzianum* (NBRI-1055) W.P. formulation in the field had no adverse effect on the beneficial microbes, *viz.*, arbuscular mycorrhiza (*Glomus* spp.) in cumin rhizosphere at all dosage levels tested for bio-efficacy.

In our experiments, seed treatment of cumin resulted in reducing the number of infected plants coupled with enhanced growth and yield of the protected plants regardless of their differential initial tolerance to the disease. The reduction in the infection may have been due to suppression in the population of *F. oxysporum* f. sp. *cumini* (Sunil and Satish, 2004). The results indicate that *T. harzianum* was also effective as soil application though less than that of seed treatment. Patel and Patel (1998) also reported reduction in wilt disease incidence after treatment with *Trichoderma* spp. The increased crop yield was associated with reduced percentage of disease infection. The results of the present investigation also suggest that the application of *T. harzianum* is safe for the plants as well, as there was no phytotoxicity at any point of time of the whole cropping season in both the years.

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