Effect of Tricho-compost against Seedling Blight Disease of Wheat Caused by *Sclerotium rolfsii*

M. Iqbal Faruk*

*Plant Pathology Division Bangladesh Agricultural Research Institute Joydebpur, Gazipur-1701, Bangladesh*

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The efficacy of formulated *Trichoderma harzianum*-based Tricho-compost, seed treatment with Tricho-inocula, and chemical fungicide Provax 200 WP against foot and root rot diseases of wheat caused by *Sclerotium rolfsii* was tested in the pot house and in the research field of Plant Pathology Division, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh. Tricho-compost was prepared with a mixed substrate of cow dung, rice bran, and poultry refuse colonized by *T. harzianum*. Seedling mortality of wheat was significantly reduced by the Tricho-compost, Tricho-inocula, and Provax 200 WP both in the pot house as well as in the field experiments. The yield of wheat was sharply increased over the control due to the *T. harzianum* formulations and Provax 200 WP. Among the treatments, soil application of Tricho-compost was more efficient in reducing seedling mortality and accelerating plant growth with an increased yield of wheat with *S. rolfsii*-inoculated pot cultures and field experiments.

**Keywords:** Trichocompost, *Trichoderma harzianum*, Tricho-inocula, *Sclerotium rolfsii*, seedling blight, wheat

**Introduction**

Wheat (*Triticum aestivum* L.) is considered as one of the most important cereal crops in the world and it became to the second most important cereal crop after rice in Bangladesh. The average yield of this crop is only 2.60 t/ha in Bangladesh [1]. The average yield of wheat in Bangladesh is lower in comparison to other countries. Diseases play an important role in lower yield of wheat in the country. Wheat is attacked by at least 20 different diseases in Bangladesh [2, 3], of which five are considered as major diseases, they are Bipolaris leaf blight-BpLB (*Bipolaris sorokiniana*), leaf rust (*Puccinia recondita*), seedling blight (*Bipolaris sorokiniana*), foot and root rot (*Sclerotium rolfsii* Tode) and black point (*B. sorokiniana, Alternaria alternata* (Fr) Keissler, *Curvularia lunata* (Wakker) Boedijn and a species of *Fusarium. S. rolfsii*, an omnivorous, soil-borne fungal pathogen, causes disease on a wide range of agricultural and horticultural crops.

Management of this pathogen through conventional method such as physical, cultural etc. is difficult. The use of chemicals has been found effective in controlling fungal diseases of plant, but chemical control using fungicides required large amount which made health hazardous to grower and pollution of environment and soil. Public concern with fungicide residues, as well as pathogen resistance to some pesticides, has increased the need to find alternative methods for protection of crops against the diseases [4, 5]. Thus, biological control using antagonistic microbes alone, or as supplements to minimize the use of chemical pesticides in a system of integrated plant disease management, has become more important in recent years [6]. Many studies have shown that biological control offers an environmentally friendly alternative method for soil-borne pathogens [7, 8]. Vari-
ous fungal species have been used as biological agents that effectively control plant diseases, and about 90% of such bio-control agents are different strains of *T. harzianum*, *T. virens*, *T. viride* [9]. The effect of *T. harzianum* as bio-agent against *S. rolfsii* and *F. oxysporum* was reported by many investigators [10, 11]. *T. harzianum* has been identified as potential biocontrol agents for the management of various plant diseases including seedling diseases caused by several plant pathogenic fungi [12–14]. *Trichoderma* spp. have been reported to compete for nutrients and space, secrete antifungal compounds, parasitize fungal pathogens, and induce systemic resistance in the host plant [15, 16]. *T. harzianum* is commercially used as a preventive measure for several soil borne plant pathogenic fungi [11, 17]. The mass production of *Trichoderma* on solid substrates promotes the synthesis of enzymes which help in its bio-control mechanism [18].

The utilization of large number of agro-wastes as substrates, use of wide variety of materials, low capital involvement and potential higher volumetric productivity etc. are necessary to promote *Trichoderma*. Many researchers have been used cost effective substrates like wheat bran, rice bran, maize bran, sawdust [19]; rice straw, chickpea bran, grass pea bran, rice course powder, black gram bran [20]; cow dung, poultry manure, ground nut shell, black ash, coir waste, spent straw from mushroom bed, talc, vermiculite [21], sewage sludge compost [22]. So, mass production of *T. harzianum* on comparatively cheap, stable and easily available substrate is essential. Yet information on mass production of *T. harzianum* to control seedling disease of wheat is inadequate under Bangladesh condition. Therefore, the present study was aimed to find out a suitability of solid substrate for mass production of Tricho-compost with *T. harzianum* and also its inocula for seed treatment to reduce foot and root rot disease caused by *S. rolfsii* Sacc. of wheat.

**Materials and Methods**

The performance of Tricho-inocula (*T. harzianum*), Tricho-composts and Provax 200 WP in controlling foot and root rot disease of wheat caused by *Sclerotium rolfsii* was investigated both in pot culture for one season during 2012–13, and in the field experiments at three cropping seasons during 2013–14, 2014–15 and 2015–16. Previously, seventy two isolates of *T. harzianum* were obtained from different location of Bangladesh and their efficacy was tested against different soil borne pathogens including *S. rolfsii* in the laboratory. Few isolates of *T. harzianum* including TM7 were found more vigorous to suppress the soil borne pathogens including *S. rolfsii*. A pure culture of *T. harzianum* (TM7) was grown in potato dextrose agar (PDA) medium which was used to formulate in the substrates.

**Tricho-compost preparation**

Isolated *T. harzianum* (TM7) was initially multiplied on substrate containing a mixture of rice bran, wheat bran and mustard oilcake to obtain a formulated *T. harzianum*. The formulated *T. harzianum* was used for mass multiplication in two different mixtures of cow dung based compost materials. One of those composts contained cow dung and rice bran and the other contained a mixture of cow dung, rice bran and poultry manure and these composts were designated as Tricho-compost-1 and Tricho-compost-2, respectively. The formulated *T. harzianum* was added in between two layers of compost materials and kept for 45–50 days maintaining the moisture content approximately 60–70% for rapid multiplication of *T. harzianum* in the compost materials.

**Pathogenic fungal inocula preparation:** The pure cultures of the pathogenic fungi *S. rolfsii* was prepared on PDA medium. The inoculum of *S. rolfsii* was multiplied separately on a mixture of wheat bran, khesari bran and mustard oilcake (MOC).

**Seed treatment**

The *T. harzianum* was cultured in PDA and potato dextrose broth (PDB) media and the spores were harvested from 10 days old culture separately. The seeds of wheat (var. BARI Gom 26) were treated with the spore suspension of *T. harzianum* maintaining the approximate spore concentration of $1 \times 10^8$/ml. Similarly another set of seeds were also treated with Provax 200 WP (Carboxin + Thiram37.5%WS) at 2.5 g/kg seeds at the time of sowing.

**Pot experiment**

The pot experiment was carried out in the pot house of Plant Pathology Division, Bangladesh Agricultural...