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Management studies on anthracnose disease in greater yam (*Dioscorea alata*)

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Abstract

Anthracnose caused by *Colletotrichum gloeosporioides* is a major threat to greater yam cultivation in India. The yield loss due to this disease is around 50 to 90%. The present study was undertaken to evaluate different treatments for the management of Anthracnose disease. A field experiment was conducted during 2017-18 and 2018-19 under All India Co-ordinated Research Project on Tuber Crops at Vegetable Research Station, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad, Telangana, India. The trial was laid out with four treatments and five replications in randomised block design with Sree Karthika variety of greater yam. The treatments included: T1: Soil application of *Trichoderma asperellum* + Tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g carbendazim/ litre) thrice at 15 days interval after initiation of the symptom, T2: Soil application of *Trichoderma asperellum* + Tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further four sprays at monthly interval, T3: foliar spray of carbendazim @ 0.05% (1g carbendazim / litre) thrice at 15 days interval after initiation of the symptom and further 4 sprays at monthly interval and T4: Control. Among the treatments tested minimum disease intensity (6.36 percent) and maximum yield (15.27 t/ha) was recorded in T₂ treatment followed by T₁ treatment (10.5 percent and 15.17 t/ha), T₃ (16.0 percent and 12.55 t/ha) and highest disease incidence (35.55 percent) and lowest yield (8.15 t/ha) was recorded in T₄ control treatment. The study indicated that anthracnose disease of greater yam could be effectively managed by soil application with *Trichoderma asperellum* + Tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g carbendazim / litre) three times at 15 days interval after initiation of the symptom and further four sprays at monthly interval in Telangana region.

Keywords: Greater yam, *Dioscorea*, anthracnose, *Colletotrichum*, *Trichoderma* sp.

Introduction

Yams (*Dioscorea* sp.) are important food security crop for many people in the tropical and subtropical regions of Africa, Asia, the Pacific, the Caribbean and Latin America. *Dioscorea alata* known as the "greater yam" or the "winged yam" is one of the major cultivated species with wide geographical distribution. They have high yield potential, easily propagated, early growth, high vigour for weed suppression, long storage capacity with high nutritional content with an average crude protein content of 7.4%, starch content of 75–84% and vitamin C content ranging from 13.0 to 24.7 mg/100g. (Muzac Tucker *et al.*, 1993) [8]. Yam is used as food as raw yam, curry, cooked soup, boiled, fried, roasted, flakes, chips and powder or flour in food preparations. Yam tuber contains more bioactive components *viz.*, mucin, dioscin, dioscorin, allantoin, choline, poly-phenols, diosgenin, and vitamins such as carotenoids and tocopherols. Mucilage of yam tuber contains soluble glycoprotein and dietary fiber. Hypoglycemic, antimicrobial and antioxidant activities of yam extracts were reported. Yams may stimulate the proliferation of gastric epithelial cells and enhance digestive enzyme activities in the small intestine (Chandrasekara and Kumar, 2016) [4]. Yam production declined due to many pathogens and pests in fields and in storage. Among them, the most important field pathogen is *Colletotrichum gloeosporioides* which causes anthracnose- is a major threat to yam cultivation, in all yam-producing areas (Abang *et al.*, 2003) [1]. Anthracnose can affect all parts of the yam plant and at all stages of crop development (Akem, 1999) [2]. The symptoms of the disease are leaf necrosis and shoot dieback thus reducing the photosynthetic efficiency of the plant, which results in yield losses of over 90% in susceptible genotypes (Egesi *et al.*, 2007) [5]. So, the present study was undertaken to evaluate different treatments for the management of anthracnose disease.

Materials and Methods

Field experiment was carried out during the year 2017-18 and 2018-19 under All India Coordinated Research Project on Tuber Crops (AICRP TC) at Vegetable Research Station, Sri Konda Laxman Telangana State Horticultural University, Rajendranagar, Hyderabad, Telangana State, India. The variety used in the experiment was Sree Karthika. The trial was laid out with 4 treatments and 5 replications in Randomized block design. The treatments included: T1: Soil application of *Trichoderma asperellum* + Tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom, T2: Soil application of *Trichoderma asperellum* + Tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further 4 sprays at monthly interval, T3: foliar spraying of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further 4 sprays at monthly interval and T4: Control. Soil treatment with *Trichoderma asperellum* @ 50 g of 10^7 cfu g^{-1} twice, once at the time of planting and another during third month tuber treatment with *Trichoderma asperellum* @ 5 g in fresh cow dung slurry per kg of tuber. The disease incidence on leaves and vines was observed based on 0–5 scale (0=no visible symptom; 1=<1% leaf area infected; 2=1–10% leaf area infected; 3=11–25% leaf area infected; 4=26–50% leaf area infected; 5=>50% leaf area infected (Arya *et al.*, 2019) [3] and the Percent Disease Index (PDI), tuber yield and B: C ratio was calculated. The data was analyzed statistically using F-test following Gomez and Gomez (1984) [6]. LSD values at $P=0.05$ were used to determine the significance of difference

between treatment means.

Results and Discussion

Pooled data of 2017-18 and 2018-19 revealed that, all the treatments were found to have good germination percentage and also effective in reducing the incidence of anthracnose disease compared to control (Table-1). Among the treatments imposed, highest population (24.91×10^2 cfu/g of soil) of *Trichoderma* in soil after harvest was observed in T₂ treatment- soil application with *Trichoderma asperellum* + tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further 4 sprays at monthly interval followed by T₁ (19.11×10^2 cfu/g of soil) - Soil application with *Trichoderma asperellum* + tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and least population was observed in control (12.35×10^2 cfu/g of soil). Minimum disease intensity (6.36 percent) and maximum yield (15.27 t/ha) was recorded in T₂, followed by T₁ (10.50 percent and 15.17 t/ha), T₃ (16.00 percent and 12.55 t/ha) and highest disease incidence (35.55 percent) and lowest yield (8.15 t/ha) was recorded in T₄ control (Table 1 & 2). Highest Benefit to Cost ratio was recorded in T₁ (2.53) followed by T₂ and T₃ and least in T₄ treatment. Mehetre and Deshmukh, 2011 [7] reported similar results with *Trichoderma viride* which was found very effective bio-control agent against anthracnose in greater yam. Reynaldo De la Cruz -Quiroz *et al.*, (2018) [9] also found *Trichoderma asperellum* and *Trichoderma longibranchiatum* were found excellent potential agents against *Colletotrichum gloeosporioides* in Mexico.

Table 1: Effect of different treatments for the control of anthracnose on growth and disease intensity in greater yam

Treatment	Germination Percentage (%)	Population of <i>Trichoderma</i> in the soil (10^2 cfu/g of soil)		Disease intensity (%)
		Initial	Final	
T1: Soil application of <i>Trichoderma asperellum</i> + Tuber treatment with <i>Trichoderma asperellum</i> + foliar spray of carbendazim @ 0.05% (1g carbendazim/ litre) thrice at 15 days interval after initiation of the symptom	95.14	8.60	19.11	10.50 (18.74)
T2: Soil application of <i>Trichoderma asperellum</i> + Tuber treatment with <i>Trichoderma asperellum</i> + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further four sprays at monthly interval	94.25	10.79	24.91	6.36 (14.06)
T3: Foliar spray of carbendazim @ 0.05% (1g carbendazim / litre) thrice at 15 days interval after initiation of the symptom and further 4 sprays at monthly interval	94.44	9.48	18.70	16.00 (23.54)
T4:Control	90.74	6.34	12.35	35.55 (36.35)
S.Em \pm	0.17	0.16	0.26	2.9
C.D. (p=0.05)	0.52	0.47	0.78	8.61

Pooled data of two years (2017-18 and 2018-19)

The values in the brackets are angular transformed values

Table 2: Effect of different treatments for the control of anthracnose on yield and economics in greater yam

Treatments	No. of tubers /Plant	Yield (t/ha)	Cost of cultivation (in lakhs)	Gross income (in lakhs)	Net income (in lakhs)	B:C ratio
T1: Soil application of <i>Trichoderma asperellum</i> + Tuber treatment with <i>Trichoderma asperellum</i> + foliar spray of carbendazim @ 0.05% (1g carbendazim/ litre) thrice at 15 days interval after initiation of the symptom	2.16	15.17	0.60	1.517	0.917	2.53
T2: Soil application of <i>Trichoderma asperellum</i> + Tuber treatment with <i>Trichoderma asperellum</i> + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further four sprays at monthly interval	2.44	15.27	0.64	1.527	0.887	2.39
T3: foliar spray of carbendazim @ 0.05% (1g carbendazim / litre) thrice at 15 days interval after initiation of the symptom and further 4 sprays at monthly interval	2.16	12.55	0.56	1.255	0.695	2.24
T4:Control	1.74	8.15	0.46	0.815	0.355	1.77
SEM _±	1.17	0.76				
CD (p=0.05)	3.52	2.26				

Pooled data of two years (2017-18 and 2018-19)

Selling price of Tubers: 10/- per Kg

Conclusion

Anthraco disease of greater yam could be effectively be managed by soil application of *Trichoderma asperellum* + tuber treatment with *Trichoderma asperellum* + foliar spray of carbendazim @ 0.05% (1g Bavistin/ litre) thrice at 15 days interval after initiation of the symptom and further four sprays at monthly interval in Telangana region.

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