

Original Research Article

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Management of Post-Harvest Rot of Banana by Chemicals and Bioagents

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ABSTRACT

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Banana fruits are highly perishable in nature with estimated 25-30 per cent post-harvest losses and it is very difficult to store for longer period. Therefore, it needs immediate marketing and utilization. Different chemicals and bioagents were tested for management of post-harvest rot of banana. 100% growth inhibition was observed by Tebuconazole, Tebuconazole + Trifloxystrobin, Carbendazim, Thiophanate methyl, Propiconazole and Carbendazim + Mancozeb in *in vitro* condition. Among bioagents *Trichoderma hamatum* inhibited 61.4% radial growth of causal fungus followed by *Trichoderma harzianum* (54.37%). *Pseudomonas fluorescens* was found to be best inhibiting 100% mycelial growth.

Introduction

Banana is constituted the fourth most important global food commodity after rice, wheat and maize in terms of gross value of production.

It suffers loss in consumer's value due to post-harvest diseases.

Among these post-harvest diseases, banana anthracnose caused by *Colletotrichum musae* is considered as the most important disease of banana in the global level and is one of the major constraints to banana production.

Materials and Methods

Management studies

In vitro evaluation of fungicides

The fungicides were tested initially under *in vitro* conditions by using poisoned food technique (Nene and Thapliyal, 1973) at desired concentration. Required amount of fungicides were added to sterilized potato dextrose agar medium. Then 20ml of poisoned medium was poured into sterilized petridishes. Mycelial disc of eight mm from actively growing zone of ten days old culture

were inoculated in to each plate and placed at the centre of petriplate. Control was maintained without adding any fungicide. Each treatment was taken with three replications. The plates were incubated at $27\pm 1^{\circ}\text{C}$ temperature and radial growth of fungal mycelium was measured from both direction and radial growth was calculated. The data were analysed statistically and efficacy of fungicides were expressed as percentage of inhibition of mycelia growth over control. The Percent inhibition over control was calculated according to formula given by Vincent (1947) as follows.

$$I = \frac{C-T}{C} \times 100$$

I= Percent inhibition

C= Mean Radial growth in control

T= Mean Radial growth in treatment

***In vitro* evaluation of bio-control agents**

The efficacy of biocontrol agents were tested against causal organism by dual culture technique. Biocontrol agents like *Trichoderma viride*, *Trichoderma harzianum*, *Trichoderma hamatum*, *Bacillus subtilis* and *Pseudomonas fluorescens* were tested against the fungus. The fungal antagonists were grown in potato dextrose agar media and bacterial antagonist in nutrient agar media to get fresh active culture for the experiment

Dual culture technique

About 20 ml of potato dextrose media was poured into petridishes and allowed to cool down. The fungal mycelial disc (8mm) was transferred to one end of the plate and fungal antagonist culture disc placed opposite to it leaving 5-6 mm distance from the periphery of the plates. In case of bacterial antagonist, spore suspension of bacteria was mixed in the molten media at 38°C and thoroughly mixed and plated immediately. Eight mm fungal disc

was put in the centre after solidification and cooling. The radial growth of the fungus was measured. Fungal disc was also put in the petriplate without bacterial suspension as control. Each treatment was replicated three times. The inoculated plates were incubated at room temperature.

After five days, observations were taken. The efficacy of bio-control agents were expressed as percentage inhibition of mycelia growth over control. The Percent inhibition over control was calculated according to formula given by Vincent (1947) as follows.

$$I = \frac{C-T}{C} \times 100$$

I= Percent inhibition

C=Mean Radial growth in control

T= Mean Radial growth in treatment

Results and Discussion

Efficacy of various chemicals against radial growth (mm) of *C. musae*

Nine fungicides were evaluated against the growth *Colletotrichum musae* in laboratory condition and the percent inhibition over control was calculated. Tebuconazole (0.15%), Tebuconazole + Trifloxystrobin (0.06%), Azoxystrobin (0.1%), Carbendazim (0.1%), Thiophanate methyl (0.1%), Propiconazole (0.15%) and Carbendazim + Mancozeb (0.1%) recorded 100% growth inhibition of the fungus. Propineb also controlled significantly the radial growth of the causal fungus in laboratory test. Sparshy radial growth of causal fungus was also observed in treatment plates with orange colouration of spores. It was also observed that Azoxystrobin (0.1%) and Copper oxychloride (0.3%) recorded similar control habit against the pathogen with colony diameter 23.17mm and 27.50mm respectively (Table 1).

Table.1 Efficacy of different chemicals against radial growth of *Colletotrichum musae* in vitro (mm)

Treatments	Chemicals	Dose (g/lt)	Mean Colony diameter (mm)	Percent inhibition on control
T ₁	Propineb (70% WP)	2	14.00 (3.81)*	78.12
T ₂	Tebuconazole (25.9% EC)	1.5	0.00 (0.71)	100
T ₃	Tebuconazole (50% WG) + Trifloxystrobin (25% WG)	0.6	0.00(0.71)	100
T ₄	Azoxystrobin (23% EC)	1	23.17 (4.85)	63.80
T ₅	Carbendazim (50% WP)	1	0.00 (0.71)	100
T ₆	Thiophanate methyl (75% WP)	1	0.00 (0.71)	100
T ₇	Propiconazole (25% EC)	1.5	0.00 (0.71)	100
T ₈	Copper oxychloride (50% WG)	3	27.50 (5.29)	57.03
T ₉	Carbendazim (12% WP) + Mancozeb (63% WP)	1.5	0.00 (0.71)	100
T ₁₀	Control		64.00 (8.03)	
SE(m) ±			0.095	
CD at 5%			0.283	

*Figures in parentheses indicate $(x+0.5)^{1/2}$ transformed values.

Table.2 Antagonistic effect of some fungal bioagents against radial growth of *Colletotrichum musae*

Bioagents	Mean radial growth (mm)	Percent inhibition over control
<i>Trichoderma viride</i>	24.83	45.22
<i>T. harzianum</i>	22.50	50.37
<i>T. hamatum</i>	17.50	61.40
Control	45.33	

Table.3 Antagonistic effect of some bacterial bio-agent against radial growth of *Colletotrichum musae*

Bioagents	Mean radial growth (mm)	Percent inhibition over control
<i>Pseudomonas fluorescens</i>	0.00	100
<i>Bacillus subtilis</i>	17.5	73.88
Control	67.00	

Bio-efficacy of fungal and bacterial bio-agents against radial growth of *C. musae*

The causal pathogen *Colletotrichum musae* was evaluated against three fungal bioagents namely *Trichoderma viride*, *Trichoderma harzianum*, *Trichoderma hamatum* in dual culture. It was found that *Trichoderma hamatum* reduced 61.4% radial growth of causal pathogen followed by *Trichoderma harzianum* (Table 2). *Pseudomonas fluorescens* and *Bacillus subtilis* were also evaluated in spore suspension method as per material methods. *Pseudomonas fluorescens* caused 100% inhibition of test pathogen followed by *Bacillus subtilis* (Table 3).

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