

SUMMARY

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I. Effect of fungicides on soil microflora:

a) Effect of the fungicides Vitavax Captan and Topsis M 70 on total bacterial count:

The application of fungicides gradually inhibited the rhizosphere microflora of cotton plants, at the early stages of plant growth. This was found with the normal recommended dose and this trend lasted till 15 days from sowing, then microorganisms gradually increased till the end of the experiment where the total bacterial count approximated that of control with Vitavax Captan and surpassed that of control with Topsis M 70 .

However, with both fungicides the harmful effect of fungicides on the total count was more obvious at the higher dose (10 fold) than the lower dose (normal dose) and in the uncultivated than cultivated soil.

b) Effect of fungicides on spore-former bacteria:

The application of fungicides reduced the density of spore-former bacteria. Minimal spore-former counts were obtained after 15 days from sowing. At the normal dose of Vitavax Captan, spore-former count in the rhizo-

sphere of cotton plants surpassed that of control after 90 days from sowing. However, the effect of Vitavax Captan was more drastic on the spore-former count in the uncultivated soil. Topsin M 70 greatly decreased spore-formers counts at both concentrations used in the cultivated and uncultivated soils all over the experimental period.

c) Effect of fungicides on actinomycetes count:

Fungicides application reduced the actinomycetes count. The extent of inhibition was in line with the rate of application. By the end of the experiment; at the normal dose of fungicides, actinomycetes count mostly surpassed that of control. This was found with both fungicides in the cultivated and uncultivated soils. With the higher dose of fungicides, actinomycetes count at the end of the experiment approximately levelled that of control.

d) Effect of fungicides on fungal count:

The application of fungicides highly decreased the density of fungi in the rhizosphere of cotton plants and in the uncultivated soil till the end of the experiment (90 days from sowing). This was found with both fungicides. The reduction in fungal count was in line with the rate of application.

e) Effect of fungicides on anaerobic nitrogen fixers count:

The application of Vitavax Captan at the normal dose decreased the anaerobic nitrogen fixers count in the rhizosphere of cotton plants till 7 days from sowing then anaerobic nitrogen fixers started to increase and counts surpassed that of control after 30 days from sowing and thereafter. In case of the 10 fold dose of Vitavax Captan and both rates of Topsin M70% application, anaerobic nitrogen fixers counts were lower than their respective control in the majority of the investigated samples till the end of the experiment.

f) Effect of fungicides on aerobic nitrogen fixers count:

This group was also affected by the application of fungicides. At the normal dose of fungicides application, Azotobacter count decreased in the early stages after fungicides application, then counts levelled or even surpassed their respective control. The higher dose of the fungicides greatly decreased. Azotobacter count in all treatments all over the experimental period.

g) Effect of fungicides on nitrifying bacteria:

Both fungicides showed drastic effect on nitrifiers count in the cultivated and uncultivated soils.

II. Effect of the fungicides on pathogenic fungi:

A- Effect of the fungicides Vitavax Captan and Topsin M70% on pathogenic fungi, in vitro.

1- Vitavax Captan:

The minimal concentrations of the fungicides Vitavax Captan which completely inhibited the growth of the pathogenic fungi, in vitro, were:

- 500 ppm of Vitavax Captan were necessary for the complete inhibition of Fusarium oxysporum.
- 100 ppm of Vitavax Captan completely inhibited R.solani.
- 5 ppm or lower of Vitavax Captan completely inhibited the growth of Scl.rolfsii.

2- Topsin M 70%:

The minimal concentrations of the fungicide Topsin M 70%, which completely inhibited the growth of the pathogenic fungi, in vitro, were

- 1000 ppm of Topsin M 70% were required for the complete inhibition of R.solani.
- 100 ppm of Topsin M 70% completely inhibited F.oxysporum
- 10000 ppm of Topsin M 70% were not sufficient for the complete inhibition of Scl.rolfsii.

B- Effect of fungicides Vitavax Captan and Topsin M70%
on fungal count in soil and rhizosphere of cotton
plants, sown in sterile soil infested with the patho-
gens R.solani and Sci.rolfsii.

The application of fungicides, decreased the fungal count in sterilized soil infested with the pathogens. The effect was more drastic in the uncultivated soil. The toxic effect was obvious after 7 days from fungicide application and thereafter. Vitavax Captan seemed to be more toxic than Topsin M 70.

C- Effect of fungicides on reducing the damping-off in
cotton plants sown in sterilized soil infested with
the root-rot pathogens.

Fungicides application increased the percentages of germination and survival plants and almost decreased the the pre- and post-emergence damping-off percentages as compared to their respective control (sterilized soil infested with the pathogen, without fungicide application). This was found with both fungicides and for all investigated pathogens.

III. Effect of infestation with fungal pathogens and application of fungicides on microbial counts:

Infestation of the soil with R. solani; increased the total bacterial counts in the rhizosphere of cotton plants.

The application of the fungicides, reduced the bacterial counts in the infested, cultivated and uncultivated soils during the early stages of the experiment. However, at the later stages; bacterial counts increased and in some cases levelled or even surpassed their respective control.

Effect of soil infestation with R. solani and fungicides application on actinomycetes count:

Soil infestation with the pathogen R. solani and treatment with fungicides showed the same trend previously found with the total count. But till the end of the experiment, counts of fungicide treatments were still lower than control.

Effect of soil infestation with R. solani and fungicides application on fungal counts:

Fungicides application showed a drastic effect

on fungal counts in cultivated and uncultivated soils during 7-15 days from application. At the later stages, fungal counts increased, but were always lower than control in the rhizosphere of the cultivated and in the uncultivated soil.

Effect of soil infestation with *Scl.rolfsii* and fungicides application on microbial counts:

Soil infestation with *Scl.rolfsii* increased the total bacterial, actinomycetes and fungal counts. Fungicides application decreased the bacterial, actinomycetes and fungal counts in the cultivated and uncultivated soils. The extent of inhibition was in line with the rate of application.

IV. Antagonistic efficiency of microbial isolates, from the rhizosphere of seed dressed cotton plants with fungicides sown in infested soil with the pathogens, against root-rot pathogens.

A- Antagonistic fungi:

1- Fungal antagonists against *R.solani*:

The study showed that out of 675 fungal isolates investigated, 170 isolates antagonized *R.solani*. Out of

these antagonists, 82 isolates were potent antagonists against R.solani. All the light brown Aspergillus isolates (30 isolates), the Trichoderma isolates (16 isolates) and 80% of the 25 isolates of the olive green Penicillium were potent antagonists against R.solani.

2- Fungal antagonists against Scl.rolfsii:

The study showed that out of 675 fungal isolates investigated, 150 isolates antagonized Scl.rolfsii, out of these, 83 isolates were potent antagonists. All the investigated isolates of the light brown Aspergillus (30 isolates), olive green Penicillium (25 isolates) and Trichoderma (16 isolates) proved to be potent antagonists against Scl.rolfsii.

B- Antagonistic bacteria:

1- Bacterial antagonists against R.solani:

The study indicated that out of 722 bacterial isolates investigated, 160 isolates antagonized R.solani, out of these antagonists, 34 isolates highly antagonized R.solani. Most of the potent antagonists were found to belong to genera Pseudomonas and Bacillus.

2- Bacterial antagonists against *Scl.rolfsii*:

The study showed that out of 722 bacterial isolates, 171 isolates antagonized *Scl.rolfsii*, out of these antagonists, 54 isolates proved to be efficient antagonists against *Scl.rolfsii*. The preliminary identification showed that most of the potent antagonists belonged to genera *Pseudomonas* and *Bacillus*.

C- Antagonistic actinomycetes:

1- Actinomycetes antagonists against *R.solani*:

The investigation showed that out of 627 actinomycetes isolates investigated, 281 isolates antagonized *R.solani*, out of which, 122 isolates proved to be potent antagonists. The majority of the coloured actinomycetes showed higher percentages of antagonists than non coloured actinomycetes. Among the coloured antagonists, 86.9% of the violet antagonists, 80% of the yellow antagonists and 66.7 of the orange pigmented antagonists were potent antagonists against *R.solani* as compared to their respective groups.

2- Antagonistic actinomycetes isolates against Scl.rolfsii:

The study showed that out of 627 actinomycetes isolates investigated, 279 isolates antagonized Scl.rolfsii. Out of these antagonists, 99 isolates were found to be potent antagonists.

Many of the coloured actinomycetes showed higher percentages of antagonists against Scl. rolfsii than uncoloured actinomycetes . . Among the coloured antagonists, 57.3% of the grey antagonists and 52% of the violet antagonists proved to be potent antagonists against Scl.rolfsii.

Effect of fungicides on the potent antagonists, in vitro.

A. Effect of fungicides on the potent fungi antagonists:

The potent antagonist, Aspergillus sp. isolate was very sensitive to Vitavax Captan, but could tolerate high concentrations of Topsin M70%. The potent antagonist Penicillium sp. isolate was sensitive to Topsin M 70 than Vitavax Captan. The efficient antagonist, Trichoderma sp. isolate was sensitive to Topsin M 70, but could tolerate moderate concentrations of Vitavax Captan.

B. Effect of fungicides on the potent antagonistic bacterial isolates:

Vitavax Captan was more toxic, than Topsin M 70, to the potent bacterial antagonists. Vitavax Captan inhibited 4 bacterial antagonists at very low concentrations, while the fifth isolate tolerated 10,000 ppm. It was found that potent antagonists belonging to the same genus differed in their tolerance to different fungicides.

C. Effect of fungicides on the potent antagonistic actinomycetes isolates:

Antagonistic actinomycetes showed more sensitivity to Vitavax Captan than Topsin M70. Potent antagonistic actinomycetes isolates having the same pigment (colour) differed in their tolerance to different fungicides.

Biological control as compared to chemical control of damping-off in cotton:

Seed inoculation with the potent antagonist, *Aspergillus* sp. isolate increased the percentages of germination and survival plants and decreased the damping-off percentages as compared to control.

Seed inoculation with the potent antagonist, Penicillium sp. isolate was not efficient as the Aspergillus sp. isolate inoculation. However, seed inoculation with a mixture of the two potent antagonists (Aspergillus sp. isolate + Penicillium sp. isolate) showed the greatest effect than when any of the antagonists was inoculated solely.

The study showed that biological control nearly levelled chemical control of damping-off in cotton.