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Efficacy of Dimethomorph against *Phytophthora* Root Rot of Avocado

J.A. Duvenhage and J.S. Köhne
Merensky Technological Services, P O Box 14, Duivelskloof, 0835, RSA

ABSTRACT

Drenches of dimethomorph were compared with drenches of fosetyl-Al and metalaxyl for control of Phytophthora cinnamomi root rot of avocado (Persea Americana Mill) using Edranol seedling rootstocks and Duke 7 clonal rootstocks.

At 1 mg a.i/ℓ dimethomorph did not control root rot effectively. However, at 10 and 100 mg a.i./ℓ, dimethomorph controlled root rot as effectively (on Edranol seedling rootstocks) or better (on Duke 7 clonal rootstocks) than fosetyl-Al (3000 mg a.i./ℓ) or metalaxyl (150 mg a.i./ℓ). Dimethomorph concentrations of 1000 and 10 000 mg a.i./ℓ were phytotoxic.

Key words: dimethomorph, root rot, Phytophthora cinnamomi, avocado, Persea Americana, metalaxyl, fosetyl-Al.

INTRODUCTION

Root rot of avocado *(Persea Americana* Mill), caused by *Phytophthora cinnamomi* Rands (*Pc*), is the most important avocado disease in Australia (Broadbent & Baker, 1974; Pegg, *et al,* 1982), California (Zentmyer, 1984) and South Africa (Kotzé, *et al,* 1987).

The South African avocado industry relies heavily on chemical control of root rot with phosphite compounds. However, resistance of *Pc* to these compounds remains a possibility and has been reported on *Chamaecyparis lawsoniana* (Vegh, *et al.,* 1985) which is unrelated to avocado. Also reported is the tendency of *Pc* from soil of avocado trees treated with phosphites over a prolonged period to be less sensitive to phosphites *in vitro* than *Pc* from soil of untreated trees (Duvenhage, 1994). Resistance of *Pc* to phosphites would constitute a serious threat to the avocado industry as the only other commercially available fungicide for use against *Pc,* namely metalaxyl, has been rendered ineffective for control of root rot in many cases due to the development of resistant strains (Darvas & Becker, 1984) or biodegradation in certain soils (McKenzie & Margot, 1982).

The novel fungicide dimethomorph was first described in 1988 (Albert, *et al.),* and was reported to be effective against downy mildew and *Phytophthora* (Albert, *et al.,* 1990), and has a mode of action different from phosphites or metalaxyl. Dimethomorph which is produced by American Cyanamid Company has also shown efficacy against stem infection of *Phytophthora cinnamomi* in *Rhododendron, Leucadendron* and *Eucalyptus* (Marks & Smith, 1990).

The aim of these trials was to determine the efficacy of dimethomorph in controlling *Phytophthora cinnamomi* root rot of avocado.

MATERIALS AND METHODS

An isolate of *Phytophthora cinnamomi* (PREM 50801; deposited at the National Collection of Fungi; Plant Protection Research Institute, Pretoria) was cultured in 1ℓ Erlenmeyer flasks. Each flask contained 800 ml basal liquid medium, consisting of 1% glucose and 0,1% yeast extract, and was inoculated with 10 discs (2 mm in diameter) taken from the margin of an actively growing culture of *Pc* grown on potato dextrose agar. Cultures were incubated at 25°C in a reciprocal shaker and harvested after 14 days using Whatman no. 1 filter paper. Excess liquid was removed from the mycelium by blotting on filter paper. The mycelium was then macerated with an "Ultra Turrax" (Janke & Kunkel, Staufen) for 15 sec. in 0,1% water agar. This mycelium suspension (0,5 % [w/v]) was used as inoculum.

Vermiculite was inoculated with *Pc* (0,05% [w/v]) and mixed thoroughly by shaking in a plastic bag. Disease free avocado rootstocks *(Pc* sensitive Edranol seedlings and less *Pc* sensitive clonal Duke 7) were planted in the *Pc*-inoculated vermiculite. Plants were planted in 2ℓ plastic bags, using 10 replicate plants per treatment, and placed in a mistbed which supplied irrigation twice a day for 5 minutes. Plants received the following chemical treatments the day after planting, and again after 14 days: fosetyl-Al (3000 mg a.i./ℓ), dimethomorph (100 mg a.i./ℓ), dimethomorph (10 mg a.i./ℓ), dimethomorph (1 mg a.i./ℓ), and metalaxyl (150 mg a.i./ℓ). These products were applied as drenches (300 ml/bag). A leaf nutrient spray (0,9% "Polyfeed"; Plaaskem Pty Ltd) was applied to all trees 2 weeks after the commencement of the trial, in order to compensate for the lack of nutrients in the vermiculite medium. In a preliminary test, dimethomorph was highly phytotoxic when used as a drench at 1000 or 10 000 mg a.i./ℓ. When used at 10 000 mg a.i./ℓ all plants died within 4-7 days. When used at 1000 mg a.i./ℓ, roots of all plants developed severe symptoms of phytotoxicity after 7-14 days.

Plants were removed from bags after 6 weeks and the roots cleaned by rinsing in tap water. Root rot severity was rated visually on the following scale:

0. = No visible sign of disease
1. = Less than 20% root rot
2. = 21-40% root rot
3. = 41-60% root rot
4. = 61-80% root rot
5. = More than 80% root rot

RESULTS

All chemical treatments resulted in significantly less root rot for both rootstocks when compared to the control. Dimethomorph applied at 1 mg a.i./ℓ resulted in significantly

more root rot than all other treatments (except the control) (Figures 1 & 2). Dimethomorph at 10 mg a.i./ℓ or 100 ml a.i./ℓ, metalaxyl and fosetyl-Al did not differ significantly in their control of root rot of Edranol seedlings (Figure 1) and gave excellent disease control. On Duke 7 rootstocks, dimethomorph at 10 mg a.i./ℓ and 100 mg a.i./ℓ did not differ significantly in controlling root rot, but both controlled root rot significantly better than metalaxyl and fosetyl-Al (which did not differ from each other in controlling root rot) (Figure 2).

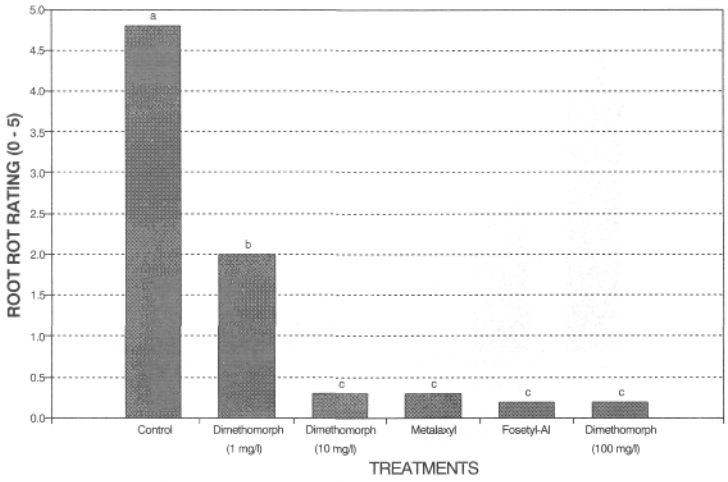

Figure 1

The influence of chemical treatments on root rot of Edranol seedling rootstocks planted in *Pc*-inoculated vermiculite.

Bars not accompanied by the same letter are significantly different according to Duncan's multiple range test (P = 0,05).

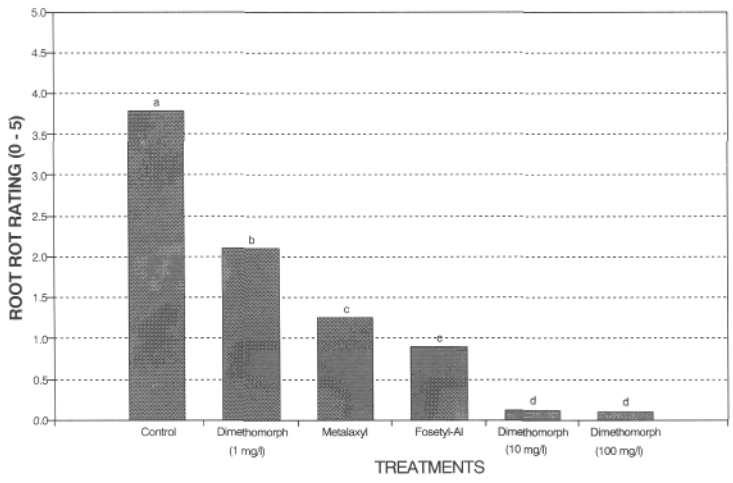

Figure 2
The influence of chemical treatments on root rot of Duke 7 clonal rootstocks planted in *Pc*-inoculated vermiculite.
Bars not accompanied by the same letter are significantly different according to Duncan's multiple range test ($P = 0,05$).

DISCUSSION

The phytotoxicity caused by dimethomorph to avocado in this study was apparently more severe than the slight phytotoxicity reported by Marks and Smith (1990) with *Eucalyptus sieben* treated with 1200 mg a.i./ℓ dimethomorph.

Excellent control of avocado root rot was obtained at much lower concentrations than the 600-1200 mg a.i./ℓ previously reported for control of *Phytophthora cinnamomi* stem infections of *Rhododendron, Leucadendron,* and *Eucalyptus* (Marks *et al,* 1990). This may possibly be due to higher concentrations of the chemical in the roots of plants than those obtained in the stem after translocation from the roots. Results of this trial show dimethomorph to be as effective (on Edranol seedling rootstocks) or more effective (on Duke 7 clonal rootstocks) than metalaxyl, whereas Marks *et al* (1990) found dimethomorph to be less effective than metalaxyl on *Rhododendron, Leucadendron* and *Eucalyptus.*

The fact that control of root rot by dimethomorph was comparable to metalaxyl and fosetyl-Al on Edranol seedlings, but was significantly better than these fungicides when used on Duke 7 clonal rootstocks, may be explained by an apparent root growth enhancing effect observed on the Duke 7 plants.

Results of this trial show high efficacies of dimethomorph against root rot of avocado (especially Duke 7 rootstock) when applied as a drench. As Duke 7 is worldwide the most important avocado root-stock, evaluation of dimetomorph under orchard conditions is to be undertaken.

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