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MONITORING THE RESISTANCE OF *PHYTOPHTHORA CINNAMOMI* TO FOSETYL-AL AND H_3PO_3

J A DUVENHAGE
Merensky Technological Services, P.O. Box 14, Duivelskloof 0835, RSA

ABSTRACT

Isolates of Phytophthora cinnamomi *obtained from trees treated with phosphonate, or untreated, for a prolonged period, were evaluated for sensitivity towards Fosetyl-Al and* H_3PO_3*, as determined by inhibition of growth* in vitro.

Results indicate that isolates obtained from trees continuously treated with phosphonates, tend to be less inhibited by Fosetyl-Al and H_3PO_3 in vitro *than isolates obtained from trees not treated with phosphonates. Monitoring should therefore continue.*

UITTREKSEL

Isolate van Phytophthora cinnamomi *verkry van borne wat 'n geruime tyd behandel is met fosfonate, of onbehandel is, is geëvalueer vir sensitiwiteit teenoor Fosetyl-Al en* H_3PO_3*, soos bepaal deur inhibisie van groei* in vitro.

Resultate dui aan dat isolate verkry van borne langdurig behandel met fosfonate, geneig is om mider gei'nhibeer te word deur Fosetyl-Al en H_3PO_3 ;n vitro as *isolate verkry van borne nie behandel met fosfonate nie. Monitering behoort dus voortgesit te word.*

INTRODUCTION

Effectiveness Fosetyl-Al against stem canker and root rot of avocado (caused by *Phytophthora cinnamomi)* was first reported in the late 1970's (Frossard, Haury & Laville, 1977; Zentmyer & Ohr, 1978). Today, Fosetyl-Al and its metabolite phosphorous acid (Williams, Beach, Horriëre & Marechal, 1977), are the active ingredients of registered fungicides and relied upon by avocado growers for root rot control.

Resistance of *P. cinnamomi* to Fosetyl-Al and H_3PO_3 would constitute a serious threat to the avocado industry as there are no readily available alternative fungicides. Although strains of *Phytophthora capsici* with tolerance to Fosetyl-Al and H_3PO_3 have been cultured under laboratory conditions by exposure to chemical mutagens (Bower & Coffey, 1985), resistance arising under field conditions has not been reported. However, it is of the highest importance that orchards that have been treated with phosphonates for a prolonged period should be monitored for PC strains with tolerance to phosphonates.

Sensitivity to Fosetyl-Al and H_3PO_3 of *P. cinnamomi* isolates obtained from an avocado

orchard which has been treated with phosphonates for the longest period (since 1981) in the avocado industry, is investigated.

MATERIALS AND METHODS

Isolates of *P. cinnamomi* were obtained from soil of trees (Fuerte and Hass on seedling rootstocks; ± 20 years old) that were treated with Fosetyl-Al or H_3PO_3 (partially neutralised with KOH to a pH of 6.1), or which received no treatment. Application of the chemicals was done by injection into the trunk (Darvas, Toerien & Milne, 1983) at a rate of 0.4 g a.i./m^2 canopy area. The orchard treatments, started by Dr. Darvas during 1981, have been applied annually up to the present time.

Five to ten *P. cinnamomi* isolates from each field treatment were used. Isolates were grown, as described by Fenn and Coffey (1984), on CMA amended with Fosetyl-Al (200mg a.i./ℓ) or H_3PO_3(100mg a.i./ℓ), or unamended CMA for the control.

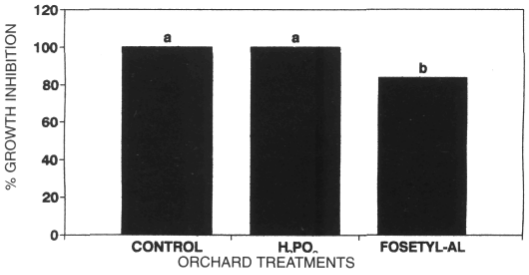
This was done by placing a 3mmdiameter agar disk, taken from an actively growing colony on CMA, in the centre of each plate. Plates were then incubated in the dark at 25°C. The growth diameter of the colonies was determined by calculating the average of the diameter taken at two points on the petri dish, having subtracted the diameter of the agar disk used as inoculum. Subsequently the inhibition of growth of the isolates was determined by calculating the difference in growth diameter of each isolate on Fosetyl-Al and H_3PO_3 amended, or unamended medium, and expressing it as the percentage growth inhibition. The experiment was performed during October 1992, and repeated in March 1993, and November 1993.

RESULTS AND DISCUSSION

During October 1992, *P. cinnamomi* isolates obtained from trees treated with Fosetyl-Al were inhibited significantly less by Fosetyl-Al and H_3PO_3 when compared to isolates from untreated (control) trees (Fig.1 and 2). However, isolates obtained from H_3PO_3 treated trees were significantly less inhibited only by Fosetyl-Al when compared to control isolates (Fig.1 and 2).

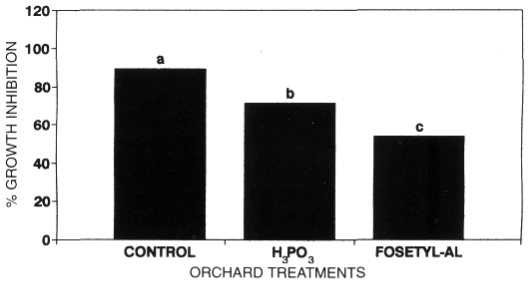
However, during March 1993, isolates obtained from H_3PO_3 treated trees were significantly less inhibited by Fosetyl-Al and H_3PO_3 when compared to control isolates. Inhibition by Fosetyl-Al and H_3PO_3 of isolates obtained from Fosetyl-Al treated trees and control trees did not differ significantly (Fig.3 and 4).

This tendency of isolates obtained from Fosetyl-Al or H_3PO_3 treated trees to be less inhibited by Fosetyl Al and H_3PO_3 (as described above) was also apparent when testing isolates during November 1993, but results did not differ significantly (Fig.5and 6). Reduced sensitivity to Fosetyl-Al and H_3PO_3 *in vitro* of *P. cinnamomi* isolates from Fosetyl-Al or H_3PO_3 treated orchard trees has not been reported before. This raises uncertainty about the future effectiveness of the direct mode of action of Fosetyl-Al and H_3PO_3 to *P. cinnamomi.* However, the effects of continuous treatment of trees with phosphonates on other modes of action of the phosphonates, such as enhancement of host defence responses (Guest & Bompeix, 1990; Grant, Dunstan, Griffith, Niere & Smillie, 1990) are unknown and should be investigated. Results given here urge that the sensitivity of *P. cinnamomi* isolates from trees treated with phosphonates for a prolonged period must be monitored continuously.



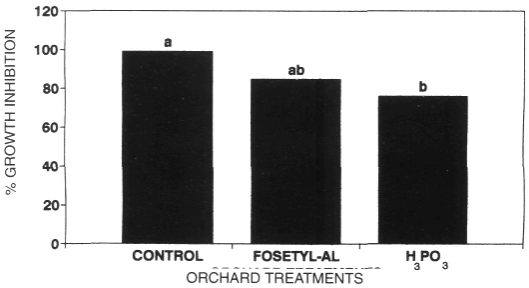
Values not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0.05).

FIG 1. Growth inhibition of P.c. (October '92) by Fosetyl-Al



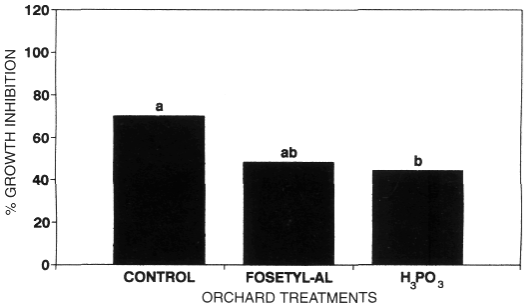
Values not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0.05).

FIG 2. Growth inhibition of P.c. (October '92) by H_3P0_3



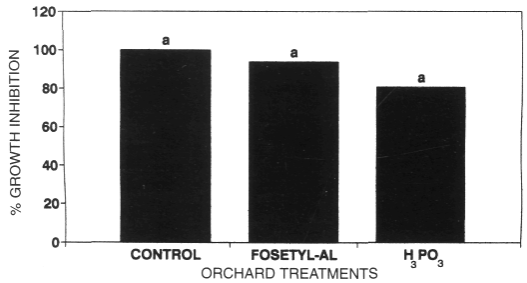
Values not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0.05).

FIG 3. Growth inhibition of P.c. (March '93) by Fosetyl-Al



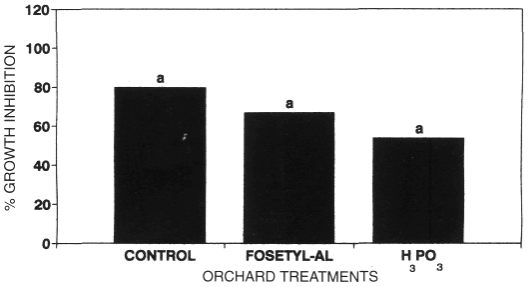
Values not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0.05).

FIG 4. Growth inhibition of P.c. (March '93) by H_3P0_3



Values not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0.05).

FIG 5. Growth inhibition of P.c. (November '93) by Fosetyl-Al



Values not followed by the same letter are significantly different according to Duncan's multiple range test (P = 0.05).

FIG 6. Growth inhibition of P.c. (November '93) by H_3P0_3

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