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LOSS OF CONTROL OF AVOCADO ROOT ROT BY METALAXYL

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OPSOMMING

Edranol-saailinge gemokuleer met P cinnamomi*, gefsoleer vanafgrond waar metalaksiel beheer van avokadowortelvrot nnisluk het, is behandel met verskeie aan-wendingsmetodes van metalaksiel. Die effekte van grond bakteriee en wortelvrotfungi is ook bestudeer. Stamaanwending van metalaksiel het 'n mate van beheer van die siekte tot gevolg gehad, terwyl grond inwas van metalaksiel misluk het. Die grond bakteriee en wortelvrot fungi het geen invloed op die veriles van beheer gehad nie.*

SUMMARY

Edranol seedlings inoculated with P cinnamomi*, isolated from soils where metalaxyl failed to control avocado root rot, were treated with various application methods of metalaxyl. The effects of soil bacteria and root rot fungi were also studied. Stem application of metalaxyl resulted in some control of the disease, while soil drench of metalaxyl failed. The soil bacteria and root rot fungi had no influence on the loss of control of root rot.*

INTRODUCTION

Metalaxyl at 2, 5 g ai/m of the granular formulation gave good control of avocado root rot and inhibited *Phytophthora cinnamomi* infection during the first two years of application. However, the repeated use of metalaxyl for more than two years led to the inability of this chemical to control avocado root rot (Darvas, 1982 and Darvas, 1983).

In their studies, McKenzie and Margot (1982) noticed a decline in vigour of trees treated with metalaxyl for more than two years. They also recovered *P cinnamomi* earlier than expected from treated soils. Their laboratory studies with zoospores showed that the fungus was fully sensitive to metalaxyl and indicated that loss of control could be due to a faster breakdown by bacteria of metalaxyl in treated soils.

Snyman and Kotzé (1983) stated that the repeated use of metalaxyl could have led to reduced sensitivity of *P cinnamomi* to metalaxyl. They also observed that the stem applications of metalaxyl were not as ineffective as the soil drench application in soil where metalaxyl failed to control root rot.

Hunger et al (1982) suggested that commercial applications of metalaxyl could result in

the selection for tolerant strains of *P megasperma*, which may lead to loss of disease control. Resistance to metalaxyl in *P infestans* was reported by Davidse *et al* (1983).

This study confirms the observations of Snyman and Kotzé (1983) and reports on the effect of avocado soil bacteria and other root pathogens on this problem.

MATERIALS AND METHODS

Seedlings were planted in a 1:2:1 mixture of course river sand, Irish peat and perlite *P cinnamomi*-C and *P cinnamomi*-R inoculum was added separately to the planting bags as described in Snyman et al (in press). *P cinnamomi*-C inoculum contained *P cinnamomi* isolates obtained from the root zones of avocado trees that had not been treated with metalaxyl before. *P cinnamomi*-R inoculum contained isolates of *P cinnamomi* obtained from the root zones of trees treated with metalaxyl repeatedly for five years. To eliminate some biological variation three Edranol seedlings were planted in one plastic bag. A bag was treated as one experimental unit. Treatments were applied after the replanted seedlings started to flush, indicating a root-shoot balance. This occurred approximately one month after planting.

To confirm the resistance of *P cinnamomi*-R to metalaxyl the following treatments were used in addition to the above treatments:

TREATMENT

Metalaxyl drench 2, 5 g ai/m

Metalaxyl sponge band 0, 5 g ai/seedling

Metalaxyl stem paint 100 g ai/ℓ

To determine if the presence of soil bacteria or other root pathogens could contribute to the resistance of *P cinnamomi*-R to metalaxyl the following treatments were added for seedlings inoculated with *P cinnamomi*-C and for a duplicate set of seedlings inoculated with *P cinnamomi*-R: Metalaxyl drench 2,5 g ai/m + root pathogens + soil bacteria Metalaxyl drench 2,5 g ai/m + soil bacteria Metalaxyl drench 2,5 g ai/m + root pathogens

The root isolates consisted of an equal (volume) mixture of inoculants prepared for the root isolates used by Snyman et al (in press). The soil bacteria were added by drenching the growth medium with 500 ml soil extract.

The soil extract was prepared from soil gathered in the root zones of trees that had been treated for five years with metalaxyl. In this soil metalaxyl lost its ability to control root rot (Darvas, 1983).

Uninoculated and an inoculated controls were used in the experiments. The drench and stem paint treatments were applied every six weeks. The sponge band treatments were renewed after twelve weeks.

The dry mass of the lateral roots of the Edranol seedlings was used as criterium for root

rot control in analysis to evaluate the various treatments.

RESULTS

1. Resistance of *P cinnamomi* to metalaxyl

To determine if metalaxyl could control root rot of seedlings inoculated with *P cinnamomi*-R the metalaxyl soil drench, sponge band and stem paint treatments were applied to seedlings inoculated with *P cinnamomi*-C and to seedlings inoculated with *P cinnamomi*-R. Results are summarized in Table 1.1

TABLE 1.1. Mean dry mass of lateral roots of Edranol seedlings inoculated with *P cinnamomi*-C or *P cinnamomi*-R and treated with metalaxyl.

Metalaxyl treatment	*P cinnamomi*-C	*P cinnamomi*-R
Soil drench 2,5 g ai/m	11,73	8,52
Sponge band 0,5 g ai/tree	12,98	10,44
Stem paint 100 g ai/ℓ	9,52	9,18
Mean	11,26 a	8,95 b
CV	43,69 %	

1: Means followed by the same letter do not differ significantly (Duncan, P=0,05).

From Table 1.2. Is evident that seedlings inoculated with *P cinnamomi*-C had a significantly higher dry mass of lateral roots than seedlings inoculated with *P cinnamomi*-R. The biggest numerical difference in yield of lateral roots between inoculated seedlings occurred between seedlings treated with the soil drench application of metalaxyl.

The dry mass of lateral roots of seedlings treated with the various metalaxyl applications and inoculated with *P cinnamomi*-R compared to an untreated control and an inoculated control are summarized in Table 1.2.

Seedlings treated with the sponge band application of metalaxyl had a significantly higher dry mass of lateral roots compared to untreated control seedlings. The dry mass of lateral roots of seedlings treated with metalaxyl drench and metalaxyl stem paint did not differ significantly from the dry mass of lateral roots of the control seedlings.

TABLE 1.2 Mean dry mass of lateral roots of Edranol seedlings inoculated with *P cinnamomi*-R and treated with three application techniques of metalaxyl.

Metalaxyl treatment	Dry mass of lateral roots
Uninoculated control	16,96 a
Untreated control	6,02 c
Drench 2,5 g ai/m	8,52 bc
Sponge band 0,5 g ai	10,44 b
Stem paint 100 g ai/ℓ	9,18 bc
CV	41,26 %

1: Means followed by the same letter do not differ significantly (Duncan, P=0,05).

2. The effect of avocado soil bacteria and root isolates on the resistance problem

The objective of this part of the experiment was to determine if other root pathogens or soil bacteria could have an effect on the resistance problem. Seedlings inoculated with *P cinnamomi*-C and *P cinnamomi*-R separately were additionally inoculated with a mixture of root pathogens and drenched with a soil extract containing soil bacteria prior to treatment with metalaxyl drench. The results are summarized in Table 2.

TABLE 2. Mean dry mass of lateral roots of Edranol seedlings inoculated with *P cinnamomi*-C or *P cinnamomi*-R in combination with avocado root isolates and soil bacteria, treated with metalaxyl drench.

Treatment added	*P cinnamomi*-C	*P cinnamomi*-R
Control	11,46	9,62
Root isolates	12,32	7,70
Soil bacteria	11,66	8,52
Root isol + soil bact	11,48	8,24
Mean	11,82 a	8,15 b
CV	43,21 %	

1: Means followed by the same letter do not differ significantly (Duncan, P=0,05).

DISCUSSION

Root rot was not controlled by metalaxyl drench in the growth medium inoculated with *P cinnamomi*-R. The only metalaxyl treatment that differed significantly from the control was the metalaxyl sponge band treatment. This confirms the results of Snyman and Kotzé (1983). In the previous study seedlings were planted in soil void of any previous metalaxyl treatments (Snyman and Kotzé, 1983). In this study sterilized artificial growth medium was used. In both cases the difference was the inoculum. In this study the soil was amended with soil bacteria from soil, where metalaxyl could no longer control root rot. Various root pathogens were used as another amendment. Neither amendment nor a combination resulted in a loss of control in *P cinnamomi*-C or P cinnamomi-R

inoculated growth medium.

The observations made, indicate that after repeated exposure to metalaxyl at effective rates *P cinnamomi* can become resistant to the effect of the chemical.

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