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CHEMICAL CONTROL OF PHYTOPHTHORA ROOT ROT ON FULLY GROWN AVOCADO TREES

JM DARVAS
WESTFALIA ESTATE

OPSOMMING

Voorlopige resultate dui aan dat CG A 48988 baie belowend is vir die beheer van Phytophthora *wortelvrot by volwasse avokadobome. Die middel was in die grond toegedien in 'n proel teen 10 en 50 g per boom. Dit wil voorkom asof 50 g per boom die swam sodanig beheer dat die boom herstel. Dit net die verspreiding van die siekte bekamp en die swam in die grond uitgewis.*

Ethazole en L S 74-783 was relatief ondoeltreffend.

INTRODUCTION

Avocado root rot, caused by *Phytophthora cinnamomi* was first reported in South Africa by Wager (1941) from the Western Transvaal and Natal. Since then it became known as the most devastating disease to the avocado industry. Various methods of controlling root rot were tested in the past. Chemical control has received considerable attention recently. In the course of testing soil fumigants Zentmyer & Klotz (1949) found materials which showed satisfactory control of *P. cinnamomi* in infested soils. Methods for testing soil fungicides to control this fungus were worked out by Zentmyer (1955) who tested 47 different chemicals. A fungistatic chemical, Dexon, received particular attention (Zentmyer, 1973), but its registration was later terminated in the United States. Another chemical that was effective is Ethazole (Zentmyer, 1977). It is now registered in California for control of *Phytophthora* root rot of avocados.

In South Africa, Milne, Brodrick & Hughes (1975) found that the best treatments against avocado root rot were Vapam and a combination of Telone before planting and Dexon applied at the time of planting. Donald & Von Broembsen (1977) achieved good control of *P. cinnamomi* in forest nursery soil with the soil fumigants Basamid and Vapam.

This experiment was laid out to evaluate various fungicides against *Phytophthora* root rot on fully grown avocado trees.

MATERIALS AND METHODS

An eight year old Fuerte avocado orchard was selected for this experiment, where the condition of trees ranged from 0 to 6 according to the 0 to 10 rating system. The soil contained 48% clay and the pH was 5,4. Treatments were done on sub-blocks running parallel with the slope to allow the natural downward spread of the fungus.

The treatments used were:

1 CGA 48988 5% granular at 10 g a.i./tree at 10 week intervals.

2 CGA 48988 5% granular at 50 g a.i./tree at 10 week intervals.

3 Ethazole 10% granular at 100 g a.i./tree at 10 week intervals.

4 LS 74-783 80% wp sprayed on foliage at 0,3% a.i. solution at 6 week intervals.

5 Untreated control.

Treatments started in September, 1977 and the last application was made in March, 1978. During this period treatment numbers 1, 2 and 3 received 4 applications, whilst number 4 was applied 6 times. Granules were evenly spread under trees within the dripline. Soil samples were analysed for a semi-quantitative determination of *Phytophthora* inoculum. In each treatment soil was collected from the root zone under 4 trees (disease rating 4). After homogenisation 3 x 250 g of each soil sample were put into plastic cups and planted with pre-germinated lupine seedlings (5 in each cup). Damped-off seedlings were cut and plated on $P_{10}VP$ medium. Direct isolation of the fungus from dead avocado root pieces on $P_{10}VP$ was also attempted.

Soil microbial biomass activity was measured at the University of Pretoria, Department Microbiology and Plant Pathology, to detect changes in general microbial population in treated soil (Ausmus, 1971). Total number of trees in the experiment was 139.

RESULTS

The number of diseased trees in each treatment and disease severity was rated at commencement of the experiment (1977) and repeated a year later (1978).

DISCUSSION

Concluding from Table 1 the systemic CGA 48988 at a rate of 50 g a.i. per tree applied 10 weekly in the form of granules resulted in a substantial improvement in the condition of diseased trees. All granular treatments were applied during light rain to ensure immediate wash-in. There was an exceptionally fast root recovery. Many fine feeder roots were seen which were absent on untreated trees. CGA 48988 prevented the disease from spreading to healthy trees (Table 2). No *Phytophthora* was recovered from the soil following the high rate CGA 48988 treatment and the fungus could not be isolated from dead roots (Table 3). As in all other treatments it showed a lower microbial activity than the control 5 months after commencement of the trial in the rainy period and sharply increased in April when dryer conditions prevailed (Table 4).

The second best treatment in reducing the disease symptoms was 10 g a.i. CGA 48988 per tree. It did not, however, stop the disease from spreading slowly and the fungus was isolated, particularly from the deeper soil regions.

In this experiment Ethazole, in the granular form, appears to be relatively ineffective in improving conditions of sick trees and killing *P. cinnamomi* in soil. It may have a slow accumulative action in the upper layer, as seen in the lupine baiting figures of Table 3.

LS 74-783 was sprayed on foliage to run-off point. This treatment slowed down the symptom development on diseased trees but, however, could not prevent further spread. The fungus population was reduced initially in the upper soil layer.

The microbial activity of the soil was governed by climatic conditions rather than the above chemical treatments.

SUMMARY

In this report preliminary results are presented on two new systemic and a contact fungicide which were tested against *Phytophthora cinnamomi* root rot on fully grown avocado trees under field conditions.

The 50 g a.i. rate of CGA 48988 resulted in significant improvement of diseased trees and eradicated the fungus in the soil.

LS 74-783 has given mediocre results and had little effect on the population of the pathogen in soil.

The granular form of Ethazole appeared ineffective in reducing symptoms or preventing the disease from spreading.

None of these chemicals interfered much with the natural microbial biomass activity of the soil based on ATP assays.

TABLE 1: Effect of various fungicidal treatments on Phytophthora root rot

Treatments	Average disease severity (rated from 0 to 10)		Disease or increase in disease severity
	1977	1978	
1. CGA 48988 gran. 10 g	2,5	2,3	− 0,2
2. CGA 48988 gran. 50 g	1,8	0,8	− 1,0
3. Ethazole gran. 100 g	0,9	1,7	+ 0,8
4. LS 74-783 0,3% spray	0,5	0,8	+ 0,3
5. Control	0,9	1,6	+ 0,7

TABLE 2: Effect of various fungicidal treatments on the spread of the disease

Treatments	Number of diseased trees		Decrease or increase in number
	1977	1978	
1. CGA 48988 gran. 10 g	20 out of 29	21 out of 29	+ 1
2. CGA 48988 gran. 50 g	14 out of 34	14 out of 34	0
3. Ethazole gran. 100 g	7 out of 21	14 out of 21	+ 7
4. LS 74-783 0,3% spray	9 out of 35	15 out of 35	+ 6
5. Control	7 out of 20	13 out of 20	+ 6

TABLE 3: Abundance of *P. cinnamomi* in the soil of the root zone by using the lupine bait and direct isolation techniques

Treatments	% Lupine seedlings killed by *P. cinnamomi*			Direct isolation of *P. cinnamomi* from avocado roots	
	February 1978	April 1978		February 1978	April 1978
	15 cm depth	15 cm depth	30 cm depth		
1. CGA 48988 gran. 10 g	13	2	10	+	+
2. CGA 48988 gran. 50 g	0	0	0	–	–
3. Ethazole gran. 100 g	36	35	70	+	+
4. LS 74-783 0,3% spray	15	37	40	+	+
5. Control	20	52	35	+	+

TABLE 4: Adenosine triphosphate assay for the measurement of active biomass in soil

Treatments	Average fg ATP per gram of soil	
	Febr. 1978 15 cm depth	April 1978 15 cm depth
1. CGA 48988 gran. 10 g	$0,35 \times 10^5$	$1,04 \times 10^6$
2. CGA 48988 gran. 50 g	$0,11 \times 10^5$	$3,04 \times 10^6$
3. Ethazole gran.100 g	$0,36 \times 10^5$	$2,10 \times 10^6$
4. LS 74-783 0,3% spray	$0,11 \times 10^5$	$3,32 \times 10^6$
5. Control	$0,62 \times 10^5$	$2,75 \times 10^6$

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