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# THE LONG-TERM IMPLICATIONS OF THE USE OF RIDOMIL 5G FOR THE CONTROL OF AVOCADO ROOT ROT IN SOUTH AFRICA.

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***OPSOMMING***

*Die aanhoudende gebruik van metalaksiel vir die beheer van* Phytophthora cinnamomi *in bate avokadoboorde in Suid-Afhka mag onvoldoende beheer totgevolg he. Die probleem is nog nie heeltemal geidentifiseer nie, maar alhoewel 'n algemene verskuiwing in die sensitiwiteit van die* Phytophthora *populaste nog nie aangedui kon word nie, blyk dit dat die afbreek van metalaksiel in gronde wat voorheen met metalaksiel behandel is, bale vinniger plaasvind as in gronde wat nooit met die produk behandel was nie. Langtermyn maatreels wat op die beheer van avokadowortelvrot gerig is, moetgesoek word in 'n stelsel vangeintegreerdesiektebestuur.*

***SUMMARY***

*The repeated use of metalaxyl on many avocado orchards in South Africa for the control of* Phytophthora cinnamomi *may lead to situations of poor protection. The problem has not been fully identified, and while a general shift in the sensitivity of the* Phytophthora *population could not be shown to have occurred, evidence points strongly to a more rapid degradation of metalaxyl in soils which have a history of metalaxyl use when compared to soils that have never received metalaxyl. Long term measures aimed at controlling avocado root rot should be sought in an integrated pest management system.*

## INTRODUCTION

Field experiments were initiated in 1977, jointly, by the Citrus and Subtropical Research Institute, Westfalia Estates and Ciba-Geigy (Pty) Limited, to examine the effect of metalaxyl for the control of avocado root rot caused by *P cinnamomi*. As a result of these and further trial work, Ridomil 5G® was registered for use on avocados in South Africa, in 1979.

Results were originally spectacular, but, after the third and fourth seasons of continual use of metalaxyl, the inhibition of *P cinnamomi* was only partial and the conditions of trees deteriorated at the trial site on Westfalia Estates (Darvas, 1982). Sensitivity tests carried out on *P cinnamomi* isolates taken from these soils showed the fungus to be completely sensitive to metalaxyl. Furthermore, studies carried out by Ciba-Geigy Ltd, Switzerland, showed that metalaxyl, in these soils, known to have a history of metalaxyl use, was degraded far more rapidly, than in soils that had never received metalaxyl (Mc-Kenzie & Margot; 1982).

We have continued to monitor the condition of avocado trees, the presence of *P cinnamomi*, the sensitivity of *P cinnamomi* to metalaxyl and the degradation of metalaxyl in soils, from various localities.

This article summarizes some of these results.

## METHOD

We are currently conducting field trials in four localities viz. Richmond, Natal; Hazyview, Nelspruit and Brondal. One trial is conducted on the variety, Edranol and the other three on Fuerte.

Treatments are as follows:

1. Untreated control trees.
2. Ridomil 5G applied at 2, 5 g ai/$m^2$ twice per season, every year.
3. Ridomil 5G applied at 2, 5 g ai/$m^2$ twice per season for two or three consecutive seasons, and then only every alternate season.

### Assessments are carried out as follows:

1. Tree response: On a seasonal basis using the 0 -10 disease rating system.
2. Phytophthora recoveries: Using lupine cotyledons as bait, the percentage lupin cotyledons attacked by *P cinnamomi* are recorded on a monthly basis.
3. Sensitivity studies: Recovery and/or colony growth, of *P cinnamomi* isolates in the presence of various concentrations of metalaxyl are deter mined.
4. Degradation studies: The degradation of metalaxyl in various soils is being examined by Prof M Loos of the University of Stellen bosch (Details of these results have not yet been released).

## RESULTS

### Tree Responses:

Fig 1 3 illustrate the condition of avocado trees following applications of Ridomil 5G. In all trials, trees showed a dramatic recovery after one or two seasons use of Ridomil but then remained fairly static for some time or started deteriorating.

The untreated trees at the Natal site (Fig 1) have generally shown a steady decline, while treated trees remained fairly static for 4 seasons. These trees have however declined considerably over the past two seasons. When Ridomil was withheld for a season, the trees deteriorated considerably, then improved after re-application but have since also followed a declining trend.

Untreated trees at the Nelspruit site (Fig 2) have also shown a steady decline for the duration of the trial. Trees treated continually began declining slowly after the second season but they have since shown some improvement. Where Ridomil was withheld in the 4th season, trees have continued to decline.

Untreated trees at the Brandal site (fig 3) have only deteriorated slightly over the trail period. These trees have however remained small and are in most cases half as big as treated trees. Treated trees improved dramatically after the second season and have remained fairly static ever since. Trees from which Ridomil was withheld in the third season are beginning to show a gradual decline

### Phytophthora recoveries

Phytophthora recoveries at the Natal site (Fig 4) were virtually zero for the first two seasons of Ridomil treatments, but have since started to increase and are now considered to be at an unacceptable level. No advantage was seen by withholding Ridomil for a season.

Phytophthora recoveries at the Nelspruit site (Fig 5) have generally been low from Ridomil treated soils and recoveries from soils where Ridomil was withdrawn for a season, show a trend to be decreasing, although this would have to be examined further.

Phytophthora recoveries at the Brondal site (Fig 6) have remained at zero since the trial was initiated and this after 5 season’s applications of Ridomil.

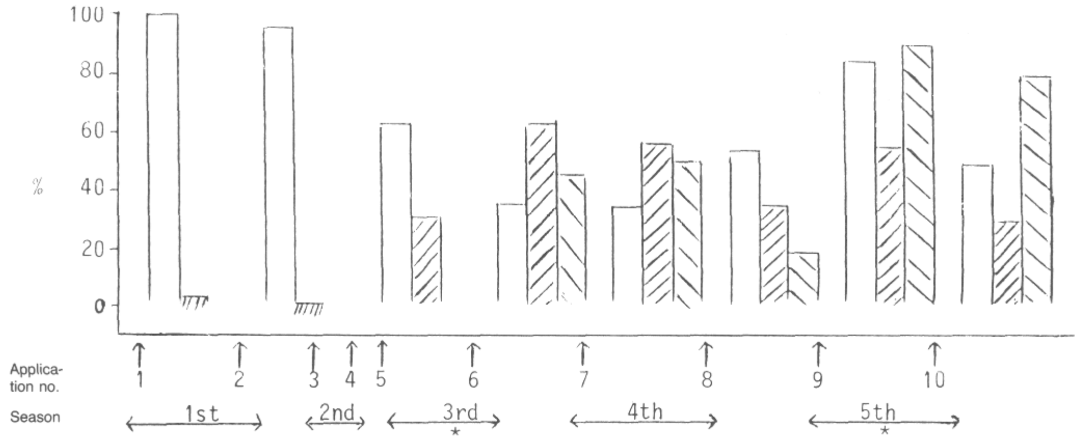



Fig 4: NATAL. *Phytophthora* recoveries presented as a percentage of lupin cotyledons attacked

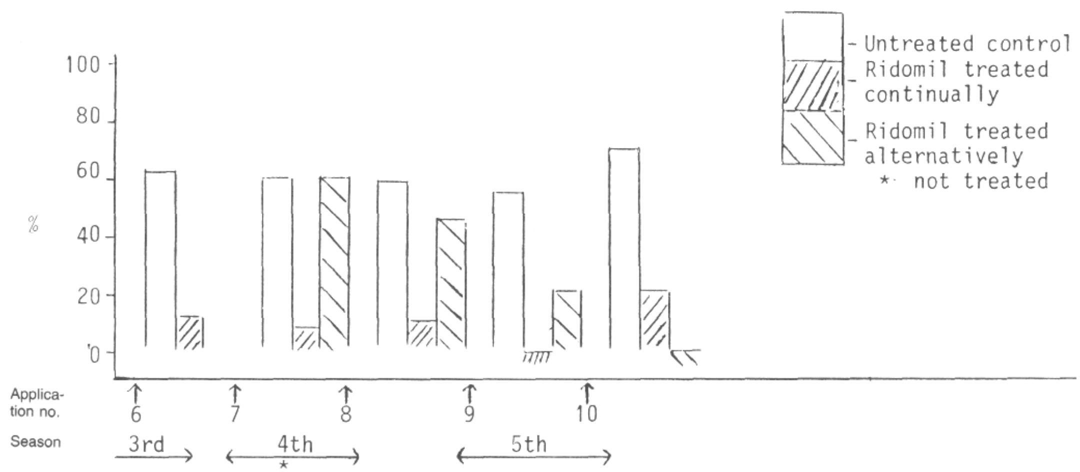



Fig 5: NELSPRUIT. *Phytophthora* recoveries presented as a percentage of lupin cotyledons attacked.

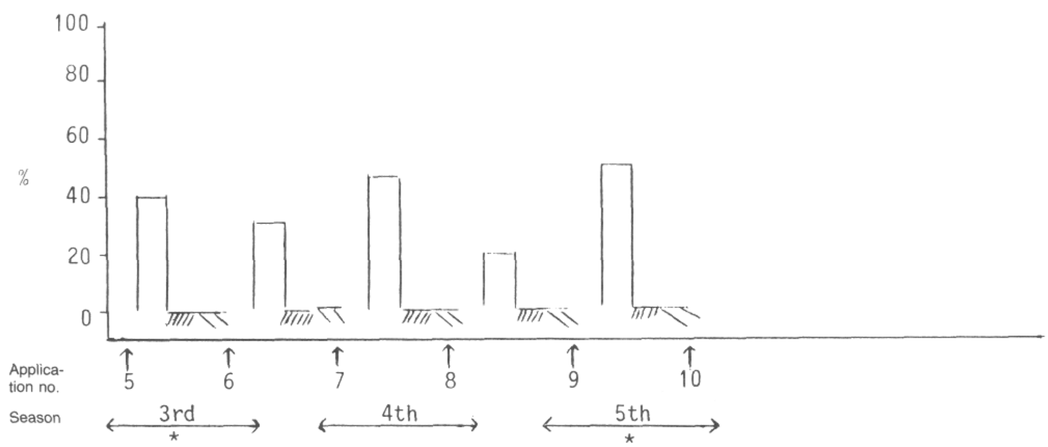



Fig 6: BRONDAL. *Phytophthora* recoveries presented as a percentage of lupin cotyledons attacked.

**TABLE 1: Recovery of *P cinnamomi* in the presence of various concentrations of metalaxyl.**

| Trial Site | Field Treatment | *Phytophthora* recovery % Lupins attacked | | | | |
|---|---|---|---|---|---|---|
| | | Metalaxyl cons ppm | | | | |
| | | 0 | 0,1 | 1 | 5 | 10 |
| Natal | Never treated | 44 | 20 | 1 | 5 | 0 |
| | Ridomil treated | 27 | 26 | 9 | 4 | 0 |
| Hazyview | Never treated | 60 | 31 | 4 | 0 | 0 |
| | Ridomil treated | 68 | 47 | 10 | 0 | 0 |
| Nelspruit | Never treated | 40 | 23 | 4 | 0 | 0 |
| | Ridomil treated | 28 | 3 | 7 | 0 | 0 |

**TABLE 2: Growth of *P cinnamomi* isolates on various concentrations of metalaxyl amended V-8 medium. Number of isolates tested shown in brackets.**

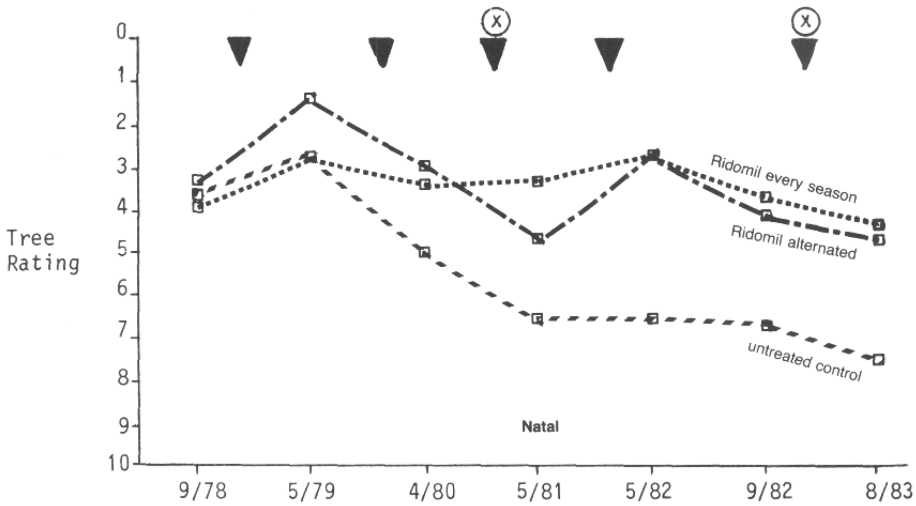
| Site | Field Treatments | Ave daily increase in colony diameter (mm) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Metalaxyl cons ppm | | | | | | |
| | | 0 | 0,1 | 1,0 | 5,0 | 10 | 100 | 250 |
| Westfalia Evenrond Block 4A | Never treated (8) | 6,6 | 5,1 | 3,2 | 1,5 | 0 | 0 | 0 |
| | Ridomil (23) Treated | 7,8 | 8,8 | 4,3 | 0,8 | 0 | 0 | 0 |
| Hazyview | Never treated (6) | 7,4 | 6,4 | 4,4 | 0 | 0 | 0 | 0 |
| | Ridomil (10) treated | 6,6 | 6,7 | 4,5 | 0 | 0 | 0 | 0 |

## Degradation studies

A summary is presented:

**TABLE 3: Trends in metalaxyl degradation in orchard soils that have never been treated and soils treated with Ridomil in various localities (details not yet available; Loos personal communication).**

| Site | Field treatment | Trend |
|---|---|---|
| Westfalia (Evenrond) | Never treated | Gradual |
| | Ridomil treated | Very rapid |
| Hazyview | Never treated | Gradual |
| | Ridomil treated | Very rapid |
| Natal | Never treated | Gradual |
| | Ridomil treated | Rapid |
| Nelspruit | Never treated | Gradual |
| | Ridomil treated | Gradual but more than in untreated soils |
| Brondal | Never treated | Gradual |
| | Ridomil treated | Gradual |



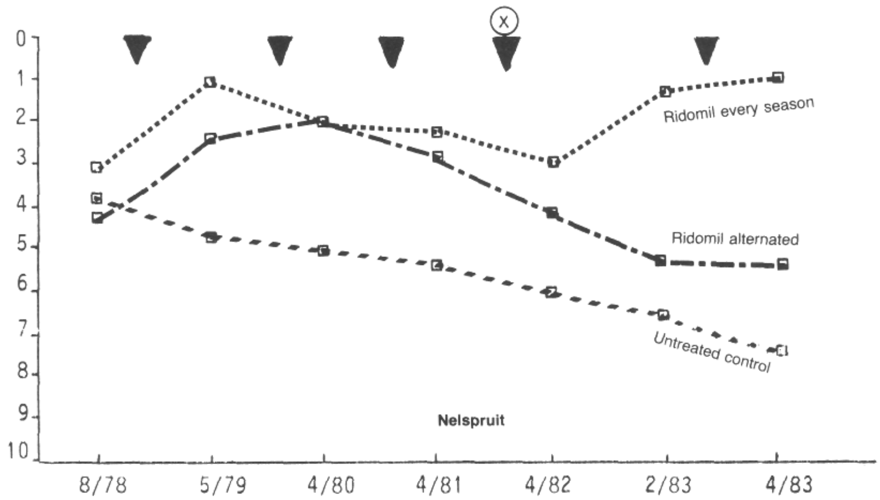




Fig 2:

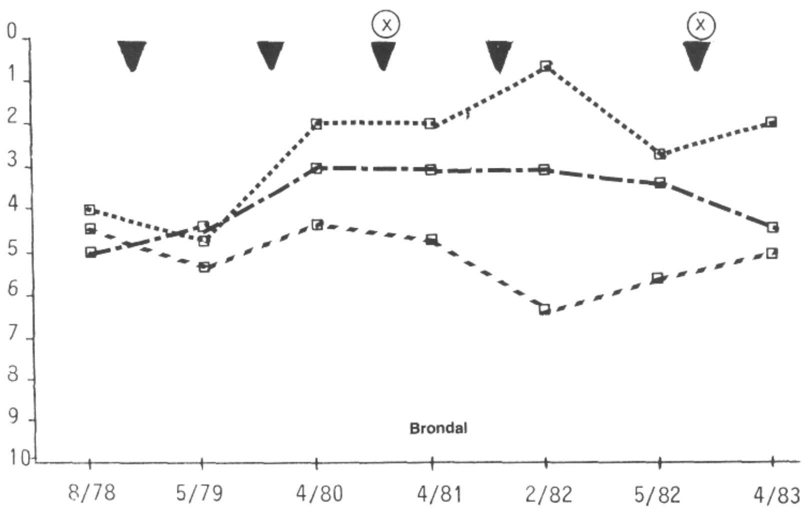



Fig 1 - 3: *Response of avocado trees to application of Ridomil in Natal, Nelspruit and Brondal*

.......... Ridomil 5G every season
. — . — Ridomil alternated (x season not applied)
- - - - - Untreated control
▼ Indicates treatment period

## Sensitivity studies

From Tables 1 and 2, there is no indication that the Phytophthora population has shown a general shift from sensitive to resistant.

In a detailed survey of the influence of metalaxyl on colony growth, no real differences could be found between untreated and Ridomil treated isolates. In a few isolates, the fungus appeared to start growing out on metalaxyl concentrations of 5 ppm and higher but never formed a colony and appeared rather abnormal and sparse. At 1 ppm the colony growth was already abnormal however it could be measured as a colony.

A number of these isolates were cross-checked in Ciba-Geigy's resistant laboratories in Switzerland, and were found to be completely sensitive to metalaxyl (personal communication) with EC50 values ranging from 0, 18 ppm metalaxyl to 0, 22 ppm when compared to a standard isolate whose EC50 was 0, 18 ppm metalaxyl.

The degradation of metalaxyl in treated and untreated citrus soils at two sites is in all instances very gradual.

## DISCUSSION

The length of protection given by metalaxyl against avocado root rot, in a particular area, orchard or even under a particular tree may vary considerably and in turn be governed by many external factors which are as yet undefined. The continual use of Ridomil on certain sites or in certain areas, may lead to an increased biodegradation. Mechanisms resulting in this reduced activity are not fully understood but these results do not indicate a general shift in the sensitivity of the *P cinnamomi* population. On the contrary, degradation of metalaxyl seems to vary in different areas and there seems to be some degree of correlation between, tree vigour, *Phytophthora* recoveries and the degradation of metalaxyl in the soil.

Recommendations for future use of Ridomil on avocados in South Africa should be limited to situations where the compound has not previously been used intensively, especially in situations where trees are beginning to decline rapidly as a result of *P cinnamomi,* and secondly, where young trees are being established in infested soil.

Various cultural practices as well as such aspects as irrigation water must have long term effects on the development of root rot. Most irrigation water must be considered to contain *P cinnamomi* and through this means, the fungus is constantly being reintroduced into avocado orchards. An exception to this may occur when orchards are irrigated by borehole water. An example of this is the Brandal site, where trees have responded favorably after 5 season’s continual use.

In summing up the situation, the long term control of *P cinnamomi* on avocado orchards must be viewed within an integrated pest management system. The sole, continual and indiscriminate use of chemicals may lead to problem situations. Chemicals, such as metalaxyl, should if possible, be used in conjunction with other, unrelated compounds, and sound cultural practices, as well as the use of resistant or tolerant root stocks, should be integrated in such a way as to afford maximum protection against attack by *P cinnamomi.*

## ACKNOWLEDGEMENTS

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