South African Avocado Growers' Association Yearbook 1991. 14:61-62

CONTROL OF PREHARVEST FRUIT DISEASES OF AVOCADO

Part I: Efficacy of various Triazole fungicides against Cercospora spot and Sooty blotch

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ABSTRACT

Cercospora spot of avocado was effectively controlled by pre-harvest applications of Flusilazol or Copper oxychloride. Cyproconazole and Triadimenol were slightly less effective. Penconazole gave only slight control of Cercospora spot. With the exception of Copper oxychloride and Penconazole none of the compounds tested controlled Sooty blotch. Where Flusilazol, Cyproconazole or Triadimenol were alternated with Copper oxychloride sprays, good control of Cercospora was achieved. None of the triazole compounds tested left visible spray residues on fruit.

UITTREKSEL

Cercospora-vlek van avokado's is effektief beheer deur vooroestoedienings van Flusilasol of koperoksikloried. Siprokonasool en Triadimenol was minder effektief. Penkonasool het min beheer van Cercospora-vlek gegee. Met die uitsondering van koperoksikloried en Penkonasool het nie een van die middels Roetvlek beheer nie. Waar Flusilasool, Siprokonasool of Triadimenol afwisselend met koperoksikloried gespuit is, is effektiewe beheer van Cercospora-vlek verkry. Die triasoolmiddels wat getoets is, het geen sigbare spuitreste op vrugte nagelaat nie.

INTRODUCTION

Cercospora spot of avocados, caused by the fungus *Pseudocercospora purpurea* (cke) Deighton (Darvas & Kotzé, 1979), and Sooty blotch caused by *Akaropeltopsis* sp (Theron, Kotzé & Wehner, 1985), spoil the appearance of the fruit, making it unacceptable for export.

Correctly timed Copper oxychloride sprays effectively control both these diseases. However, it leaves unsightly residues on the fruit which have to be removed in the packhouse before such fruit can be exported. It is estimated that the removal of these residues slows down the packing tempo by as much as 50% (Dr J J Bezuidenhout, personal communication). Benlate sprayed in the final round (January) helps to alleviate this problem, as it does not leave visible residues on fruit when sprayed at the recommended dose of 50 g/100 ℓ water. However, this fungicide does not effectively control Sooty blotch. It has also been suggested by Darvas (1982) that tolerance of

Pseudocercospora purpurea to this chemical exists. Trials conducted at Westfalia Estate over a period of six years indicated that progressively poorer control was achieved with Benlate.

The purpose of this study was to screen a group of triazole fungicides as possible replacements for Benlate sprays. The results are based on trials of the past two seasons.

MATERIALS AND METHODS

1989/90 Season

Ten-year-old Fuerte trees in an orchard at Westfalia Estate (Block 10, Waterval) were used for the experiment. There were five randomly selected trees in each treatment. The fungicides were applied twice in the growing season, the first application in the first week of January 1990 and the second in early February 1990. A high volume applicator was used to apply the sprays. An average of 30 fruit per tree was used for evaluation of results. Cercospora spot was rated on a scale 0 — 3 where:

0 represents clean fruit
1 : 1 — 5 spots
2 : 6 — 10 spots
3 > 10 spots.

Sooty blotch was rated on a scale 0 — 4 where:

0 represents clean fruit
1 : 1 — 10% covered
2 : 11 — 25% covered
3 : 25 — 50% covered
4 : > 50% covered.

Fruit was evaluated for the presence of visible spray residues at the time of picking

The chemicals used in the experiment were:

Cooper oxychloride 85% WP

Flusilazol 10% EC

Cyproconazole 10% EC

Penconazole 10% EC

Triadimenol 10% GR.

1990/91 Season

Ten-year-old Fuerte trees in an orchard at Westfalia Estate (Block 4, Waterval) were used for this experiment. There were five randomly selected trees in each treatment. Spraying commenced in mid-October 1990, a second application was applied in mid-

November 1990 and a final application was applied in mid-January 1991. A high volume applicator was used to apply the sprays. Fruit was evaluated according to the methods used in the 1989/90 season.

Fruit was evaluated for visible spray residues on a scale 0 — 3 where:

TABLE 1 The effect of various fungicide treatments on Cercospora spot and Sooty blotch of avocados 1989/90

Treatment	Rate	Time of application	% Clean Fruit		Visible Spray Residue
			Cercospora Spot	Sooty Blotch	
Control	—	—	4,64 e *	15,3 bc	—
Cu-oxychloride	255 g ai/100 ℓ	Jan 1990 & Feb 1990	96,0 a	47,98 a	+
Penconazole	10 g ai/100 ℓ	Jan 1990 & Feb 1990	18,6 d	35,9 ab	—
Cyproconazole	2 g ai/100 ℓ	Jan 1990 & Feb 1990	70,6 c	16,6 bc	—
Flusilazol	2 g ai/100 ℓ	Jan 1990 & Feb 1990	87,3 ab	14,0 c	—
Triadimenol	0,2 g ai/m^2 drip area	Jan 1990 & Feb 1990	83,0 b	6,0 c	—

* Values are the means of five replicates. Values followed by the same letter in the same column do not differ significantly according to Duncan's Multiple Range test. — = None present + = Present

TABLE 2 The effect of various fungicide treatments on the control of Cercospora spot and Sooty blotch of avocados 1990/91

Treatment	Rate	Time of Application	% Clean Fruit		Average Residue
			Cercospora Spot	Sooty Blotch	
CONTROL	—	—	18,6 c	16,6 c	0 c
Cu-oxy Cu-oxy Cu-oxy	255 g ai/100 ℓ	Oct 1990 Nov 1990 Jan 1991	97,3 a	92,0 a	1,66 a
Cu-oxy Cu-oxy Flusilazol	255 g ai/100 ℓ 4 g ai/100 ℓ	Oct 1990 Nov 1990 Jan 1991	89,3 a	46,0 b	0,54 b
Cu-oxy Cu-oxy Cyproconazole	255 g ai/100 ℓ 4 g ai/100 ℓ	Oct 1990 Nov 1990 Jan 1991	87,8 a	48,0 b	0,42 b
Cu-oxy Cu-oxy Triadimenol	255 g ai/100 ℓ 0,4 g ai/m^2 drip area	Oct 1990 Nov 1990 Jan 1991	71,9 b	21,2 c	0,31 bc
Flusilazol Cu-oxy Cu-oxy	4 g ai/100 ℓ 255 g ai/100 ℓ	Oct 1990 Nov 1990 Jan 1991	89,3 a	86,6 a	1,68 a
Cyproconazole Cu-oxy Cu-oxy	4 g ai/100 ℓ 255 g ai/100 ℓ	Oct 1990 Nov 1990 Jan 1991	96,6 a	90,6 a	1,33 a
Triadimenol Cu-oxy Cu-oxy	0,4 g ai/m^2 drip area 255 g ai/100 ℓ	Oct 1990 Nov 1990 Jan 1991	99,3 a	81,3 a	1,55 a

* Values are the means of five replicates.
Values in the same column followed by the same letter do not differ significantly (P = 0,05), according to Duncan's Multiple Range Test.

0: no visible spray residue
1: slight (< 10% covered)
2: moderate (up till 50% covered)
3: heavy (more than 50% covered).

The chemicals used were:

— Copper oxychloride 85% WP
— Flusilazol 10% EC
— Cyproconazole 10% SL
— Triadimenol 10% GR.

RESULTS AND DISCUSSION

Cercospora spot incidence was generally high for the 1989/90 season resulting in less than 5% clean fruit in the untreated controls. Two applications of Flusilazol were as effective as two Copper oxychloride applications in controlling Cercospora spot. Cyproconazole and Triadimenol were slightly less effective and Penconazole gave

hardly any control of Cercospora spot. No visible spray residues were observed on any of the fruit sprayed with Cyproconazole, Flusilazol, Penconazole or Triadimenol (Table 1).

Although the systemic triazole compounds tested performed well against Cercospora spot in the 1989/90 season, it is important to remember that these compounds are sterole-inhibiting fungicides (Kato, 1982). As such they have a very specific mode of action, namely the inhibition of ergosterol biosynthesis of fungi (Fletcher, 1985). For this reason these compounds were alternated with copper oxychloride sprays in follow-up trials to reduce the chances of resistence build-up to these compounds by *P purpurea.*

From the results obtained from the 1990/91 trials (Table 2), it is clear that three applications of Copper oxychloride is as effective in controlling Cercospora spot as two applications of Copper oxychloride alternated with an application of Flusilazol or Cyproconazole.

Where the latter were applied in the January spray application, visible spray residues were significantly lower than in cases where the final application was Copper oxychloride. Soil-applied Triadimenol, applied in the final January application and preceded with two applications of Copper oxychloride, was found to be significantly less effective than three rounds of copper. This could be due to the time needed for the compound to be taken up by the roots and to be transported to the fruit, since there was a significant increase in Cercospora control when this fungicide was applied in October.

It would appear from the results of the two seasons, that foliar sprays of Cyproconazole or Flusilazol and soil applications of Triadimenol effectively control Cercospora spot, without leaving visible spray residues on the fruit, thereby alleviating the residue removal problem in the packhouse. They do not, however, control Sooty blotch. Since Sooty blotch can be removed in the packhouse using the chlorine process as described by Bezuidenhout (1991), the importance of the pre-harvest control of this disease is open for debate.

Finally, none of the triazole compounds mentioned in this article are registered for use on avocados in South Africa and cannot be used commercially at this stage.

ACKNOWLEDGEMENTS

I wish to thank SAAGA for providing funding for this project; Mr Jürn Strauss for assistance with the evaluation of fruit in the 1989/90 season; Mr John Thete for help with spraying of the trials. Thanks are also due to Sentrachem, Bayer, Sandoz and FBC for providing the fungicides used in these trials.

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