South African Avocado Growers' Association Yearbook. 2002. 25:11-14

Evaluation of new generation fungicides for control of Cercospora spot on avocado fruit

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ABSTRACT

High volumes of copper sprays cause buildup of copper in soils and could render soils unfit for fruit production in future. Alternative chemicals were evaluated for control of Cercospora spot and postharvest diseases with the aim to replace or reduce copper sprays.

The experiments were carried out at Westfalia Estate near Tzaneen and first treatments were applied during the 1999/2000 season. Bion, Flint, Ortiva and Avogreen were selected for further evaluation in 2000/01. During the 2000/01 season Bion, Lime sulphur and Ortiva gave good control of Cercospora spot when used in a programme with Copper oxychloride (CuOCl).

INTRODUCTION

While fruit diseases of avocado remain a concern for growers, consumers are becoming more critical of the use of fungicides. In South Africa the most problematic pre-harvest disease of avocado is still avocado black spot (*Cercospora* spot – caused by *Pseudocercospora purpurea*) (Darvas & Kotzé, 1979). It is controlled with two to three high volume copper sprays, while benomyl may be included in the spray programme once per season. Applications are normally done during November, December and January.

High volume sprays are expensive, cause high levels of chemical wastage and can cause buildup of copper in soils that could render soils unfit for fruit production (This has already occurred in Europe). Furthermore, stricter legislation is proposed that will limit the use of copper. Fortunately, low volume spraying has been implemented by the industry over the past few years reducing the amount of copper applied and also making the application of new generation fungicides more economically feasible.

This project was carried out to evaluate the efficacy of new generation fungicides in comparison with standard copper sprays for the control of Cercospora spot and postharvest diseases with the aim of replacing or reducing copper application.

MATERIALS AND METHODS

The trials were carried out at Westfalia Estate near Duiwelskloof under conditions of high disease pressure. Seven large cv. Fuerte trees were used for each treatment and the trials were conducted during the 1999/2000 and 2000/01 seasons. Treatments were applied by high volume spraying with hand guns to first assess efficacy of the products.

1999/2000 season:

Bion (salicylic acid compound from Novartis SA (Pty) Ltd), Westfalia Biocoat (or-

Table 1. Treatment schedule for 1999/2000.

No	Date and treatment: 1999/2000				
	7 Oct 1999	2 Nov 1999	2 Dec 2000	10 Jan 2000	7 Feb 2000
1	Untreated	-	-	-	-
2	-	CuOCl (3g/ℓ)	-	CuOCl	-
3	-	CuOCl (3g/ℓ)	-	-	-
4	Bion (0,15g/ℓ)	Bion	Bion	Bion	Bion
5	-	Biocoat (1ml/ℓ)	Biocoat	Biocoat	Biocoat
6	-	Capitan (0,15g/ℓ)	Capitan	Capitan	Capitan
7	-	Stroby (0,15g/ℓ)	Stroby	Stroby	Stroby
8	-	Flint (0,15g/ℓ)	Flint	Flint	Flint
9	-	Ortiva (0,3ml/ℓ)	Ortiva	Ortiva	Ortiva
10	-	CuOCl (3g/ℓ)	-	Avogreen (2ml/ℓ)	Avogreen

ganic acids from Hygrotech Seed (Pty) Ltd), Capitan (flusilazole from Du Pont), Stroby (strobulorin from BASF SA (Pty) Ltd), Flint (strobulorin from Novartis SA (Pty) Ltd), Ortiva (strobulorin from Zeneca Agrochemicals (Pty) Ltd) and Avogreen (*Bacillus subtilis* from University of Pretoria) were tested in comparison with the standard Demildex treatment (CuOCl from Delta Chemicals (Pty) Ltd).

Treatments were applied monthly from November to February. However, Bion was applied monthly from October to allow time for strengthening of the plant before onset of high disease pressure. Avogreen was used in an integrated programme with CuOCl as recommended for commercial use.

2000/01 season:

Bion (salicylic acid compound from Novartis SA (Pty) Ltd), Flint (strobulorin from Novartis SA (Pty) Ltd), Ortiva (strobulorin from Zeneca Agrochemicals (Pty) Ltd), Avogreen (*Bacillus subtilis* from University of Pretoria), Solanacure (*Bacillus spp.* from Agricultural Research Council) and Lime Sulphur (Unisun (Pty) Ltd) were tested in comparison with the standard Demildex treatment (CuOCl from Delta Chemicals (Pty) Ltd).

All treatments received a CuOCl application in November and the various other compounds in January. However, Avogreen and Solanacure were also applied in February due to them being *Bacillus spp.* formulations which needed more frequent applications. Bion was applied together with the first CuOCl treatment to allow time for strengthening of the plant before onset of high disease pressure. Lime sulphur was also applied monthly on its own to assess its potential to totally replace CuOCl.

Every season one hundred and forty fruit were randomly picked from each treatment and evaluated for incidence of Cercospora spot, sooty blotch and visible spray residues in the orchard (during April of each year). A 0-3 scale was used for evaluations:

For Cercospora spot:

0= no symptoms
1=1-5 Cercospora spot lesions
2= 6-10 Cercospora spot lesions
3= more than 10 Cercospora spot lesions.

For sooty blotch and spray residues respectively:

0= totally unaffected fruit
1= less than 20% of fruit surface affected
2= 20-50% of fruit surface affected
3= more than 50% of fruit surface affected.

After harvest 70 fruit of each treatment were stored at 5.5EC for 28 days, ripened at 20EC, and evaluated externally and internally for postharvest diseases (anthracnose, stem-end rot and *Dothiorella / Colletotrichum* complex) and physiological disorders (cold damage, lenticel damage, pulp spot and grey pulp).

All results were statistically analysed using Tuckey's test at P=0.05.

RESULTS AND DISCUSSION

1999/2000 season:

Two sprays of CuOCl gave the best control of Cercospora spot, followed by the CuOCl/ Avogreen treatment, Ortiva, Flint and Bion (Table 3). These results support the efficacy of Avogreen (*Bacillus subtilis*) in an integrated program reported by Korsten *et al* (1997). Westfalia Biocoat, Capitan (flusilazole) and Stroby did not control Cercospora spot. This is contrary to results of Lonsdale which found flusilazole to be effective for control of Cercospora spot (1991, 1992). No statistical differences were found in control of sooty blotch and this may be attributed to the low incidence of sooty blotch in this trial (results not shown).

Anthracnose was controlled best by treatments including a CuOCl spray, followed by the Flint and Westfalia Biocoat treatments. All treatments except Bion gave significant control of stem-end rot. No incidence of D/C complex was observed and no significant differences were observed in the incidence of any physiological disorders (results not shown). Avogreen, Ortiva, Flint and Bion were selected for

Table 2. Treatment schedule for 2000/01.

No	Date and treatment: 2000/01		
	2 November 2000	5 December 2000	6 January 2001
1	Untreated	-	-
2	CuOCl (3g/ℓ)	-	-
3	CuOCl (3g/ℓ)	-	Flint (0,15g/ℓ)
4	CuOCl (3g/ℓ)	-	Ortiva (0,3ml/ℓ)
5	CuOCl (3g/ℓ)	-	Lime sulphur (7,5ml/ℓ)
6	CuOCl (3g/ℓ)	Avogreen (2g/ℓ)	Avogreen
7	CuOCl (3g/ℓ)	Solanacure (2ml/ℓ)	Solanacure
8	CuOCl (3g/ℓ) +Bion (0,15g/ℓ)	Bion (0,15g/ℓ)	Bion
9	Lime sulphur (7,5ml/ℓ)	Lime sulphur	Lime sulphur

Table 3. Percentage fruit free from different diseases.

Treatment	% Disease free fruit: 1999/2000			
	Cercospora spot	Sooty blotch	Anthracnose	Stem-end rot
Untreated	0 e	82,9 ab	6 g	53,6 d
CuOCl (2X)	91,4 a	100 a	70,2 a	88,1 ab
CuOCl (1X)	39 c	100 a	61,7 ab	91,7 a
Bion	21,4 d	88,6 ab	15,5 fg	54,8 d
Biocoat	0 e	81,4 ab	47,2 bc	88,9 ab
Capitan (Flusilazole)	0 e	100 a	22,6 efg	82,1 ab
Stroby	8,6 de	77,1 b	27,8 def	77,8 abc
Flint	21,4 d	89,3 ab	56 abc	88,1 ab
Ortiva	37,9 c	90,7 ab	36,9 cde	72,6 bc
CuOCl / Avogreen	73 b	100 a	55 abc	91,7 a

Figure 1. Percentage fruit free from Cercospora spot.

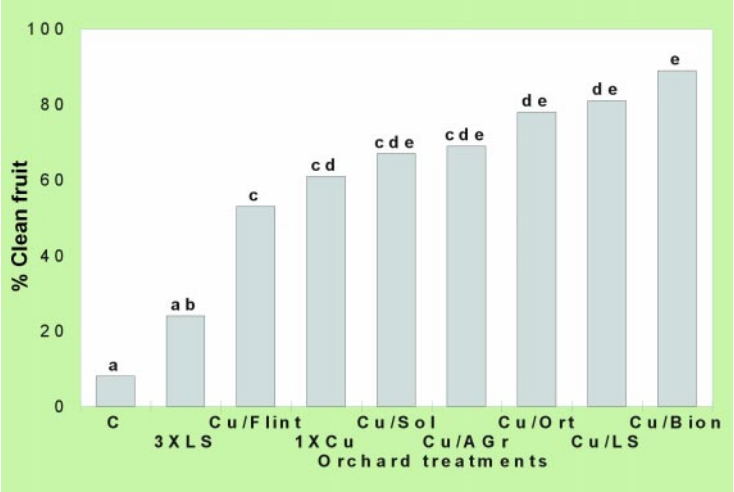
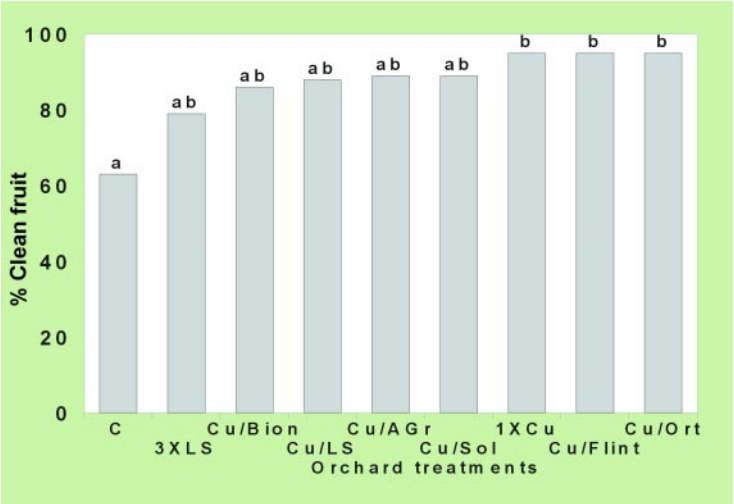


Figure 2. Percentage fruit free from anthracnose.



further evaluation in the 2000/01 season.

2000/01 season:

The CuOCl/Bion treatment gave the best control of Cercospora spot, followed by the CuOCl/Lime Sulphur treatment, the CuOCl/Ortiva treatment, the CuOCl/Avogreen treatment and the CuOCl/Solanacure treatments respectively (Fig. 1). These treatments did not differ significantly from each other. CuOCl/Flint and three sprays of Lime Sulphur gave significantly poorer control of Cercospora spot than CuOCl/Bion, CuOCl/ Lime Sulphur or CuOCl/Ortiva treatments. No significant differences were found in control of sooty blotch and this may be attributed to the low incidence of sooty blotch in the trial (results not shown).

One spray of CuOCl, the CuOCl/Flint treatment and the CuOCl/Ortiva treatment controlled anthracnose significantly when compared with the untreated control treatment (Fig. 2). No differences were observed in control of stem-end rot or D/C complex due to the low disease incidence, and no differences were observed in physiological disorders (results not shown).

CONCLUSION

Although Bion in an integrated programme with CuOCl controlled Cercospora spot well it did not control anthracnose or stem-end rot. As Bion is an expensive product and registration on avocado is not foreseen it will not be evaluated further. Lime Sulphur was effective for control of Cercospora spot when used in an integrated programme with CuOCl and will be evaluated further as this treatment is more environmentally friendly. Of the strobulorins tested, Ortiva gave the best control of Cercospora spot and also showed potential

for control of anthracnose, and needs further evaluation. Avogreen was effective for control of Cercospora spot in the first season of the trial and is registered for commercial use in South Africa. It will be important to use area specific programs for its use.

ACKNOWLEDGEMENTS

The author wishes to thank SAAGA for financial support and Westfalia Estate for the use of experimental orchards and funding. The technical assistance of Mr. T. Mookamedi, Mr. H. Mashele and Ms. A. Willis is much appreciated.

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