Research reports

Effect of Bordeaux mixture sprays applied after flowering on fruit finish of apricot

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Summary

Experiments were conducted over three seasons in a commercial apricot orchard to determine the effect of post flowering Bordeaux mixture sprays on fruit finish. Such sprays are applied for the control of bacterial canker caused by *Pseudomonas syringae* pv. *syringae*. In the first season, fruit receiving two post flowering sprays was significantly more russetted than fruit from the control plots, while in each of the following two seasons, there was no significant difference. Russet, which consisted of fine specks and red patches over the fruit surface, was not severe enough to seriously downgrade the fruit for canning, although it is possible that under certain weather conditions more serious damage could result.

Introduction

Bordeaux mixture, one of the earliest known fungicides (McCallan 1967), is still widely used because of its persistent anti-fungal and anti-bacterial properties (Foltzer and Deruche 1985). However, Bordeaux mixture is also known to be phytotoxic on some plants depending on the strength of the mixture applied and the weather conditions (Jacks and Taylor 1956). Recently, Wimalajeewa (1987) established that apricots are most susceptible to bacterial canker caused by *Pseudomonas syringae* pv. *syringae* during late winter and spring, coinciding with periods when the epiphytic populations of the bacterium are highest (Wimalajeewa and Flett 1985). Field trials have shown that reduced rates of Bordeaux mixture or other copper-based fungicides applied post flowering are an important supplement to autumn and winter sprays for the control of bacterial canker in apricot (Wimalajeewa, unpublished data). However, considerable grower resistance to the use of these post flowering sprays was encountered because of the perceived risk of phytotoxicity. These trials were designed to obtain additional data on the effect of such sprays on fruit finish.

Methods

The experiment was conducted at Ardmona, northern Victoria, in a commercial block of 10 year old Trevatt apricots grown on Myrobalan rootstocks and planted at a spacing of 5.5 × 3.7 m. The experiment was arranged as a randomized block design, consisting of six blocks of trees, each block containing two plots of 15 trees (three rows wide and five trees long). Sprays were applied by commercial airblast sprayer at 3000 L ha^{-1}. All trees received the normal program of fungicides and insecticides which included dormant season sprays of Bordeaux mixture and sprays of propiconazole (Tilt 250 EC, 250 ml per 1000 L, Ciba-Geigy Australia Ltd.); triforine (Saprol 20 EC, 1000 ml per 1000 L, Shell Chemicals (Australia) Pty. Ltd.); iprodione (Rovral 50 WP, 500 g per 1000 L, Rhône-Poulenc Rural Pty. Ltd.); thiram (Thiram 80 WP, 1500 g per 1000 L, Incitec Ltd.); metiram (Polyram 2000, 1500 g per 1000 L, BASF Australia Ltd.); azinophos-methyl (Gusathion 350, 1400 g per 1000 L, Bayer Australia Ltd.); and *Bacillus thuringiensis* (Dipel 2500 g per 1000 L., Schering Pty. Ltd.), applied during the growing season (Table 1). One plot of trees in each pair received two additional sprays of Bordeaux mixture at the rate of 3 kg copper sulphate and 4 kg calcium hydroxide in 1000 L water (3:4:1000). The first spray was applied seven days after petal fall and the second about seven days later. Spray dates were the 19th and 26th September 1986, the 25th September and 2nd October 1987, and the 22nd September and 7th October 1988. Weather data was recorded at the Institute for Sustainable Agriculture, Tatura, about 7 km south of the trial site.

On the 23rd December (1986) or the 21st

Table 1.Fungicides and insecticides applied to apricot trees cv. Trevatt, Ardmona 1986-88.

1986			1987			1988		
date		treatment	date		treatment	date		treatment
April – August		Bordeaux (6 sprays)	April – August		Bordeaux (6 sprays)	April – August		Bordeaux (6 sprays)
September	1	propiconazole (½)[1]	September	2	triforine	September	6	iprodione (½)[1]
	8	propiconazole (½)[1]		10	propiconazole		9	iprodione (½)[1]
	19	thiram (½)[1]		18	thiram (½)[1]		12	iprodione (½)[1]
		Bordeaux[2]		23	thiram (½)[1]		22	Bordeaux[2]
	24	thiram (½)[1]		25	Bordeaux[2]		26	thiram (½)[1]
	26	Bordeaux[2]	October	2	Bordeaux[2]	October	4	thiram (½)[1]
October	8	thiram		13	metiram		7	Bordeaux[2]
	29	metiram	December	8	metiram plus *Bacillus thuringiensis*		24	metiram
December	3	metiram plus *Bacillus thuringiensis*				November	26	metiram
	22	metiram plus azinphos-methyl				December	12	metiram
							19	metiram
							26	iprodione plus azinphos-methyl

[1] (½) = alternate row spraying
[2] half strength Bordeaux (3:4:1000)

Table 2. Effect of post flowering Bordeaux sprays on apricot fruit russet.

Treatment	% fruit area russetted		
	1986	1987	1988
Normal sprays	7.6	3.5	2.8
Normal plus two post flowering Bordeaux sprays	16.6	3.9	3.0

S.E.D. for comparing treatments within or across years = 1.6 (d.f.~8)
S.E.D. for comparing years within a treatment = 1.4 (d.f.=20)

December (1987 and 1988), one to two weeks before harvest, 100 fruit were sampled from the middle three trees in the centre row of each plot. On the following day fruit were assessed for skin russet by rating each fruit on a scale of 0-4 where 0 = clean, 1 = 1-5% fruit area affected , 2 = 5-15%, 3 = 15-40%, 4 = 40-100%. The percentage fruit area affected per block was calculated by multiplying the number of fruit affected by 0, 2.5, 10, 27.5 or 70 , for categories 0, 1, 2, 3 or 4 respectively , and the results were subjected to analysis of variance.

Results and discussion

The symptoms of russet were a fine red-brown specking and red blotching over the fruit surface. Symptoms were often concentrated on the side of the fruit exposed to the sun. The symptoms were usually not consistent with those caused by any of the known apricot diseases, although occasionally symptoms typical of those caused by *Pseudomonas syringae* pv. *syringae* were observed.

Results of the trials are shown in Table 2, and indicate that in 1986 fruit russet was significantly worse in plots treated with two post flowering Bordeaux mixture sprays. However in the following two seasons there was no significant difference between the treatments. The area russetted on fruit from the control plots in both 1987 and 1988 was less than half that observed in 1986, indicating that some other factor in addition to the Bordeaux mixture spray caused russet in 1986.

Rainfall for September and October, when the post flowering Bordeaux mixture sprays were applied, totalled 108.6, 50.5 and 81.3 mm for 1986, 1987 and 1988, respectively. All post flowering Bordeaux mixture sprays were applied on rain free days separated by at least 24 hrs from other rain, with the exception of the first spray in 1986 which followed seven days of wet weather (total rainfall 37.6 mm), and the last spray of 1988 which was on the second day of a four day rain period (total rainfall 5.2 mm).

Fruit russet in apricot may be affected by factors such as weather conditions, tree health and pesticide sprays. Earlier work on apricot in Victoria has shown that Bordeaux mixture sprays applied post flowering can be phytotoxic. Fish and Hammond (1927) found that Bordeaux mixture at the rate of 7.6 kg copper sulphate and 5 kg calcium hydroxide in 1000 L water (7.6:5:1000) applied at shuckfall caused a crimson skin blush which seriously downgraded the fruit. In later work Fisher and Jenkins (1954) found that Bordeaux mixture at the rate of 6 kg copper sulphate and 15 kg calcium hydroxide in 1000 L water (6:15:1000) and 3 kg copper sulphate and 7.5 kg calcium hydroxide in 1000 L water (3:7.5:1000) applied at shuck fall caused fruit russet which was more severe at the high rate. The present work indicates that post flowering Bordeaux mixture sprays at the rate tested will not on their own cause russet, but when combined with other factors they may increase russet. In apples, russet is only reported to occur under conditions of high humidity, frequent rain or dew (Faust and Shear 1972). It is possible that the prolonged rainfall during petal fall in 1986 was sufficient to cause some phytotoxicity on fruit from all plots, which was aggravated by the post flowering Bordeaux mixture sprays.

The level of fruit russet observed in these trials was generally low, and the grower considered that the highest level of russet observed was not serious enough to downgrade fruit intended for canning. Despite this, it is conceivable that under certain weather conditions more serious damage could result; as a consequence such post flowering Bordeaux mixture sprays should be used with caution.

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