Tree Fruit Diseases

Organic Fungicides for Control of Apple Scab and Powdery Mildew

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Fungicide treatments were arranged in a randomized complete block design in plantings of 42-yr 'Red Delicious' and 39-yr 'Jonathan' apples on M.4 rootstock on a 20 x 20 ft spacing. Each treatment was applied to 4 single tree replicates in each cultivar. Fungicides were applied using a hydraulic handgun sprayer at 300 psi at a rate or 400 gal water/acre. Approximately 20 to 25 gal of spray solution were used per 4 trees depending on growth stage. Treatments were applied every 7 to 10 days, depending on weather conditions. Applications were made on 7 Apr, 14 Apr, 27 Apr, 4 May, 12 May, 20 May, 28 May, 8 Jun and 17 Jun. Average bloom dates were 7 Apr (prepink), 16 Apr (pink), 29 Apr (full bloom) and 6 May (calyx). In general, 'Jonathan' bloom dates were 4 to 5 days ahead of 'Red Delicious'. Applications of Guthion 35WP (2.5 lb/acre) on 28 May and 17 Jun, and Diazinon 50WP (4 lb/acre) on 13 Aug were made for control of codling moth. Apple scab infection periods were monitored using a Metos environmental monitoring system. Using a modified primary infection model (wet periods start with rain and end with 8 hours drying time) a total of 17 infection periods was detected during Apr and May: 11 high infection periods (8, 13, 16, 22, 24 and 28 Apr; 7, 19, 24, 26 and 29 May); 2 moderate infection periods (20 Apr and 5 May); 4 low infection periods (1, 3, 12 and 21 May). A conidial model detected 20 infection periods from May through Jul. Leaf scab incidence was evaluated on 13 May on 'Red Delicious' by examining 200 leaves randomly selected from the lower portion of each tree. Incidence of leaf scab also was evaluated on 24 Jun for 'Jonathan' and 'Red Delicious' by examining all leaves from 15 vegetative shoots (125 to 145 leaves) randomly selected from the lower portion of each tree. Incidence of phytotoxicity on leaves of 'Red Delicious' was evaluated on 7 Jul by examining all leaves from 15 vegetative shoots (125 to 145 leaves) randomly selected from the lower portion of each tree. The percentage of 100 terminals with powdery mildew in 'Jonathan' was evaluated on 29 Jun. A random selection of 100 fruit was examined in 'Jonathan' on 9 Aug from each tree and evaluated for incidence of apple scab and fruit russeting. Poor fruit set and high disease pressure resulted in insufficient 'Red Delicious' fruit available to rate for scab.

Weather was highly conducive to the development of apple scab and powdery mildew. All treatments significantly reduced the incidence of scab and powdery mildew in 'Jonathan' when compared to the nontreated and water controls (Table 1). All treatments significantly reduced leaf scab on the 2nd evaluation date in 'Red Delicious' when compared to the nontreated and water controls (Table 2). Incidence of scab was significantly the lowest for both cultivars treated with lime sulfur. Incidence of scab was similar for the combination of sodium bicarbonate plus ultrafine oil and ultrafine oil alone, whereas sodium bicarbonate alone was significantly higher. This indicated that the ultrafine oil was the more efficacious of the two materials when used in combination for control of scab. The use of ultrafine oil on a 7- to 10-day

schedule produced a phytotoxic reaction in leaves of 'Red Delicious', resulting in tan brown necrotic spots, which were distinctly different from the olivaceous necrotic spots produced by scab. This phytotoxic response was also evident in treatment using ultrafine oil in the cultivar 'Jonathan' (quantitative data not obtained). Incidence of fruit russeting on 'Jonathan' was significantly lower for sodium bicarbonate and ultrafine oil used alone than when used in combination and when compared to the nontreated and water controls. Lime sulfur significantly had the lowest incidence of fruit russeting.

Table 1. 'Jonathan'.

	Apple scab (%)*		Powdery mildew	
Treatment and rate/acre	Leaves	Fruit	% infected terminals*	% fruit russeting*
Nontreated	77.1a	83.4a	63.3a	35.3a
Water control	74.3a	88.8a	57.0a	28.5b
Sodium bicarbonate 17.7 lb + Sunspray ultrafine oil 4 gal	34.1c	14.8c	20.3bc	28.0b
Sodium bicarbonate 17.7 lb	53.8b	57.3b	35.8b	20.4c
Sunspray ultrafine oil 4 gal	37.1c	24.0c	21.8bc	21.8c
Lime sulfur 8 gal	2.4d	2.5d	9.3c	10.5d

*Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=0.05).

Table 2. 'Red Delicious'.

	Leaf scab (%)*		
Treatment and rate/acre	13 May	24 Jun	Phytotoxicity (%)*
Nontreated	46.9a	82.1a	3.0c
Water control	41.5a	78.9a	4.2c
Sodium bicarbonate 17.7 lb + Sunspray ultrafine oil 4 gal	16.1b	24.7d	23.5b
Sodium bicarbonate 17.7 lb	35.9a	63.8b	3.2c
Sunspray ultrafine oil 4 gal	12.6b	35.6c	34.7a
Lime sulfur 8 gal	9.5b	3.1e	1.7c

*Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=0.05).