Ornamental Plants
Annual Reports and Research Reviews 2002

Special Circular 189

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January 2003
Special Circular 189
Ohio Agricultural Research and Development Center
In Partnership With Ohio State University Extension

The Effects of Sprayer Configuration on Efficacy for the Control of Scab on Crabapple

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Introduction

Production of woody environmental and floral crops represents more than 12% of American agricultural receipts. Unfortunately, fungus diseases like apple scab, caused by *Venturia ineaqualis*, result in millions of dollars of nursery crop losses each year. Effective fungicides must be applied to produce aesthetically pleasing plants.

New guidelines for registering, using, and maintaining pesticides through the U.S. Environmental Protection Agency were created by the Food Quality Protection Act of 1996 (FQPA-96) and require information on how pesticides are used.

Research is crucial on fungicide spray methods related to efficacy. Assessment in past studies involved only macroscopic disease ratings. More complete knowledge of the fate and behavior of fungicides will lead to reduced pesticide use with less off-target deposition.

The purposes of this study were to directly evaluate and correlate the fungicide coverage with the amount of apple scab disease; to assess the effects of sprayer/nozzle type on efficacy and disease control; and to assess any drift or non-target deposition from two types of sprayers in nurseries.

Materials and Methods

Plant Materials

Dedicated nursery plots consisting of six crabapple replication rows with four treatments per replication each were planted (Figure 1). A replication consisted of seven, two-year-old crabapple whips of each cultivar — *Malus* spp. cv. Candied Apple and cv. Red Jade — for a total of 14 trees per replication. Barrier rows were also planted between crabapple treatment rows in all production nurseries.

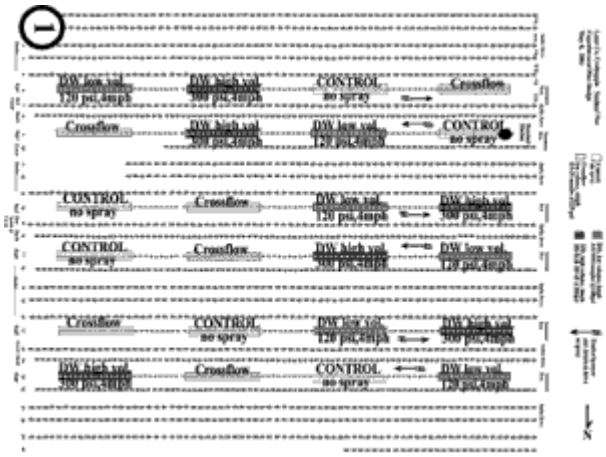

Figure 1. Dedicated nursery plots consisting of six crabapple replication rows with four treatments per replication each were planted.

Treatments

Treatments were randomized in each of six rows as follows:

- Axial flow, airblast sprayer with conventional high-volume nozzle delivering 300 psi, traveling at 4 mph.
- Axial flow, airblast sprayer with air induction nozzles delivering 120 psi traveling at 4 mph.
- Experimental air curtain sprayer or cross-flow fan sprayer with air induction nozzles delivering 120 psi at 4 mph.
- Unsprayed control.

Spray treatments were begun in May 2001. Figure 2 shows the axial flow, airblast sprayer delivering a treatment to one of the replications.

Figure 2. The axial flow, airblast sprayer delivers a treatment to one of the replications.

Bioassay and Leaf Analysis

Sample holders used for mounting samples for scanning electron microscopy (SEM) called stubs, each with conductive, adhesive specimen mounts (Ted Pella, Tustin, Calif.), were mounted in trees before each treatment. Leaves and stubs were collected from each treatment after each spray for bioassay and electron beam analysis (EBA), a combination of SEM and energy dispersive X-ray analysis (EDXA). Leaves from each treatment were collected after each spray and freshly mounted on stubs using adhesive specimen mounts.

A cold field emission scanning electron microscope (CFESEM) and a variable pressure scanning electron microscope (VPSEM), both equipped with EDXA, located at the Molecular and Cellular Imaging Center at The Ohio State University's Ohio Agricultural Research and Development Center's (OSU/OARDC), Wooster campus, were used for EBA. Electron beam analysis permitted direct visualization and identification of the pathogens, morphologically, and chemical characterization of any fungicide present.

The fungicide used in this study was Mankocide, a combination of $Cu(OH)_2$ and mancozeb that permitted EBA identification based on the presence of Cu, MN, and Zn in the molecule.

Disease Evaluation

Disease incidence ratings based on a modified Horsfall-Barrett Scale were taken each month during spray treatments.

Weather Stations

A portable meteorological station (Campbell Scientific Instruments) was installed within the experimental plot to remotely monitor air temperature, leaf wetness, relative humidity, wind

speed and direction, rainfall, and solar radiation, according to guidelines of the United States National Oceanic and Atmospheric Administration.

Results and Discussion

During the 2002 growing season, little apple scab disease was observed macroscopically. Free moisture on leaf surfaces was lacking, as recorded by the meteorological station, indicating conditions were not conducive for disease development.

Figure 3. A portable meteorological station was installed within the experimental plot.

Electron beam analysis of leaf samples observed during the early portion of the year (2002) confirmed the lack of the fungal pathogen. When limited disease (< 5% to 10%) occurred on both cultivars in June 2002, EBA confirmed the presence of the pathogen. While fungicide coverage was measured with EBA, low disease pressure did not permit quantifying differences in efficacy.

This project involved development of experimental methods, including the use of remote leaf wetness sensors, essential for studies of apple scab. The use of fungicides as tracers for EBA was developed as part of the analytical protocol for studying spray efficacy. Specimen handling technology was developed for subsequent studies. Techniques developed in this study will be adapted for assessment of other disease and pest management problems. Improved knowledge of the basis of efficacy and coverage will improve grower profitability and protect farm workers, consumers, and the environment.

Acknowledgments

This research is sponsored in part through a grant from the Horticultural Research Institute, American Nursery and Landscape Association, Washington, D.C. The U.S. Department of Agriculture, Agricultural Research Service (ARS), Application Technology Unit also expresses its appreciation to Robert Lyons, President, Sunleaf Nursery, Madison, Ohio, and Colin Ruckle, President, Warner Kingwood Nursery, Willoughby Hills, Ohio, for the use of their respective nurseries during this long-term project.

The authors also wish to thank Rolly Hart for applying spray; Jay Daley and Ray Headly, Sunleaf Nursery; and Mac Fulton, Warner Kingwood Nursery, for their cooperation during this investigation.

Disclaimer

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References

Chatfield, J. A., E. A. Draper, and K. D. Cochran. 1996. Comprehensive aesthetic evaluations of crabapples in Ohio: 1993-1995. *Malus: International Ornamental Crabapple Bulletin* 10(1) 5-16.

Krause, Charles R. 2000. Partnerships with the Green Industry: the new Molecular and Cellular Imaging Center. Special Circular 177. Ohio Agricultural Research and Development Center, The Ohio State University, pp. 113-117.