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Assessment of New Fungicides for the Control of Southern Blight on Aucuba[1]

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Abstract

Drenches of Lynx 3.6F, ProStar 50W, Fluazinam 500F, Terraguard 50W, and Curalan DF were compared with Terraclor 75W for the control of southern blight on container-grown aucuba (*Aucuba japonica*) 'Variegata'. Over the three-year test period, ProStar 50W and Fluazinam 500F across a range of rates completely protected aucuba from attack by the causal fungus, *Sclerotium rolfsii*. Also, both fungicides gave better disease control in two of three years than the current industry standard Terraclor 75W. Lynx 3.6F at the 0.54 g a.i./liter rate proved as effective in controlling southern blight as ProStar 50W and Fluazinam 500F. Terraclor 75W, which was applied at over twice the labeled drench rate, gave inconsistent disease control. Terraguard 50W and Curalan DF failed to provide effective control of southern blight on aucuba. No symptoms of phytotoxicity were observed.

Index words: *Sclerotium rolfsii*, *Aucuba japonica*, triazole fungicide, disease, chemical control, fungicide drench.

Species used in this study: aucuba (*Aucuba japonica* [Thunb.] 'Variegata').

Significance to the Nursery Industry

Outbreaks of southern blight caused by *Sclerotium rolfsii* can cause significant losses of some trees and shrubs in container production and landscape settings. The fungicides ProStar 50W and Fluazinam 500F over a range of application rates completely protected container-grown aucuba from southern blight and gave superior disease control as compared with the current industry standard Terraclor 75W. Lynx 3.6F proved as effective as ProStar 50W and Fluazinam 500F in controlling southern blight only at the highest drench rate tested. Terraguard 50W and Curalan DF had little or no activity against southern blight on aucuba.

Introduction

Southern blight, which is incited by the soilborne fungus *Sclerotium rolfsii* Sacc. (teleomorph = *Athelia rolfsii* (Curzi) Tu & Kimbrough), is found occasionally in southeastern nurseries on a variety of container and field-grown trees and shrubs (3, 5). Outbreaks of southern blight also occur in residential and commercial plantings of selected woody landscape crops, particularly aucuba (*Aucuba japonica* [Thunb.]). Although sanitation practices that exclude the pathogen are helpful in avoiding disease outbreaks, timely fungicide treatments are often required to prevent significant plant loss.

PCNB, marketed under the trade names Terraclor, and Defend as a granular (10G), emulsifible concentrate (2E), and wettable powder (75W) formulation, is the only fungicide currently registered for the control of southern blight on woody landscape crops. When applied as a soil drench at the labeled rates of 0.35 to 0.7 g a.i./liter of spray volume, Powell (4) demonstrated that Terraclor 75W protected container-grown ajuga from attack by *S. rolfsii*.

In contrast, efficacy of Terraclor in controlling *S. rolfsii*-incited diseases on other crops, particularly peanut, has been questioned (1, 2).

Recently, several fungicides have been identified with activity against *S. rolfsii* superior to that of Terraclor. Lynx 3.6F (tebuconazole), ProStar 50W (flutolanil), and Fluazinam 500F (fluazinam) have given significantly better control of southern blight on peanut than Terraclor 10G (1,2,6). Formulations of Lynx 3.6F [Folicur 3.6F] and ProStar 50W [Moncut 50W] have been registered on peanut for the control of southern blight. The efficacy of these fungicides on container-grown woody landscape crops for the control of southern blight has, however, never been established. Terraguard 50W, which has the same mode of action as Lynx 3.6F, is registered for the control of several soilborne diseases on floral and woody landscape crops but not for southern blight. Curalan DF is cleared for use on primarily floral crops for the control of botrytis blight but is not known to have activity against some soilborne plant pathogenic fungi. This report presents the results of a three-year study to compare the efficacy of the fungicides Lynx 3.6F, ProStar 50W, Fluazinam 500F, Terraguard 50W, and Curalan DF with that of Terraclor 75W for the control of southern blight on aucuba. Efficacy of Lynx 3.6F, ProStar 50W, and Fluazinam 500F over a range of application rates was also determined.

Material and Methods

Plant culture. Each year, aucuba (*A. japonica* 'Variegata') liners were transplanted into 3.8 liter (1 gal) containers in a pine bark-peat moss medium (3:1 by vol) amended with 4.9 kg (14 lb) of Osmocote (17–7–12) fertilizer, 2.1 kg (6 lb) of dolomitic limestone, 0.7 kg (2 lb) of gypsum, and 0.5 kg (1.5 lb) of Micromax per cubic meter. Prior to each trial, the aucuba were held on oyster shell-covered beds under 40% shade and watered daily with overhead sprinklers.

Inoculum preparation. Stem pieces cut from the crown of a southern blight-infected aucuba were surface sterilized in 0.5% sodium hypochlorate (NaOCl) for 1 minute, blotted dry with sterile tissue, then placed on Difco potato dextrose agar (PDA). A single stock culture of *S. rolfsii* from these stem pieces was stored on plates of PDA in a refrigerator at 5.6C (42F) . Inoculum was prepared by placing 200 ml of oat seed and 100 ml of deionized water in a 500 ml flask.

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Table 1. **Evaluation of fungicides for the control of southern blight on aucuba.**

Fungicide	Application rate g.a.i./liter	% Survival year 1992	1993	1994
Lynx 3.6F	0.27	80[z]	90	37
ProStar 50W	1.2	100	100	100
Fluazinam 500F	1.25	100	100	100
Terraguard 50W	0.6	40	80	0
Terraclor 75W	1.1	70	100	37
Curalan DF	0.3	30	0	0
Inoculated control	—	20	20	0
Uninoculated control	—	100	100	100
LSD (P = 0.05)		32	26	26

[z]Mean separation within columns according to Fisher's protected least significance (LSD) test (P = 0.05).

The mixture was autoclaved at 123C (250F) and 104 kPa (15 psi) for 15 minutes on three consecutive days. When the oats had cooled to room temperature, three or four 1-cm plugs taken from a 10- to 14-day old culture of *S. rolfsii* were added to each flask. Inoculated oat seed was incubated for 7 to 30 days at room temperature at 22C (72F).

Approximately 1 gm of inoculum (20 to 25 seeds) was distributed in 2 to 3 holes, 0.5 to 1.3 cm (0.2 to 0.5 in) in depth, evenly spaced around the collar of each plant, then covered with fresh potting medium. Prior to inoculation, each plant had previously been treated with a fungicide or left untreated. No oat seeds were incorporated into the potting medium of the uninoculated control plants.

Fungicide comparison. In the screening trials conducted annually from 1992 through 1994, fungicide treatments included Lynx 3.6F (tebuconazole, Bayer Corp., Kansas City, MO) at 0.27 g a.i./liter, ProStar 50W (flutolanil, Agr Evo, Wilmington, DE) at 1.2 g a.i./liter, Fluazinam 500 F (fluazinam, Zeneca Ag Products, Wilmington, DE) at 1.25 g a.i./liter, Terraguard 50W (triflumizole, Uniroyal Chemical Inc., Middlebury, CT) at 0.6 g a.i./liter, Curalan 50DF (vinclozolin, BASF, Research Triangle Park, NC) at 0.3 g a.i./liter, and Terraclor 75W (PCNB, Uniroyal Chemical Inc., Middlebury, CT) at 1.1 g a.i./liter. In a second series of trials conducted in 1993 and 1994 to determine optimum application rate, treatments included Lynx 3.6F at 0.14, 0.27, and 0.54 g a.i./liter, ProStar 50W at 0.3, 0.6, and 1.2 g a.i./liter, and Fluazinam 500F at 0.31, 0.63, and 1.25 g a.i./liter. In all tests, inoculated (positive) and uninoculated (negative) controls were included. Approximately 200 ml of spray solution were applied with a CO_2 pressurized backpack sprayer 24 hr prior to inoculation with the *S. rolfsii*-infested oat seed and repeated two to four weeks later to thoroughly wet the three inches of stem and the potting medium in the vicinity of the base of the plant. A randomized complete block design with five replicates of two plants per treatment was used. Initial fungicide applications, which were made on September 2, 1992, June 30, 1993, and September 7, 1994, were repeated either two or four weeks later. To facilitate disease development, plants were held after inoculation until each trial was terminated in a plastic greenhouse at day temperatures up to 35 to 40C and hand-watered daily to maintain high moisture levels in the media. Plant survival was assessed on September 30, 1992, September 29, 1993, and September 26, 1994. Significance of treatment effects were tested by analysis of variance and treatment means were compared with Fisher's protected least significant difference (LSD) test with a level of significance at P = 0.05.

Results and Discussion

In 1992, significant increases in the survival of aucuba, as compared with the inoculated control, were obtained with Fluazinam 500F, ProStar 50W, Lynx 3.6F and Terraclor 75W. (Table 1). Southern blight was not observed on aucuba treated with Fluazinam 500F or ProStar 50W. Although a few of the Lynx 3.6F and Terraclor 75W-treated aucuba succumbed to southern blight, the level of disease control obtained with these two fungicides did not significantly differ from that provided by Fluazinam 500F and ProStar 50W. Terraguard 50W and Curalan DF failed to improve the survival of aucuba. The level of plant survival in the inoculated controls was similar to that recorded for the Terraguard 50W or Curalan DF-treated aucuba.

In the following year, all fungicides except Curalan DF significantly increased the survival of aucuba above the levels observed in the inoculated control (Table 1). Southern blight did not develop on the aucuba drenched with ProStar 50W, Fluazinam 500F, or Terraclor 75W. Although Terraguard 50W and Lynx 3.6F failed to prevent some plant death, the level of southern blight control obtained with these fungicides did not significantly differ from that provided by ProStar 50W, Fluazinam 500F, and Terraclor 75W. All of the Curalan DF-treated aucuba, as well as the majority of the inoculated controls, succumbed to southern blight.

For 1994, applications of ProStar 50W and Fluazinam 500F gave complete control of southern blight (Table 1). Although Lynx 3.6F and Terraclor 75W increased plant survival, neither fungicide was as effective in controlling southern blight as ProStar 50W or Fluazinam 500F. All the Curalan DF and

Table 2. **Influence of application rate on the efficacy of Lynx 3.6F, ProStar 50W, and Fluazinam 500F for the control of southern blight on aucuba.**

Fungicide	Application rate g.a.i./liter	% Survival year 1993	1994
Lynx 3.6F	0.14	20[z]	0
Lynx 3.6F	0.27	30	12
Lynx 3.6F	0.54	100	100
ProStar 50W	0.30	100	100
ProStar 50W	0.60	100	100
ProStar 50W	1.20	100	100
Fluazinam 500F	0.31	100	100
Fluazinam 500F	0.63	100	100
Fluazinam 500F	1.25	100	100
Inoculated control	—	0	0
Uninoculated control	—	100	100
LSD (P = 0.05)		16	11

[z]Mean separation within columns according to Fisher's protected least significance (LSD) test (P = 0.05).

Terraguard 50W-treated aucuba, as well as the inoculated controls, succumbed to southern blight.

In the second series of efficacy trials in 1993 and 1994, application rate did not influence the efficacy of ProStar 50W (0.3, 0.6, and 1.2 g a.i./liter) or Fluazinam 500F (0.31, 0.62, and 1.25 g a.i./liter) for the control of southern blight on aucuba but did for Lynx 3.6F (Table 2). In both years, all rates of ProStar 50W and Fluazinam 500F controlled southern blight. Survival of aucuba significantly improved as the drench rate for Lynx 3.6F increased from 0.14 to 0.54 g a.i./liter. Only the 0.54 g a.i./liter rate of Lynx 3.6F, however, proved as effective in controlling southern blight on aucuba as any rate of ProStar 50W or Fluazinam 500F.

Previous studies on peanut have shown that several of the fungicides screened provide effective control of *S. rolfsii*-incited southern blight (1, 2, 6). Our results demonstrate that ProStar 50W and Fluazinam 500F, when applied as a drench prior to disease onset, protects aucuba against southern blight better than the current fungicide standard Terraclor 75W or the fungicides Terraguard 50W and Curalan DF. In all trials, both ProStar 50W and Fluazinam 500F, when applied as a drench at rates ranging from approximately 0.3 to 1.2 g a.i./liter, completely protected aucuba from attack by *S. rolfsii*. In fact, not a single aucuba treated with either of these fungicides regardless of application rate succumbed to southern blight. Further studies are needed in order to determine the activity threshold for both ProStar and Fluazinam 500F and to determine post-infection efficacy.

Lynx 3.6F, when applied as a drench at rates of 0.14 and 0.27 g a.i./liter, failed to control southern blight as consistently as either ProStar 50W or Fluazinam 500F. In three of five trials, the majority of aucuba treated with either of the two lower rates of this fungicide were killed by *S. rolfsii*. At the highest drench rate of 54 g a.i./liter, however, Lynx 3.6F proved as effective in protecting aucuba from this disease as either ProStar 50W or Fluazinam 500F. Overall, ProStar 50W and Fluazinam 500F were more efficacious at lower drench rates than was Lynx 3.6F.

Terraguard 50W and Curalan DF demonstrated little to no activity at the rates tested against *S. rolfsii*. In two of three years, the survival rate for aucuba drenched with Terraguard 50W did not differ significantly from that of the inoculated controls. However, higher drench rates of Terraguard 50W may prove as efficacious in controlling southern blight as either ProStar 50W or Fluazinam 500F. Nearly all the Curalan DF-treated aucuba succumbed to southern blight.

The level of southern blight control obtained by Powell (4) with Terraclor 75W on ajuga was not observed. In our trials , Terraclor 75W, when drenched at 1.1 g a.i./liter, gave inconsistent control of southern blight. Only in 1993 did Terraclor 75W prove as effective in controlling southern blight as ProStar 50W or Fluazinam 500F. Also, the labeled drench rates for Terraclor 75W of 0.35 to 0.7 g a.i./liter are substantially below those employed in this study. Given the erratic southern blight control obtained with the 1.1 g a.i./liter rate of Terraclor 75W, the lower label rates listed for this fungicide may not provide acceptable control of this disease on aucuba and possibly other container-grown woody landscape crops.

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