

Effectiveness of Contans and Serenade Within a Biologically Intensive Integrated Pest Management System for Sclerotinia Drop on Lettuce: 2005 Study

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Abstract

Sclerotinia drop of lettuce, caused by the pathogenic fungi Sclerotinia minor and S. sclerotiorum, is a serious disease in most regions where this crop is grown. Conventional fungicides, such as Rovral (iprodione) and Endura (boscalid), are usually applied after lettuce is thinned and once more 2 to 3 weeks later. Two biological products, Contans (Coniothyrium minitans) and Serenade (Bacillus subtilis), are also available. In earlier field trials conducted from 2001 to 2003 in the presence of S. sclerotiorum, the mean reduction in disease by Contans, Serenade and Endura was 69, 18 and 41%, respectively. The objective of the current study was to determine the efficacy of the biological products Contans and Serenade, applied alone or in combination with each other or the conventional fungicide Endura, within a biologically intensive integrated pest management system for Sclerotinia drop on lettuce. The study was conducted at The University of Arizona, Yuma Valley Agricultural Center. Sclerotia of Sclerotinia sclerotiorum were produced in the laboratory. Lettuce 'Winterhaven' was seeded and sclerotia were applied to the plots on November 8, 2004. Disease assessment was performed three times, including plant maturity (February 24), by recording the number of dead plants in each plot. Lettuce drop caused by Sclerotinia sclerotiorum was significantly reduced by the biofungicides Contans and Serenade as well as the conventional fungicide Endura. At plant maturity, the highest level of disease control among all treatments was provided by one or two applications of the biofungicide Contans as well as application of Contans at seeding following by either Serenade or Endura after thinning. Also, two applications of the other tested biofungicide, Serenade, controlled Sclerotinia drop as well as two applications of the conventional fungicide, Endura. The results of this study suggest that the biological products Contans and Serenade, used either alone or with the conventional fungicide Endura, can provide effective levels of control of lettuce drop caused by S. sclerotiorum. Although encouraging, the results from this initial field trial will need to be confirmed by additional studies. Funding for this research project was provided, in part, by the IR-4 project under a cooperative agreement with the U.S. Environmental Protection Agency.

Introduction

Sclerotinia drop of lettuce, caused by the pathogenic fungi *Sclerotinia minor* and *S. sclerotiorum*, is a serious disease in most regions where this crop is grown. In the southwest Arizona production region, the disease can appear in lettuce fields from November through March. Annual losses attributable to Sclerotinia drop vary from year to year; however, a small crop loss of even 1% would total 700 acres with a value of \$9.5 million, using 2002 Arizona lettuce production data of 70,000 acres with a value of \$950,000,000. Conventional fungicides, such as Botran (dicloran), Rovral (iprodione), and Endura (boscalid), are usually applied after lettuce is thinned and once more 2 to 3 weeks later. Two biological products, Contans (*Coniothyrium minitans*) and Serenade (*Bacillus subtilis*), are also available. In earlier field trials conducted from 2001 to 2003, the efficacy of Contans and Serenade have been evaluated along with Endura. In the presence of *S. sclerotiorum*, the mean reduction in disease in three field trials by Contans, Serenade and Endura applied alone was 69, 18 and 41%, respectively. The excellent performance of Contans suggests that this product has high potential for widespread adoption as a stand-alone treatment in addition to participating as a component within a biologically-intensive Integrated Pest Management system in situations where *S. sclerotiorum* is a concern.

The objective of the current study was to demonstrate the efficacy of the biological products Contans and Serenade, applied alone or in combination with each other or the conventional fungicide Endura, within a biologically intensive Integrated Pest Management system for Sclerotinia drop on lettuce caused by *Sclerotinia sclerotiorum*.

Materials and Methods

This study was conducted at The University of Arizona, Yuma Valley Agricultural Center, Yuma, Arizona. The soil was a silty clay loam (7-56-37 sand-silt-clay, pH 7.2, O.M. 0.7%). Inoculum of *Sclerotinia sclerotiorum* was produced in 2 quart glass containers by seeding moist sterilized barley seeds with mycelia of the pathogen. After a 2-month incubation at 68°F, abundant sclerotia were formed. The contents of each container were then removed, spread onto a clean surface and air-dried. The resultant mixture of sclerotia and infested barley seed was used as inoculum. Lettuce 'Winterhaven' was seeded November 8, 2004 on double rows 12 inches apart on beds with 40 inches between bed centers. Sclerotia were applied to plots on November 8 as well. A 0.5 pint quantity of a dried mixture of sclerotia and infested barley grain was broadcast evenly over the surface of each 25-foot-long lettuce plot between the seed lines of lettuce on each bed, and incorporated into the top 1-inch of soil. The seed was germinated with furrow irrigation from November 8 to 11. Additional furrow irrigations were performed December 1, December 22, January 21, and February 8. Treatments were replicated five times in a randomized complete block design. Each replicate consisted of 25 feet of bed, which contained two 25 foot rows of lettuce. Plants were thinned December 12 at the 3-4 leaf stage to a 12 in. spacing. Treatment beds were separated by single nontreated beds.

Treatments were applied to soil when lettuce seed was sown (November 8 and/ or December 20). Endura was applied to the bed surface with a CO₂ sprayer at a pressure of 35 psi. and a rate of 50 gal of spray mixture per acre. Contans and Serenade were applied to the bed surface between the two rows of lettuce (where sclerotia of the pathogen had been incorporated) in 1.0 gal of water per plot. An additional 1.0 gal of water was applied to further incorporate Contans and Serenade into the soil. Mean soil temperature (°F) at the 4 in. depth was as follows: December, 53; January, 55; February 1 to 24, 57. Total rainfall in inches was as follows: December, 0.74; January, 0.74; February 1 to 24, 0.61. Disease assessment was performed soon after symptomatic plants began to appear (January 20), again about 10 days later (February 1), and finally at plant maturity (February 24) by recording the number of dead plants in each plot. As a point of reference, the original stand of lettuce was thinned to 50 plants per plot. All diseased plants were dead or dying.

Results and Discussion

Lettuce drop caused by *Sclerotinia sclerotiorum* was significantly reduced by the biofungicides Contans and Serenade as well as the conventional fungicide Endura (see data table). At plant maturity, the highest level of disease control among all treatments was provided by one or two applications of the biofungicide Contans as well as application of Contans at seeding followed by either Serenade or Endura after thinning. Two applications of the other tested biofungicide, Serenade, controlled *Sclerotinia* drop as well as two applications of the conventional fungicide, Endura.

The objective of this study was to demonstrate the efficacy of the biological products Contans and Serenade, applied alone or in combination with each other or the conventional fungicide Endura, for management of *Sclerotinia* drop in lettuce. The data indicate that in the presence of *Sclerotinia sclerotiorum*, the biological material Serenade can reduce the number of infected lettuce plants as well as the conventional fungicide Endura. Furthermore, the biofungicide Contans provided significantly better control of disease than Endura. The data supporting the efficacy of Contans and Serenade for control of lettuce drop are encouraging, however, the results from this initial field trial will need to be confirmed by additional field trials.

Funding for this research project was provided, in part, by the IR-4 project under a cooperative agreement with the U.S. Environmental Protection Agency.

2004-2005 evaluation of Contans and Serenade within a biologically intensive system for management of *Sclerotinia* drop on lettuce caused by *Sclerotinia sclerotiorum*

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Treatment	Rate of product per acre	Treatment dates ¹	Diseased plants per 25 ft plot ²		
			Jan 20	Feb 1	Feb 24
Untreated control	-----	1,2	5.0	9.4	20.2
Contans WG	4.0 lb	1,2	0.8	0.8	4.4
Serenade AS	4.0 qt	1,2	3.2	5.0	11.2
Endura 70WG	0.68 lb	1,2	0.6	2.6	12.2
Contans WG + Serenade AS	4.0 lb + 4.0 qt	1,2	0.2	0.4	5.8
Contans WG	4.0 lb	1			
Serenade AS	4.0 qt	2	0.6	1.2	4.8
Contans WG	4.0 lb	1			
Endura 70WG	0.68 lb	2	0.8	1.6	6.6
Serenade AS	4.0 qt	1			
Endura 70WG	0.68 lb	2	0.6	2.0	11.2
Contans WG + Serenade AS	4.0 lb + 4.0 qt	1			
Endura 70WG	0.68 lb	2	0.4	2.0	6.0
Contans WG	4.0 lb	1	0.6	2.0	6.6
Serenade AS	4.0 qt	1	2.0	4.2	13.4
Endura 70WG	0.68 lb	2	2.2	4.8	15.2
Contans WG+ Serenade AS	4.0 lb + 4.0 qt	1	0.6	1.6	8.4
LSD (Least Significant Statistical Difference, P=0.05) ³			1.7	2.2	4.1

1. Treatments were applied to soil on 1) November 8 (when lettuce seed was sown); 2) December 20 (after thinning). Endura was applied to the bed surface with a CO₂ sprayer at a rate of 50 gal of spray mixture per acre. Contans and Serenade were applied to the bed surface between the two rows of lettuce (where sclerotia of the pathogen had been incorporated) in 1.0 gal of water per plot. An additional 1.0 gal of water was applied to further incorporate Contans and Serenade into the soil.
2. Disease assessment was performed soon after symptomatic plants began to appear, again about 10 days later, and finally at plant maturity (February 24). All diseased plants were dead or dying.
3. Least Significant Difference at $P = 0.05$.