

# Assessment of Fungicide Performance for Management of Downy and Powdery Mildew on Lettuce in 2005

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## Abstract

Downy mildew, caused by the oomycete pathogen *Bremia lactucae*, usually can be found in some lettuce fields each year in Arizona. However, both the incidence and severity of the disease are governed by the frequency and duration of cool moist conditions required for disease development. Free moisture on the leaf surface is essential for spore germination and infection, but not growth of this pathogen within the leaf. Powdery mildew on lettuce is caused by the fungus *Golovinomyces cichoracearum* (*Erysiphe cichoracearum*). The disease is favored by moderate to warm temperatures and relatively dry weather conditions. Several fungicides were evaluated for their ability to suppress development of downy and powdery mildew on lettuce in 2005. Downy mildew was first observed in plots on February 7, whereas powdery mildew was first detected January 26. The data in the accompanying table illustrate the degree of control obtained by applications of the various materials tested in this trial. Among treatments, the degree of downy and powdery mildew suppression ranged from virtually complete to minimal; however, all treatments significantly reduced the severity of both mildew diseases compared to nontreated plants.

## Introduction

Downy mildew, caused by the oomycete pathogen *Bremia lactucae*, usually can be found in lettuce fields each year in Arizona. However, both the incidence and severity of the disease are governed by the frequency and duration of cool moist conditions required for disease development. The first symptoms of downy mildew on lettuce are pale yellow regions on the upper side of older wrapper leaves with a corresponding white fluffy growth, which contains the spores of the pathogen, on the lower leaf surface. The infected areas are limited by leaf veins. The spores (sporangia) of the fungus are produced singly on branched tree-like structures. Affected tissue will eventually turn brown in color. Powdery mildew, caused by the fungus *Golovinomyces cichoracearum* (formerly known as *Erysiphe cichoracearum*), can develop rapidly in spring lettuce during March and April in western Arizona, as the crop nears maturity, when moderate to warm temperatures and dry environmental conditions prevail. The first signs of disease can occur as early as December or January. Successful chemical control of downy and powdery mildew requires the presence of an effective fungicide on plants before disease onset. Successive applications of fungicides are required to maintain disease control until harvest. This field trial was initiated to test the efficacy of some new fungicides not registered for use on lettuce as well as combinations of products and rotational treatment programs for management of downy and powdery mildew.

## Materials and Methods

This study was conducted at the University of Arizona Yuma Valley Agricultural Center. The soil was a silty clay loam (7-56-37 sand-silt-clay, pH 7.2, O.M. 0.7%). Lettuce 'Winterhaven' was seeded November 8, 2004 in double rows, 12 in. apart on beds with 40 in. between bed centers. 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 ft of bed, which contained two 25 ft 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 with a tractor-mounted boom sprayer that delivered 50 gal/acre at 100 psi to flat-fan nozzles spaced 12 in. apart. Foliar applications of treatments were made January 20 and February 4, 2005. Maximum and minimum ranges (°F) of air temperature were as follows: December, 2004, 58-77, 32-55; January, 2005, 58-78, 34-55; February 1 to 17, 57-74, 42-54. Maximum and minimum ranges (%) for relative humidity were as follows: December 2004, 57-100, 11-73; January 2005, 77-100, 21-84; February 1 to 17, 45-100, 20-92. Total rainfall in inches was as follows: December, 0.74; January, 0.74; February 1 to 17, 0.61. Downy mildew, caused by *Bremia lactucae*, was first observed February 7 and small colonies of powdery mildew, caused by *Erysiphe cichoracearum*, were first detected January 26. The severity of downy mildew was determined near plant maturity (February 16 and 17) by counting the number of downy mildew lesions from 10 plants in the middle of each of the five replicate plots per treatment. The severity of powdery mildew was determined February 14 and 15 by rating 10 plants in the middle of each of the five replicate plots per treatment using the following rating system: 0 = no powdery mildew present; 1 = powdery mildew present on bottom leaves of plant; 2 = powdery mildew present on bottom leaves and lower wrapper leaves; 3 = powdery mildew present on bottom leaves and all wrapper leaves; 4 = powdery mildew present on bottom leaves, wrapper leaves and cap leaf; 5 = powdery mildew present on entire head. For downy mildew, the number of lesions per plant are correlated with the number of leaves infected. As these values increase, more trimming of heads is required, resulting in yield loss. For powdery mildew, yield loss due to rejected lettuce heads would normally begin to occur on plants with a rating above 2.0.

## Results and Discussion

The data in the following table illustrate the degree of control obtained by applications of the various materials tested in this trial. Among treatments, the degree of downy and powdery mildew suppression ranged from virtually complete to minimal; however, all treatments significantly reduced the severity of both mildew diseases compared to nontreated plants. Some leaf burn was noted on plants treated with Aliette; however, phytotoxicity symptoms were not noted for any other treatments.

Fungicide resistance management, which seeks to minimize the risk of a plant pathogen population becoming resistant to one or more fungicides, is imperative for the preservation of fungicide effectiveness. Resistance management is achieved by applying mixtures of fungicides or alternating among different classes of chemistries to prevent or minimize a shift in the pathogen population toward tolerance or insensitivity to one or more disease control compounds. The availability of more chemistries with different modes of action could help in efforts to control downy and powdery mildew of lettuce and at the same time support fungicide resistance management efforts for plant disease control chemicals of importance for this crop.

**2004-2005 Downy and Powdery Mildew of Lettuce Fungicide Trial**

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Treatment	Rate (lb active ingredient per acre, unless noted as amount of product)	Treatment dates <sup>1</sup>	Downy mildew lesions per plant <sup>2</sup>	Disease rating <sup>3</sup>
<b>Untreated control</b>	-----	-----	<b>17.8</b>	<b>3.5</b>
Ranman 400SC + Maneb 75DF + Silwet L-77	0.07 + 1.13 + 2.0 fl oz prod	1,2	0.4	0.5
Maneb 75DF	1.5	1,2	1.7	1.6
Phostrol 6.69AL	2.1	1,2	2.5	1.7
PREV AM + Phostrol 6.69AL	25.6 fl oz prod + 2.1	1,2	2.5	1.7
Forum + Maneb	0.2 + 1.2	1,2	2.6	2.0
Aliette 80WDG	4.0	1,2	2.6	1.3
Phostrol 6.69AL	4.2	1,2	2.8	0.9
Forum + Penetrator Plus 0.25% v/v	0.2 + 16.0 fl oz prod	1,2	4.4	1.2
Ranman 400SC + Phostrol 6.69AL + Silwet L-77	0.07 + 2.1 + 2.0 fl oz prod	1,2	4.5	3.1
Ranman 400SC + Aliette 80WG + Silwet L-77	0.07 + 2.4 + 2.0 fl oz prod	1,2	5.6	0.9
Ranman 400SC + Alude 5.17AL + Silwet L-77	0.07 + 1.62 + 2.0 fl oz prod	1,2	5.8	3.3
Quadris 2.08SC	0.25	1,2	5.9	1.2
PREV AM + Quadris 2.08SC	25.6 fl oz prod + 0.25	1,2	6.4	1.1
Microthiol Disperss 80DF	8.0	1,2	8.4	0.3
PREV AM	25.6 fl oz prod	1,2	9.3	2.0
Quintec (250 g/l)	0.334	1,2	10.3	0.3
Forum	0.2	1,2	10.8	2.5
Ranman 400SC + Silwet L-77	0.07 + 2.0 fl oz prod	1,2	11.2	0.3
Quintec (250 g/l)	0.167	1,2	11.2	0.1
1 <sup>st</sup> Biowash	16.0 fl oz prod	1,2	11.7	3.4
PREV AM + Serenade	25.6 fl oz prod + 4.0 qt prod	1,2	11.8	2.2
Procure 50WS	0.188	1,2	12.9	0
Mimic	64.0 fl oz prod	1,2	13.1	3.1
Procure 50WS	0.25	1,2	13.1	0.1
V-10118 (0.41EC)	0.02	1,2	13.2	0.1
Serenade AS	4.0 qt prod	1,2	14.1	2.3
Sonata AS	4.0 qt prod	1,2	14.2	2.4
V-10118 (0.41EC)	0.01	1,2	15.6	0.1
Table footnotes on next page				
<b>LSD (Least Significant Statistical Difference, P=0.05)</b>			<b>1.0<sup>d</sup></b>	<b>0.15<sup>d</sup></b>

- 1 Treatment dates: 1) January 20, 2005; 2) February 4.
- 2 The severity of downy mildew caused by *Bremia lactucae* was determined near plant maturity (16-17 February) by counting the number of downy mildew lesions from 10 plants in the middle of each of the five replicate plots per treatment. Downy mildew was first observed in plots on February 7.
- 3 Disease ratings were performed February 14 and 15. The severity of powdery mildew was determined by using the following rating system:
  - 0 = No powdery mildew colonies present on plant.
  - 1 = Powdery mildew present on bottom leaves.
  - 2 = Powdery mildew present on bottom leaves and lower wrapper leaves.
  - 3 = Powdery mildew present on bottom leaves and all wrapper leaves.
  - 4 = Powdery mildew present on bottom leaves, wrapper leaves, and cap leaf.
  - 5 = Powdery mildew present on entire head.Yield loss due to rejected lettuce heads would normally begin to occur on plants with a rating greater than 2.0. Small powdery mildew colonies (2 to 3 mm in diameter) were first observed on some plants January 26.
- 4 Least Significant Statistical Difference at  $P = 0.05$ .