Field Evaluation of Potential New Fungicides for Control of Lettuce Downy and Powdery Mildew in 1994 and 1995

Michael E. Matheron and Martin Porchas

Abstract

Downy and powdery mildew are caused by the plant pathogenic fungi Bremia lactucae and Erysiphe cichoracearum, respectively. Cool and moist environmental conditions favor development of downy mildew, while warmer and dry weather is conducive for development of powdery mildew. Potential new fungicides were evaluated for control of these diseases during 1994 and 1995. In 1994, downy mildew did not occur in the test plots; however, powdery mildew was severe and was controlled most effectively by Microthiol. In the 1995 study, both downy and powdery mildew developed in the test plots. The highest level of downy mildew control was achieved with three experimental compounds, Fluazinam, Dimethomorph, and BAS-490. The most effective fungicides for control of powdery mildew in 1995 were BAS-490 and Microthiol.

Introduction

Downy mildew of lettuce, caused by *Bremia lactucae*, can cause serious losses when environmental conditions favor the disease. Development of this disease is favored by cool to mild and moist conditions. The severity of downy mildew is influenced by the duration of moist weather conditions, which encourage pathogen growth, sporulation, and infection of host leaf tissue. On the other hand, powdery mildew, caused by *Erysiphe cichoracearum*, develops on spring lettuce, when warm and dry environmental conditions predominate. Lettuce planted in November in western Arizona is subject to both downy mildew during periods of moist mild weather and to powdery mildew at crop maturity, when warm dry weather conducive to this disease may prevail.

For both downy and powdery mildew, optimum disease control is achieved by having fungicidal protection in place when environmental conditions become favorable for disease development. In an attempt to increase the number of fungicides available to growers for control of these diseases, field trials were initiated in 1994 and 1995 to test the efficacy of potential new fungicides for disease control.

Materials and methods

These trials were conducted at the Yuma Valley Agricultural Center. For the 1994 study, lettuce (Coolguard) was seeded November 2, 1993 on double rows 12 inches apart on beds 40 inches between bed centers. 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 at the 3-4 leaf stage to a 12 inch spacing on December 8, 1993. Treatment beds were separated by single nontreated beds. Fungicides were applied to the downy and powdery mildew plots on February 3 and March 2, 1994. Fungicide treatments were applied with a tractor-mounted boom sprayer that delivered 100 gallons/acre at 100 psi to nozzles spaced 12 inches apart. For the 1994 trials, maximum and minimum ranges of air temperature (F) in the downy and powdery mildew plots were as follows:

December, 1993, 61-72, 34-48; January, 1994, 60-82, 33-47; February, 59-78, 35-56; March 1-8, 66-85, 46-51. Total rainfall (in.) was as follows: December, 0.00; January, 0.01; February, 0.31, March 1-8, 0.07. Furrow irrigation was used for the duration of this trial.

For the 1995 trial, lettuce (Barnburner) was seeded November 2, 1994. Treatments were applied February 7 and 22, 1995. During the 1995 study, maximum and minimum ranges of air temperature (F) were as follows: December 1994, 58-75, 31-53; January 1995, 53-74, 36-55; February, 67-86, 42-62; March 1-9, 72-81, 45-59. Total rainfall (in.) was as follows: December, 1.77; January, 0.58; February, 0.17; March 1-9, 0.02.

The severity of downy mildew caused by *Bremia lactucae* was determined at plant maturity by rating 10 plants randomly selected from each of the five replicate plots per treatment using the following rating system: 0 = no downy mildew present; 1 = downy mildew on 1-2 wrapper leaves; 2 = downy mildew on 3-4 wrapper leaves; 3 = downy mildew on 5-6 wrapper leaves; 4 = downy mildew on more than 6 wrapper leaves; 5 = downy mildew on cap leaf. The severity of powdery mildew caused by *Erysiphe cichoracearum* was determined at plant maturity by rating 10 plants randomly selected from each of the five replicate plots per treatment using the following rating system: 0 = no powdery mildew present; 1 = some colonies of powdery mildew present, with light infection on a few leaves; 2 = moderate colonization of several leaves; 3 = heavy colonization of many leaves.

Results and Discussion

Results of the 1994 trial are presented in Table 1. This trial was initiated to evaluate fungicides of control of downy and powdery mildew of lettuce; however, no downy mildew appeared in the plots this year. Powdery mildew was quite severe and both Microthiol and Fluazinam significantly reduced the severity of powdery mildew on lettuce compared to no treatment. No phytotoxicity was evident in any plots treated with fungicides in 1994. In 1995, downy and powdery mildew both developed in our field plots. Three new fungicides, Fluazinam, Dimethomorph, and BAS-490, provided the best control of downy mildew, while BAS-490 and Microthiol effectively controlled powdery mildew of lettuce in the 1995 study (Table 2).

The fungus that causes downy mildew is very different than the fungus that causes powdery mildew, and normally a fungicide with activity against one organism will have no effect against the other pathogen. However, our study in 1995 indicates that BAS-490 has strong activity against both the downy and the powdery mildew pathogens. Also, Fluazinam shows strong activity towards the downy mildew pathogen and significant activity against the powdery mildew pathogen. Evidence of phytotoxicity in the form of occasional bronzing of the cap leaf was observed in plots treated with Fluazinam in the 1995 study.

These trials have identified some new materials that might increase the chemical disease control options for lettuce in the future. Further evaluation of potential new fungicides for control of downy and powdery mildew is planned for next year.

TABLE 1. Results of 1994 field trial to evaluate fungicides for control of powdery mildew of lettuce. Michael Matheron and Martin Porchas, Yuma Agricultural Center, University of Arizona.

Treatment	Rate of product/A	Mean powdery mildew severity rating per plant
Microthiol 80 WDG	10.0 lb.	0.1 a
ICIA-5504 25 SC	16.0 fl. oz.	1.1 b
Fluazinam 85 DG	0.3 lb.	1.5 c
Fluazinam 500 g/l	15.0 fl. oz.	1.5 c
Fluazinam 85 DG	0.6 lb.	1.5 c
Fluazinam 500 g/l	7.5 fl. oz.	1.9 d
SM-9	12.0 fl. oz.	2.0 de
Aliette 80 WDG + SM-9	1.25 lb + 12.0 fl. oz.	2.3 ef
Maneb 75 DF	2.0 lb.	2.4 f
Aliette 80 WDG	1.25 lb.	2.5 fg
Untreated control	------	2.8 g

Values followed by a different letter are significantly different according to the Duncan-Waller K-Ratio Test ($P=0.05$).

Table 2. Results of 1995 field trial to evaluate fungicides for control of downy and powdery mildew of lettuce. Michael Matheron and Martin Porchas, Yuma Agricultural Center, University of Arizona.

Treatment	Rate (ai/A)	Mean downy mildew severity rating per plant*	Mean powdery mildew severity rating per plant*
Fluazinam 500F	1.0 lb.	1.8 a	1.8 d
Fluazinam 500F	0.5 lb.	2.0 a	1.9 e
Dimethomorph 50WP	0.26 lb.	2.1 a	2.4 f
BAS-490 50WG	0.31 lb.	2.3 ab	0.1 a
Maneb 75DF	2.0 lb.	2.6 ab	2.5 f
ICIA-5504 80WG	1.0 lb.	3.0 b	0.6 bc
Aliette 80WG	2.4 lb.	3.1 b	2.1 ef
SM-9		4.4 c	1.9 e
Microthiol 80WDG	4.0 lb.	4.5 c	0.9 cd
Microthiol 80WDG	8.0 lb.	4.8 c	0.4 ab
Control	-----	4.8 c	2.5 f

* Values in each column followed by a different letter are significantly different ($P=0.05$) according to the Duncan-Waller K-Ratio Test.