

Assessment of Fungicide Performance on Control of Downy Mildew of Broccoli in 1998

Michael E. Matheron and Martin Porchas

Abstract

Peronospora parasitica is the pathogen responsible for causing downy mildew of broccoli, cabbage and cauliflower. Cool moist environmental conditions favor the development of downy mildew on these crops. Several potential new fungicides were evaluated for control of this disease on broccoli in 1998. The final severity of downy mildew in this trial was moderately high. Significant reduction in disease severity compared to nontreated plants was achieved by application of standard compounds such as Aliette, Bravo, maneb and Trilogy as well as the new fungicides Actigard, an Unknown, Curzate, Quadris, RH-7281, BAS 490, Acrobat and BAS 500. Broccoli yield was significantly increased compared to nontreated plots by treatments with Bravo, Curzate, Acrobat, BAS 500, Quadris, maneb, Actigard, BAS 490, an Unknown, RH-7281 and Aliette. The future registration and subsequent availability of one or more of these new chemistries for broccoli and related crops could help minimize the risk of development of resistance to fungicides used to manage downy mildew.

Introduction

Downy mildew of broccoli, cabbage and cauliflower, caused by the plant pathogenic fungus *Peronospora parasitica*, is commonly found in areas where these crops are grown during the winter vegetable season in Arizona. Cool damp weather with high relative humidity and air movement stimulates disease development as these conditions favor sporulation, spore dispersal and plant infection by the pathogen. Downy mildew severity increases as the duration of free moisture on plant leaves rises.

The first symptoms of downy mildew of broccoli and related crops is the appearance of grayish white fungal growth on the underside of infected leaves during cool, moist weather. Spots or lesions, at first yellow then turning brown in color, appear on both sides of the leaf where the fungal growth originally was observed. Severe infections will cause extensive necrotic areas on leaves, resulting in reduced photosynthesis and potentially reduced yield.

Successful management of downy mildew can be achieved by planting cultivars that are tolerant or resistant to the disease. If susceptible cultivars are grown, it is extremely important to have fungicidal protection in place when environmental conditions become favorable for disease development. Downy mildew of broccoli, cabbage and cauliflower can be significantly reduced by timely applications of compounds such as maneb, fosetyl-Al (Aliette) and mefenoxam (Ridomil Gold). Several new agrochemicals are in development that have activity on the pathogenic fungi that cause downy mildew. A fungicide trial was initiated during the 1997-98 vegetable season to test the potential efficacy of these new chemistries on downy mildew of broccoli.

Materials and Methods

This study was conducted at the Yuma Valley Agricultural Center. The soil was a silty clay loam (7-56-37 sand-silt-clay, pH 7.2, O.M. 0.7%). Broccoli "Greenbelt" was seeded and watered November 4, 1997 on double rows 12 inches apart on beds with 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 broccoli. Plants were spaced 6-7 inches apart and treatment beds were separated by single nontreated beds. Fungicide treatments were applied with a tractor-mounted boom sprayer (hollow-cone nozzles spaced 12 inches apart) that delivered 50 gallons/acre at 100 psi. Foliar applications of fungicides were made January 8 and 23. Maximum and minimum ranges (F) of air temperature were as follows: December 1997, 53-72, 34-51; January 1998, 62-77, 33-48; February, 63-73, 39-52. Total rainfall (inches) was as follows: December, 1.47; January, 0.04; February, 0.99. Furrow irrigation was used for the duration of this trial. The severity of downy mildew caused by *Peronospora parasitica* was determined at plant maturity (February 17-19) by recording the number of leaves per plant with at least 10 downy mildew lesions from 10 plants in each of the five replicate plots per treatment. Yield was measured at the same time by weighing 30 broccoli heads from a 10-foot length of bed in each replicate plot.

Results and Discussion

Some downy mildew was present on the oldest leaves of plants when the first application of compounds was performed on January 8. A moderately high level of disease had developed by crop maturity. Significant reduction in disease severity compared to nontreated plants was achieved by application of standard compounds such as Aliette, Bravo, maneb and Trilogy as well as the new fungicides Actigard, an Unknown, Curzate, Quadris, RH-7281, BAS 490, Acrobat and BAS 500. Broccoli yield was significantly increased compared to nontreated plots by treatments with Bravo, Curzate, Acrobat, BAS 500, Quadris, maneb, Actigard, BAS 490, an Unknown, RH-7281 and Aliette. No evidence of phytotoxicity was observed on any of the treated plots.

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 between 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 future registration and subsequent availability of some of these new chemistries for broccoli and related crops could help in the implementation of an effective fungicide resistance management program.

Table 1. 1998 Downy mildew of broccoli fungicide trial
 Michael Matheron and Martin Porchas, Yuma Agricultural Center, University of Arizona.

Treatment and rate of a.i./acre	Application dates ¹	Disease severity ²	Weight of 30 heads (lb) ³
Actigard 50WP 0.03 lb	1,2	3.8 a ⁴	25.2 a-c ⁴
Unknown 0.13 lb + Latron B-1956 0.5 pt	1,2	6.6 ab	24.8 a-c
Aliette 80WDG 4.0 lb	1,2	7.2 bc	24.0 a-d
Curzate 60WDG 0.125 lb + Aliette 80WDG 3.2 lb	1,2	7.4 b-d	25.4 a-c
Bravo WeatherStik 1.12 lb	1,2	7.6 b-e	26.8 a
Quadris 25SC 0.25 lb	1,2	7.6 b-e	25.4 a-c
RH-7281 80WP 0.31 lb + Latron CS-7 1.0 pt	1,2	7.8 b-e	24.6 a-c
Curzate 60WDG 0.125 lb + Maneb 75DF 1.5 lb	1,2	8.0 c-e	26.4 a
BAS 490 50WP 0.20 lb	1,2	8.0 c-e	24.8 a-c
Maneb 75DF 1.5 lb	1,2	8.0 c-e	25.4 a-c
Acrobat 50WP 0.2 lb + Maneb 75DF 1.5 lb	1,2	8.2 c-e	25.8 a-c
Curzate 60WDG 0.125 lb	1,2	8.2 c-e	26.0 ab
BAS500 0.20 lb	1,2	8.5 c-g	25.6 a-c
Quadris 65WG 0.25 lb	1,2	8.5 c-g	25.6 a-c
Trilogy A70G 1.4 gal	1,2	8.8 e-g	22.0 cd
BAS 505 0.20 lb	1,2	9.5 f-h	22.4 b-d
Unknown 0.16 lb + Latron B-1956 0.5 pt	1,2	9.8 gh	23.8 a-d
Nontreated control	----	10.6 h	20.4 d

1 Application dates: 1=Jan 8; 2=Jan 23, 1998.

2 Average number of leaves per plant with at least 10 downy mildew lesions from 10 plants per 25 ft long plot.

3 Average weight (lb) of 30 broccoli heads from a 10-ft length of bed in each replicate plot.

4 Values in each column followed by the same letter are not significantly different ($P=0.05$) according to Duncan's Multiple Range Test.