

Comparision of New Fungicides for Management of Downy Mildew of Broccoli in 1999

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Abstract

*Downy mildew of broccoli, cauliflower and cabbage is caused by the fungus *Peronospora parasitica*. 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 1999. 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, Ridomil Gold+maneb, maneb and Trilogy as well as nonregistered chemistries including Acrobat, Actigard, Curzate, Flint, Quadris, Serenade, Sovran, BAS 500, DPX-KP481 and RH-7281. The future registration and subsequent availability of one or more of these new chemistries for broccoli and related crops could enhance the overall level of disease control as well as help minimize the risk of development of resistance to fungicides used to manage downy mildew.*

*Keywords: Crucifers, *Peronospora parasitica*, plant protection chemicals, vegetable diseases.*

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 western Arizona. Cool damp weather with high relative humidity and air movement stimulates disease development by promoting 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 pathogen. 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 diseases. This fungicide trial was initiated 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, 1998 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 (flat-fan nozzles spaced 12 inches apart) that delivered 50 gallons/acre at 100 psi. Foliar applications of fungicides were made December 18, 1998 and January 5 and 13, 1999. Maximum and minimum ranges (°F) of air temperature were as follows: December 1998, 55-79, 31-55; January 1999, 61-77, 36-51. Total rainfall (inches) was as follows: December, 0.05; January, 0.00. 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 4) by collecting one infected leaf from each of 10 different plants per plot and recording the number of downy mildew lesions observed on those 10 leaves. All sampled leaves were of the same age. Yield was evaluated at the same time by weighing 30 broccoli heads from a 10-ft length of bed in each replicate plot.

Results and Discussion

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, Ridomil Gold+maneb, maneb and Trilogy as well as the nonregistered chemistries including Acrobat, Actigard, Curzate, Flint, Quadris, Serenade, Sovran, BAS 500, DPX-KP481 and RH-7281. Compared to nontreated plots, none of the chemical treatments increased broccoli yield or caused phytotoxicity symptoms.

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. 1999 Downy mildew of broccoli fungicide trial.
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Treatment*	Rate (lb a.i./A)	Disease severity **
Acrobat or maneb	0.22 or 1.5	22.0
Actigard	0.03	23.6
Curzate + maneb	0.187 + 1.12	24.2
DPX-KP481	0.375	28.4
Maneb	1.5	33.2
Serenade	10 lb product	33.8
Curzate	0.187	36.4
Ridomil Gold + maneb	0.5 + 1.5	38.2
BAS 500	0.2	40.2
Sovran	0.2	42.2
Acrobat	0.22	54.6
Trilogy 70G	0.35 gal	57.2
Flint	0.09	59.4
Aliette	4.0	59.4
Quadris	0.25	64.8
Quadris or maneb	0.25 or 1.5	69.4
RH-7281	0.2	70.2
Nontreated control	-----	101.2

LSD (Least Significant Difference, $P=0.05$)		10.4

* Treatment dates: Dec 18, 1998 and Jan 5 and 13, 1999. When a treatment consists of one compound or another compound, then the first compound was applied Dec 18, the second compound was applied Jan 5 and the first compound was again applied Jan 13. When a treatment consists of one compound + another compound, then both materials were applied together on each of the three treatment dates.

** The severity of downy mildew was determined at plant maturity by collecting one infected leaf from each of 10 different plants per plot and recording the number of downy mildew lesions observed on those 10 leaves.