

# Management of Downy Mildew of Broccoli in 2005

Michael E. Matheron and Martin Porchas

## *Abstract*

*Downy mildew of broccoli, cauliflower and cabbage is caused by the oomycete pathogen *Peronospora parasitica*. Cool moist environmental conditions favor the development of downy mildew on these crops. Several fungicides were evaluated individually or combined with another material (applied as a mixture or in a rotational program) for control of this disease on broccoli in the 2004-05 growing season. Several treatments provided the most efficacious degree of disease control, including Maneb, Reason+Bond alternated with Aliette, Ranman+Maneb+Silwet L-77, Ranman+Silwet L-77, Forum+Maneb, Forum+Penetrator Plus, Reason+Bond alternated with Maneb, PREV-AM +Formula 1, Ranman+Aliette+Silwet L-77, Acrobat+Maneb, Aliette and Phostrol.*

## **Introduction**

Downy mildew on broccoli, cabbage and cauliflower, caused by the oomycete pathogen *Peronospora parasitica*, appears during the winter vegetable season in southwestern 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 increases. The first symptoms of downy mildew on broccoli and related crops is the appearance of grayish white 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 growth originally was observed. Severe infections will cause extensive necrotic areas on leaves, resulting in reduced photosynthesis and potentially nonuniform maturity and reduced yield. Successful management of downy mildew can be achieved by planting cultivars that are tolerant or resistant to the pathogen and by timely application of effective fungicides on susceptible cultivars when environmental conditions become favorable for disease development. This trial was initiated to test the efficacy of registered products as well as chemistries in development, alone as well as mixed or alternated with another material, on downy mildew of broccoli.

## **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%). Broccoli 'Greenbelt' was seeded November 8, 2004 in a single row per bed with 40 inches between bed centers, then germinated with sprinkler 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, with treatment beds separated by single nontreated beds. Plants were thinned December 12 to a 12-inch spacing.

Fungicide treatments were applied with a tractor-mounted boom sprayer (nozzles spaced 12 inches apart) that delivered 50 gallons/acre at 100 psi. Foliar applications of materials were made December 21, 2004, January 11, 2005 and February 5. 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 15, 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 15, 45-100, 20-92. Total rainfall in inches was as follows: December, 0.74; January, 0.74; February 1 to 15, 0.61. Downy mildew was first observed in the plots on December 21, 2004. At crop maturity (February 15), final disease severity was determined by recording the number of leaves from each of 10 plants per replicate plot that contained downy mildew lesions.

## **Results and Discussion**

A moderate level of disease had developed by crop maturity. All treatments provided a significant level of disease control compared to untreated plants, as shown in the data table. Several treatments provided the most efficacious degree of disease control, including Maneb, Reason+Bond alternated with Aliette, Ranman+Maneb+Silwet L-77, Ranman+Silwet L-77, Forum+Maneb, Forum+Penetrator Plus, Reason+Bond alternated with Maneb, PREV AM+Formula 1, Ranman+Aliette+Silwet L-77, Acrobat+Maneb, Aliette and Phostrol.

## 2004-2005 Downy Mildew of Broccoli Fungicide Trial

Mike Matheron and Martin Porchas, The University of Arizona, Yuma Agricultural Center, Yuma, AZ

Treatment	Rate (lb active ingredient per acre, unless noted as amount of product )	Treatment dates <sup>1</sup>	Number of diseased leaves <sup>2</sup>
<b>Untreated control</b>	-----	-----	<b>2.6</b>
Maneb 75DF	1.5	1,2,3	1.0
Reason + Bond	0.27 + 6.4 fl oz prod	1,3	
alternated with Aliette 80WDG	4.0	2	1.0
Ranman 400SC + Maneb 75DF	0.07 + 1.13		
+ Silwet L-77	+ 2.0 fl oz prod	1,2,3	1.0
Ranman 400SC + Silwet L-77	0.07 + 2.0 fl oz prod	1,2,3	1.1
Forum 500SC + Maneb 75DF	0.2 + 1.5	1,2,3	1.1
Forum 500SC + Penetrator Plus	0.2 + 2.0 pt	1,2,3	1.1
Reason + Bond	0.27 + 6.4 fl oz prod	1,3	
alternated with Maneb 75DF	1.5	2	1.1
PREV AM (0.4% v/v)	25.6 fl oz prod		
+ Formula 1	+ 4.0 pt prod	1,2,3	1.1
Ranman 400SC + Aliette 80WDG	0.07 + 2.4		
+ Silwet L-77	+ 2.0 fl oz prod	1,2,3	1.2
Acrobat 50WP + Maneb 75DF	0.2 + 1.5	1,2,3	1.2
Aliette 80WDG	4.0	1,2,3	1.3
Phostrol	4.2	1,2,3	1.3
Ranman 400SC + Formula 1	0.07 + 4.0 pt prod		
+ Silwet L-77	+ 2.0 fl oz prod	1,2,3	1.5
Ranman 400SC + Phostrol 6.69AL	0.07 + 2.1		
+ Silwet L-77	+ 2.0 fl oz prod	1,2,3	1.5
Mimic	64 fl oz prod	1,2,3	1.8
Formula 1	4.0 pt prod	1,2,3	2.0
Serenade AS	4.0 qt	1,2,3	2.1
Sonata AS	4.0 qt	1,2,3	2.1
1 <sup>st</sup> Biowash	12.5 fl oz prod	1,2,3	2.2
<b>LSD (Least Significant Statistical Difference, P=0.05)</b>			<b>0.15</b> <sup>3</sup>

1 Treatment dates: 1) = December 21, 2004; 2) = January 11, 2005; 3) = February 5.

2 Mean number of leaves per plant per replicate plot with downy mildew lesions.

3 Least Significant Difference at  $P=0.05$ .