Controlling Downy Mildew in Vineyards

Dr. David Gadoury, plant pathologist from Cornell University gave a very focused talk on downy mildew in the grape session of the Mid-Atlantic Fruit and Vegetable Convention in Hershey this week. His goal was to highlight what is working well, and where there is room for improvement.

Here are my notes on his presentation:

What works well are the crop protection chemicals that are available for DM and the current knowledge of the biology of the organism that informs the deployment of fungicides. Constraints include a high value crop with often little tolerance of the disease, markets that often require cultivation of more susceptible varieties and a growing environment that is well suited to the pathogen.

Fungicides are a necessary tool in wine growing under these conditions. Forecasting models are driven by weather inputs that provide real time estimates of infection periods. So far no model has proven to have a great advantage over the others. Models rely on the availability of data logger instrumentation, weather networks (e.g., NEWA), and private services such as SkyBits. Free services have so far has not been widely distributed in Eastern grape growing areas.

Overwintering oospores cause the season's first infections in the spring. Their availability is now better understood and accounted for in control strategies. Oospores are found on the soil surface where they germinate during spring rains and release swimming zoospores (a bit like microscopoic tadpoles which swim to the plants stomata and infect by entry there) that are splashed onto green tissue causing the first lesions in the spring. These lesions on leaves will, after about 5 to 7 days, produce secondary spores that will help to spread the disease. Also better understood is the ontogenic resistance of grape berries to DM. Berries are nearly immune to infection about 3 weeks after the completion of bloom when the functional stomata on the berries are converted to closed lenticels.

From 1981 to 2007 the first symptoms of DM were noted on Chancellor vines, a very sensitive indicator variety for this disease. There were three events that were consistently associated with the first appearance of symptoms of DM: 1) vine growth had reached Eichorn and Lorenz growth stage 12, 2) this stage was then followed by a rain event greater than or equal to 0.1 inches, and 3) temperature during rain of at least 52F. In 25 of 26 years when these conditions had occurred, symptoms of downy mildew were observed 4 to 6 days later (after the latent period had elapsed).

One question is why is the vine not infected before these conditions arrive. There is no resistance to DM in young shoots that prevents them beng infected. More likely it is related to the timing of maturation of overwintering spores. The spores are just waiting for the right conditions to arrive, and these conditions are not realized until 2 to 3 weeks after bud break.

The fruit is also waiting for the right conditions. The duration of bloom starts the clock for the development of resistance in the fruit. Warmer winter climates display longer and more uneven bloom periods (up to 2 weeks for a single variety), but in the northeastern US bloom occurs rapidly and synchronously (e.g., Chardonannay usually progresses from 10% to 90% bloom in 2 days in NY). Protracted cold winter temperatures synchronize and stablilize bud growth. Once berries are three weeks old ontogenic resistance has fully developed and fruit cannot be infected. Stomata are converted to lenticels.

The longevity of foliar lesions is dependent of the number of cycles of sporulation. Infections sporulate four to six times before they burn out. It is possible for DM to sporulate but not produce new lesions, and this commonly occurs on nights with dew that are follwed by fair weather days; especially if daytime temperatures are high. Existing mortality models indicate that new spores can remain viable over a period of four to eight hours after they are produced during the night when this is followed by a clear day. On overcast, cool and humid days spores can survive 24 hours and carry to the next night to continue infections if condition are favorable (generally rain is required for substantial disease increase). Sporulation only happens at night and results in a crop of spores at dawn. If it's a clear day they die in a few hours. If it's overcast they live to following night. If rain falls they can infect almost immediately (i.e., within 2 hrs).

DM is still a challenge to control with fungicides. Resistance, to metalaxyl is a problem, and resistance to strobilurins continues to threaten. The spectrum of activity of some materials like copper and phosphorus acids is very narrow (DM only really) and the minimum pre-harvest interval can be limiting with materials such as mancozeb. They can also be phytotoxic in come mixes, and copper is known to reduce activity of some DMI fungicides in tax mixes, thereby reducing their efficacy against powdery mildew and black rot.

Varieties with broad-spectrum resistance (DM, PM, and BR) can planted where practical. Cayuga White is a notable white variety that makes a fruit white wine with some similarities to Riesling and is somewhat resistant to DM, and has superior resistance to powdery mildew and black rot. Control of DM on late season varieties like red vinifera varieties is made easier by excellent control in the early season to lessen problems developing later.

After sustained infection period are their better reach back fungicides? Presence of a material may not be enough. Ridomil has erradicant properties but is very prone to resistance, and eradicant use may promote resistance development. In post-infection situations try to balance avoiding resistance with the judicious use of other materials. Phosphorus acid products are a better choice for this use than Ridomil with respect to resistance management. Mancozeb and captan have no significant post infection activity. Strobies not effective as eradicant materials on DM. In many cases, pesticide labels may prevent such use, and proscribe only protectant applications.

You can find much information about downy mildew and disease control on grapes at www.nysipm.cornell.edu/

Note: The governor has eliminated NY IPM from the state's budget. If you are reading this and live in NY, please find out how you can support the reinstatement of this essential grape program.

Editor's note: I would like to thank Dr. Gadoury for reviewing this article and making significant changes and improvements to its content and accuracy, and on very short notice.

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