



## **Downy Mildew: Unseasonable Wet Weather - a Recipe for Problems**

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Downy mildew (*Plasmopara viticola*) is a major disease in humid grape-growing areas of the world, but it has rarely been a problem in California vineyards. In Tulare County, the first documented finding of downy mildew occurred the spring of 1995, a record breaking wet spring that provided ideal conditions for the development of the disease. Last May it resurfaced in a few Ruby Seedless vineyards.

The fungus survives the winter mainly as oospores in fallen leaves, and the pathogen is dispersed by splashing rains and wind in the spring. A wet winter followed by late spring rains provide ideal conditions for disease development. During April and May, growers should closely monitor vineyards, particularly vineyards with a history of downy mildew and Ruby Seedless and Christmas Rose vineyards, which are very susceptible to the disease.

In 1997, downy mildew was first observed in a Ruby Seedless vineyard near Farmersville around Memorial Day. Reports of downy mildew in other vineyards in the same area of the county soon followed. It was most commonly found on Christmas Rose and Ruby Seedless, two varieties that are apparently very susceptible to the disease, and significant crop loss occurred in several of these vineyards. Low levels of the disease (an occasional shoot tip, leaf, or flower cluster) were also found on Red Globe, Crimson Seedless, and Fantasy Seedless.

Last year downy mildew showed up in a few Ruby Seedless vineyards in the Cutler-Orosi area in early May. Infections were severe enough to require immediate application of curative fungicides to avoid crop loss. In 1998, downy mildew could be found in vineyards throughout Tulare County.

There are a number of fungicides registered which can control downy mildew on grapes. Copper compounds, Ziram, Mancozeb, Maneb, and Captan are preventative fungicides and must be applied before an infection period begins (rainy/windy weather from mid April through bloom). Ridomil Gold Copper and Abound also perform best as preventative fungicides; however, they have curative activity as well and can provide post-infection control. Note: Abound is a broad spectrum fungicide (downy mildew, powdery mildew, phomopsis); Ziram, Mancozeb, Maneb, and Captan also provide protection against both downy mildew and phomopsis; Mancozeb, Maneb and Captan have been restricted by some raisin processors, wineries, and table grape markets.

What does the disease look like? The first obvious symptoms are yellowish green spots on the upper surfaces of leaves. After warm humid nights, white downy growth appears on the underside of the leaf within the borders of the spots. When young shoots, petioles, tendrils, or cluster stems are infected, they become

distorted, thickened or curled. In warm humid weather, they may be covered with white downy growth. Affected tissues soon turn brown and wither from the vine. Berries are susceptible to infection until they are pea-size (4 to 5 mm diameter). Mature berries are resistant to infection.

Downy mildew is very different from powdery mildew. Downy mildew is a true water mold or algal fungi, classified as a phycomyce, and it must have wet, humid conditions to develop and spread. Powdery mildew is not dependent on rainfall and high humidity to develop. Temperature plays the largest role in the development of powdery mildew, classified as an ascomycete, with optimum temperatures for germination and mycelial growth between 70° F to 86°F.

## Disease Cycle

The following description of the disease cycle was provided by the New York State Agricultural Experiment Station, Geneva, New York (Disease Identification Sheet No. 5). The fungus overwinters as tiny oospores in leaf debris on the vineyard floor. In the spring, the oospores germinate in water to form sporangia. The sporangia liberate small swimming spores,

called zoospores, if standing water is present.

The zoospores are disseminated by rain splash to grape tissues where they swim to the vicinity of stomata and encyst. Encysted zoospores infect grape tissues by forming germ tubes that enter stomata and from there invade inner tissues of the plant. At night during periods of high humidity and temperatures above 13° C (55° F), the fungus sporulates by forming sporangia on numerous branched structures, called sporangiophores, that protrude out through stomata. Sporulation only occurs on plant surfaces that contain stomata, such as the undersides of leaves, and it gives the surface of the lesions its white, downy appearance. Sporangia are disseminated by wind or rain splash to other susceptible tissue. There they liberate zoospores into water films formed by rain or dew and these zoospores initiate secondary infections. Infections can occur in as little as 2 hours of wetting at 25° C (77° F) or up to 9 hours at 6°C (43°F). Infections are usually visible as lesions in about 7 to 12 days, depending on temperature and humidity. The number of secondary infection cycles depends on the frequency of suitable wetting periods that occur during the growing season and the presence of susceptible grape tissue (see Figure).

