New Research Findings on the Control of Grapevine Powdery Mildew

W. D. Gubler, K. Rigert, and V. Canez

Because of the apparent non-effectiveness of Bayleton to control powdery mildew on grapevine in 1985 and 1986, research was initiated to investigate the problem. Isolate of Uncinula necator were collected from problem vineyards in several grape-production areas and were used in greenhouse and laboratory tests to study factors involved in disease control and Bayleton use.

The following information summarizes results of our research conducted over the past 15 months.

Protectant Activity of Bayleton

Initial tests were established using 7 isolates collected in the fall of 1985 to investigate the efficacy of Bayleton when used as a protective spray only. Bayleton was applied to leaves at 2, 4, 6 or 8 oz/A in the equivalent of 200 gal/A. After 24 hours, leaves were inoculated with the various isolates. Ten days following inoculation, leaves were rated for presence of powdery mildew infection (colonies).

Results of these tests showed that all isolates were prevented from causing infection when Bayleton was used as a protectant spray. Non-treated control leaves were 70-90 percent covered with powdery mildew. These results indicated that if Bayleton was applied before infection took place, excellent disease control would be attained, even at the 2 oz rate.

Repeated Inoculum Pressure

This test was established to determine if constant or repeated inoculum pressure would overwhelm the protectant activity of Bayleton. Results of these studies showed that at the 0.5 oz and 1 oz rates of Bayleton, minimal infection did take place. Using the 0.5 oz rate allowed infection to occur in the initial inoculation but disease did not increase with subsequent inoculations. At the 1 oz rate symptoms were expressed following the 2nd and 3rd inoculation. No disease developed when leaves treated with 2 oz of Bayleton were subjected to four inoculations. These results suggested that Bayleton at extremely low rates could be ineffective as a protectant against U. necator. However, the 0.5 and 1.0 oz rates are artificially low and below recommended rates.

Eradicant Properties of Bayleton

Preliminary tests showed that Bayleton application 1 or 2 days after inoculation effectively controlled powdery mildew. Further tests were established to determine disease pressure when Bayleton was applied at 4 oz/A (200 gal water/A) at 3, 5, 7 and 10 days after inoculation. Application of Bayleton 3 days after inoculation, effectively arrested growth and infection. Ten days after Bayleton application only 2 of 10 leaves showed mildew colonies. However, a second reading 10 days later showed these colonies to be dead. When Bayleton was applied 5 days after inoculation disease incidence increased but some colony death occurred between the first and second ratings.

Disease incidence was further increased when Bayleton was applied 7 days after inoculation and application 10 days after inoculation resulted in only slightly less disease than was observed in the non-sprayed control. Though it is probably futile to talk about "kickback activity" with a pathogen such as U. necator, these results showed that control of powdery mildew can be achieved if Bayleton application is made within 3-4 days after the spore lands on the leaf. However, in a vineyard with high inoculum density, spread of spores is probably occurring continuously and control would be dependent upon early control and a stringent spray schedule.

Spray Application Interval

These tests were conducted in order to determine the maximum Bayleton spray interval using 2, 4, and 8 oz/A product. Bayleton was applied to detached leaves and seedling plants. Beginning 2 days after treatment and thereafter at 2 day intervals, up to 30 days leaves and seedlings were inoculated. Results of these tests revealed that, at the 2 oz rate the maximum spray interval was 12 days. When the rate was increased to 4 oz, the maximum interval between sprays fell between 14 and 17 days and at 8 oz, the interval could be stretched to 19-20 days. These results become extremely important especially when results of the eradication tests are considered. A stretched interval for any given rate would allow the pathogen to become established prior to the next application of fungicide. Should the interval be stretched 5 days or longer after fungicide decay, the pathogen would be allowed to infect and colonize before the next application and eradication test results show that it is not possible to kill all colonies in this situation. With each stretched interval occurrence thereafter, inoculum pressure increases resulting in increased disease incidence.

Resistance (Decreased Sensitivity)

Because we were unable to show resistance to Bayleton at 2, 4, 6, and 8 oz/A tests were initiated to explore the possibility of decreased sensitivity among California U. necator isolates.

Isolates were exposed to Bayleton concentrations ranging from 1 to 15 ppm on detached leaves. Seven to 10 days after inoculation, leaves were rated for percent leaf area infected. ED_{95} values (effective dose = amount of material required to protect against 95% infection) were calculated and are presented in Table 1. Results from these tests clearly show a variation in isolates with respect to their sensitivity to Bayleton concentrations. The range in sensitivity indicates one of two things: 1) that what we are finding is nothing more than a normal variation in sensitivity to Bayleton among the U. necator population in California or 2) that we have identified a significant shift in sensitivity to Bayleton in the California population. We suspect the latter. In either case the occurrence of this variation could certainly be partially responsible for the decreased disease control observed with Bayleton the past 2 years.

Conclusions

Bayleton is still an effective fungicide against powdery mildew in most locations. Use of Bayleton at 2-8 oz/A in a protection control program should result in disease control. However, the material must be applied prior to any

disease incidence and the interval should be no longer than 10-17 days depending upon rates.

Bayleton should not be used in an eradicant control program.

The occurrence of insensitivity to Bayleton in the California powdery mildew population is real. We are as yet uncertain how this will affect disease control or if the same variation will be seen on the new forthcoming, closely related fungicides. Research in this area is continuing.

Bayleton ED_{95} values for 17 U. necator isolates from California.

U. necator isolates from vineyards where Bayleton was used in 1986.

Isolate	Source	ED_{95} (s.e.)	(# Tests)
206-1 2 oz	Kern County	19.5 ppm a.i. ( )	(1)
243-4 1 oz	Santa Barbara County	15.3 ppm a.i. (4.4)	(2)
M1	Tulare County	14.8 ppm a.i. (3.6)	(3)
BBRR	Napa County	14.4 ppm a.i. (3.1)	(3)
225-5	Fresno County	11.4 ppm a.i. (3.4)	(3)
225-3 2 oz	Fresno County	11.4 ppm a.i. (3.2)	(3)
206-3 1 oz	Kern County	10.6 ppm a.i. (2.0)	(4)
243-3 4 oz	Santa Barbara County	9.4 ppm a.i. (0.6)	(2)
234	Kern County	7.7 ppm a.i. ( )	(1)
BBRRss	Napa County	7.1 ppm a.i. (2.1)	(3)
243-1 1 oz	Santa Barbara County	5.6 ppm a.i. (2.1)	(2)
	Mean	11.4 ppm a.i. (1.0)	(27)

U. necator isolates from vineyards where Bayleton was not used in 1986.

Isolate	Source	ED_{95} (s.e.)	(# Tests)
291-5	Sonoma County	15.3 ppm a.i. (3.9)	(3)
312	Sonoma County	9.0 ppm a.i. (3.2)	(3)
314	Sonoma County	7.5 ppm a.i. (0.9)	(2)
313	Sonoma County	7.2 ppm a.i. (0.3)	(2)
316	Sonoma County	6.6 ppm a.i. (2.3)	(2)
300	Yolo County	5.6 ppm a.i. (0.1)	(2)
	Mean	9.0 ppm a.i. (1.3)	(14)

Population mean 10.6 ppm a.i. (0.8) (41)