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BLACK ROT OF GRAPE: Overwintering Inoculum and Practices for Managing the Disease

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Black rot is a potentially serious disease for all cultivars of grapes that are grown in the northeastern United States. The disease is caused by the fungus *Guignardia bidwellii*. The fungus infects green berries, which later shrivel into hard black mummies, and it causes circular or oval brown spots (lesions) on leaves, petioles, and shoots. Research during the last three years has revealed that the major sources of inoculum for initiating black rot during the spring are black rot-infected mummies that overwintered on the ground or within the canopy and lesions on overwintered canes. This report summarizes the patterns of spore release from overwintered canes and mummies, and discusses strategies for reducing the inoculum from those sources.

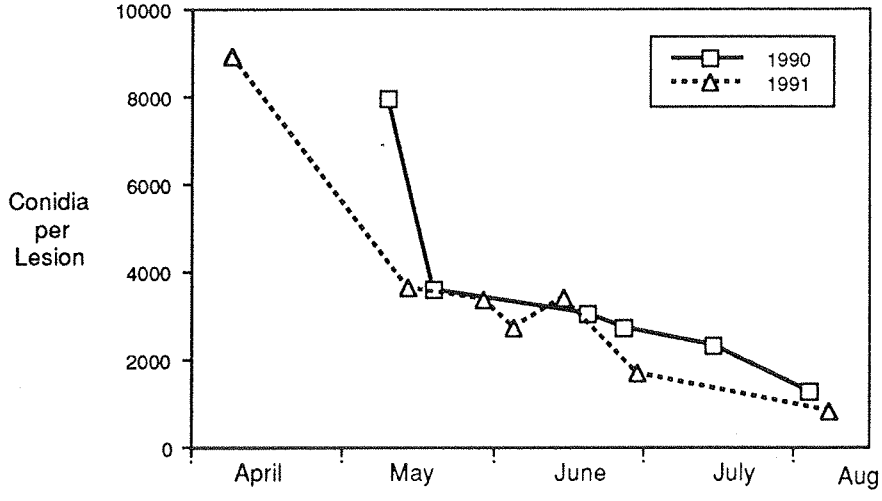

Figure 1. Number of conidia per black rot lesion on overwintered canes of Aurore grapevines at Dresden, NY.

Inoculum from black rot lesions on overwintered canes and mummies:

During 1990 and 1991, one-year-old black rot lesions were removed from Aurore canes and soaked in water for two hours to quantify the availability of spores (conidia). During both years, greater than 8,000 conidia per lesion were detected at budbreak, and approximately 800 conidia per lesion were detected at harvest (Figure 1). To verify that conidia from cane lesions were viable, bundles of overwintered Aurore or Delaware canes with black rot lesions were suspended above healthy Concord vines before budbreak. There were approximately 25 canes per bundle. At harvest, the incidence and severity of black rot on the clusters beneath the canes were evaluated. For both incidence and severity of infection, black rot on clusters beneath bundles of one-year-old canes was significantly greater than that on clusters of vines with no bundles (controls) (Table 1). Beneath two-year-old bundles the amount of black rot on the clusters was not significantly different from the controls during 1991 (a dry year), but there was significantly more black rot during 1992 (a wet year). Three-year-old canes with lesions were included only in 1992, and beneath those bundles the amount of black rot was not significantly different from the control vines.

During 1991 and 1992, the availability of inoculum was determined from mummies collected from budbreak until harvest. Mummies were collected from the ground and from the canopy and were soaked in water for two hours to

Table 1. Development of black rot on grape clusters growing beneath bundles of canes bearing black rot lesions, at Fredonia, NY.

		Year Clusters Scored for Black Rot					
		1990[1]		1991[2]		1992[3]	
Cultivar of canes	Year Bundles Collected	Incidence (%)	Severity (% Area)	Incidence (%)	Severity (% Area)	Incidence (%)	Severity (% Area)
Aurore	1990	56 a[4]	6.5 a	1 b	0.0 b	12 c	1 c
Aurore	1991	ND[5]	ND	72 a	7.1 a	48 b	10 b
Aurore	1992	ND	ND	ND	ND	51 b	8 b
Delaware	1992	ND	ND	ND	ND	89 a	33 a
Control		2 b	0.1 b	0 b	0.0 b	9 c	1 c

[1]Data are means of observations from 2 August, 14 September, and 1 October, 1990.
[2]Data collected on 24 July 1991.
[3]Data collected on 5 August, 1992.
[4]Numbers within a column which are followed by the same letter do not differ significantly at P = 0.05 according to the Waller-Duncan T-test.
[5]No data collected.

determine the numbers of conidia (asexual spores) and ascospores (sexual spores) that were available for discharge. From mummies that overwintered on the ground, ascospores were released from one to three weeks after budbreak until approximately one month after bloom or until veraison, depending on cultivar and location (Figure 2.) For mummies that had overwintered within the canopy of the grapevine, there was a delay in initial ascospore release, as well as a protracted release period extending beyond harvest. In addition, few conidia were detected from mummies that had overwintered on the ground, while very high numbers of conidia were detected throughout most of the growing season from mummies that had overwintered in the canopy.

The observance of inoculum from overwintered lesions on canes, in addition to mummies, is important to many New York growers because commercial vineyards with particularly severe outbreaks of black rot are often those that have been pruned mechanically. Nonselective machine pruning does not remove infected canes or

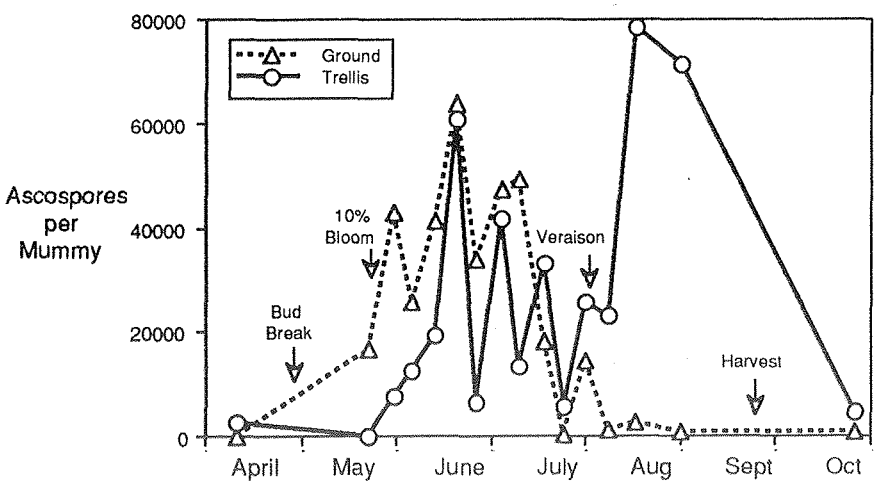

Figure 2. Release of ascospores from overwintered black rot mummies collected on or beneath Niagara grapevines at Varick, NY.

mummies that commonly remain in the canopy following mechanical harvest.

The type of training/pruning system also influences the severity of black rot in the absence of mummies. The significance of this was demonstrated by experiments at the Vineyard Laboratory at Fredonia, NY, in which the development of black rot was studied on Concord clusters grown under three training/pruning systems. In the absence of fungicides, the incidence of black rot on clusters within a hedged canopy was significantly greater than that within hand-pruned, top-wire-cordon or Umbrella-Kniffen systems (Table 2).

Managing Black Rot:

Successful management of black rot is typically dependent upon multiple applications of effective fungicides such as Carbamate (ferbam), any formulation of mancozeb, Nova (myclobutanil), or Bayleton (triadimefon). In addition, sanitation practices that remove cane lesions and mummies during dormant pruning will reduce the need for fungicides and the ultimate severity of the disease the following season.

Conidia ooze from cane lesions during rainy periods and are dispersed short distances within the canopy by rainsplash; so, while removing the canes from the vineyard is optimal, leaving them on the vineyard floor will at least remove the inoculum from the canopy. Since a mummy may contain five to twenty times more spores than an individual cane lesion, mummy removal is perhaps the single best sanitation practice for reducing the severity of black rot. Ascospores within mummies are forcibly discharged into the air during rainy periods and may be carried in air currents. In trials in commercial vineyards during 1991 and 1992, black rot mummies in the canopy were pruned out in winter and dropped to the ground. In the absence of fungicides, the removal of the mummies from the canopy area reduced the severity of black rot on clusters by 60 percent in 1991 (a dry year), and by 10 percent in 1992 (a wet year), compared to plots where mummies remained

Table 2. Effect of training/pruning system and fungicide program on black rot incidence and severity in clusters of Concord grapevines at Fredonia, NY.

Pruning System	Seasonal Fungicides	Black Rot on Clusters 1990[1] Incidence (%)	1990[1] Severity (% Area)	1992[1] Incidence (%)	1992[1] Severity (% Area)
Topwire Cordon–hand pruned	No	0.0 b[2]	0.0 a	3.2 b	0.5 ab
Umbrella Kniffen–hand pruned	No	0.5 b	0.2 a	2.9 b	0.4 b
Mechanically Hedged	No	2.5 a	0.2 a	5.5 a	0.7 a
Topwire Cordon–hand pruned	Yes	0.0 b	0.0 b	0.0 c	0.0 c
Umbrella Kniffen–hand pruned	Yes	0.0 b	0.0 b	0.0 c	0.0 c
Mechanically Hedged	Yes	0.2 b	0.0 b	0.0 c	0.0 c

[1]Data collected from 50 clusters per vine, 4 vines per replication, 4 replications per treatment, 16 Sept 1990 and 9 Sept 1992.
[2]Numbers within a column which are followed by the same letters do not differ significantly at P = 0.05 according to the Waller-Duncan T-test

within the canopy. Removal of the mummies from the vineyard and destroying them would have theoretically further reduced the amount of initial inoculum and subsequent disease. Growers should try to remove mummies from the canopy prior to budbreak and be prepared to apply effective fungicides shortly after the beginning of growth. In addition, cultivation can help reduce the overwintered inoculum by burying a portion of the pruned-out canes and mummies.

Summary:

The sources of overwintering inoculum are more numerous and their contribution to black rot development are more significant than previously thought. Lesions on overwintered canes may supply conidia beginning at budbreak. In addition, mummies on the ground may release high numbers of ascospores, especially from about three weeks after budbreak until just after bloom, or until harvest when mummies remain within the canopy region. Sanitation practices, cultivation, and choice of pruning/training systems can help reduce the ultimate severity of black rot. These factors, combined with effective fungicide programs, should allow growers to successfully manage black rot. ■

For further information and color photographs of black rot, see:

Grape IPM Disease Identification Sheet #4

Available from:

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WINE AND HEALTH: The Grape-Resveratrol Connection

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It is a scientifically established fact that people who consume moderate amounts of alcohol have a significantly lower probability of developing heart disease than abstainers. Although a scientist, I need not invoke complex statistics to describe the fact that almost twice as many teetotalers will die of heart disease than will moderate drinkers. In the case of alcohol, however, if a little is good, a lot is NOT better for you. The dangers of alcohol abuse are real and well known, and death rates from many causes increase whenever the moderate consumption level is exceeded. The key question always asked is, "What is moderate consumption?" The answer is not simple. The simplistic response is three to four glasses per day, but if someone visits your winery and drinks three to four glasses and drives away, it is probably abuse.

I recently had the great pleasure of being invited to Northern Italy for nine feasts in five days. At least four wines were served at each meal. I never saw a single person even mildly affected by the alcohol consumed. However, this is not a contradiction. Moderate consumption in spite of the abundance of wines is the result of partially filled glasses accompanied by a large variety of foods served over a long period of time. The American mental position is more likely to be: "That's four glasses per day; but it's Saturday night, so that's 4 times 7 = 28 glasses to catch up." Most Americans do not treat wine drinking like the Europeans do. There is a need to educate Americans in enjoying wine healthfully and in moderation.

Some evidence already suggests that wine is better than other liquids containing alcohol. For example, some national groups consume alcohol and have high heart disease rates. Instead of wines, the Irish drink whiskey and Germans drink beer, and data indicate that these nationals have expected high incidences of heart disease. Death rates from heart disease in one study ranged from two to three per year per 1000 men (age 55–64) for France, Italy and Switzerland, to nine to ten for the United States, Scotland and Finland. Wine consumption was 50 liters/capita/year for the first group of countries and only four for the second. Problems in establishing a unique, beneficial wine effect include many differences in diet and life style.

The television program "60-Minutes" presented a segment called the "French Paradox," which suggested several possible factors for observed low heart disease rates in Southern France. Although there were six reasons given equal status, only red wine was remembered by viewers. This was the trigger that ignited red wine sales, which increased 44 percent the following month in the United States, and which were still 30 percent higher the second month. My observation, however, was that the increase in sales was not by consumers who would normally drink red wine, and the new market was frequently in "pop wines".

Although the statistical evidence for decreased heart disease is overwhelming, there is very limited research on why this is true. A scientific basis for the association between red wine consumption and reduced heart disease is greatly needed. Our research happened to fall into this void at just the right time.

Plant scientists have been working on the anti-fungal compound resveratrol for many years. Some research groups have been working to identify new grape cultivars resistant to disease. In our laboratory we have been trying to reduce pesticide use on existing varieties by exploiting natural grape disease resistance based on resveratrol, which is found in grapevine tissues. In 1986, we changed research emphasis from leaf to fruit diseases and later found significant levels or resveratrol in our experimental wines. We hoped to use the resveratrol content of wine as a measure of the amount of disease on a variety, in a given year, and from a specific location. We started analyzing commercial wines because the information on variety, years and location is noted on the labels. Unfortunately but interestingly, this turned out to be untrue; that is, resveratrol content in wine was determined only by the grapes. Wine is truly a product of its maker as well as of its grapes.

It was soon evident that some commercial wines contained unexpectedly high amounts of resveratrol. Not knowing if it was good for us, we searched the medical literature for mammalian toxicity studies involving this compound. We found that resveratrol had already been identified as an active ingredient of a traditional oriental medicine, Kojo kon. This dried root is used in the treatment of hyperlipemia, atherosclerosis, hypersensitivity, as well as for athlete's foot (it is, after all, anti-fungal). Purified resveratrol was shown to reduce cholesterol and fat deposition in the liver and reduce platelet aggregation in animal studies. We were happy that resveratrol was apparently good for us and in something we enjoyed. We later found a published clinical study from a Bordeaux hospital that concluded that red, but not white, wine influenced human serum chemistry in ways that we thought were similar to the published effects of resveratrol in animals. The two reports seemed to fit nicely together, one using a purified resveratrol and the other, wines.

Our research has shown that red wines are usually much higher in resveratrol than are white wines because resveratrol is produced in the skin and seeds which are usually removed before the fermentation of white wines. We analyzed red and white "Bordeaux" and found the red highest in resveratrol to that date, while the whites contained essentially no resveratrol. The Bordeaux clinical study did not define the cause of the red wine effect; yet, the wines could not have been better picked (however incidentally) to test the effect of resveratrol on blood serum chemistry.

We spent most of our research time investigating why some wines are higher in resveratrol concentration than others. So far, we have defined several reasons for the variation. Wine making techniques are clearly one reason. The most obvious is the difference in skin contact between the making of red and white wines; white wines produced with skin contact are not inherently low in resveratrol. A California winery supplied experimental wines made by varying skin contact time, and this proved to be an important factor. Harvest date is a variable because disease pressure affects resveratrol production. A major factor is the variety's ability to produce resveratrol. We found Cabernet Sauvignon to be a variety which results in high resveratrol wines. Some muscadine wines were the equal of French Bordeaux in resveratrol production, and recent analysis of wine made from Nebbiolo have been equally high. A disease-resistant white grape that we tested in the leaf-disease program was capable of making 25 times more resveratrol than many traditional wine varieties. We are trying to produce enough fruit of this variety to test resveratrol concentration in its juice and wine.

The publicity which followed the wine research led to many letters from people who didn't care for wine and wondered about grapes and juice. Our inquiries at Welch's resulted in greatly needed financial aid and valuable juice samples collected at four processing locations in four states. The results of our study on grape juice expanded the national attention on this topic, as measured by increasing numbers of magazine and newspaper articles. Grape juice is a popular beverage for abstainers and the youth market, and our own experimental juice has concentrations of resveratrol equal to those of French Bordeaux wines.

Based on numerous inquiries from various sectors, our research extended to other grape products. We are now analyzing raisins, table grapes and dealcoholized wines. Recently, we have had requests for determining resveratrol content in other foods. We are participating in a Canadian clinical study similar to the French Bordeaux study, but expanded to include grape juice. In this case, Canadian wines as well as grape juice of known resveratrol content will be served to participants.

I receive many letters asking what wine to drink for health reasons. I always reply that wine is not medicine: wine is food, and good wine is good food. For everyone, a health benefit can be an additional reason to enjoy grape products, such as juice and raisins. ■

FROM THE EDITOR

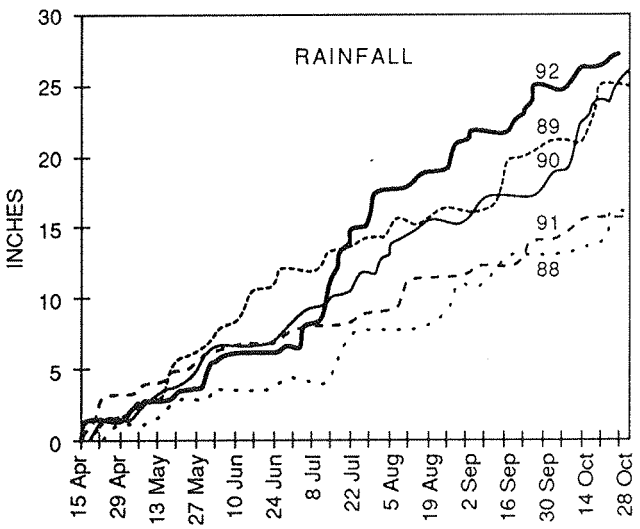
Martin Goffinet

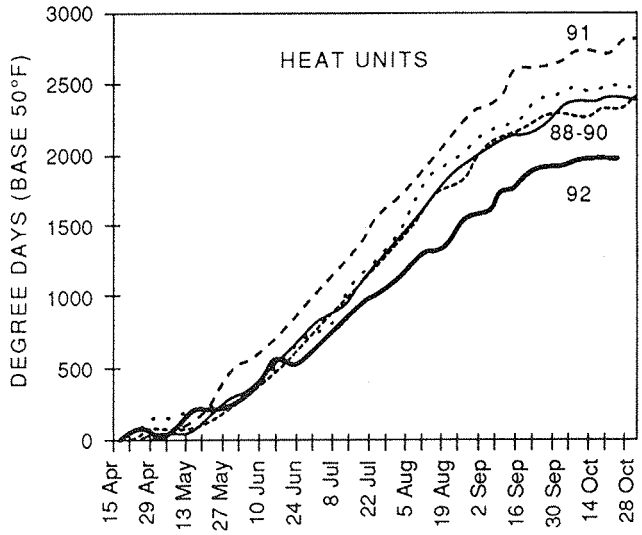
As this issue goes to press, the weather is as wet and cool as the entire summer and fall has been. Remember the summer and fall of 1991? A real difference from this year! How about the drought year 1988; was it hotter or drier than 1991? How do these years differ from the more typical years of 1989 and 1990?

Just to let you know how New York weather can change from year to year (but that's no real secret), take a look at the two graphs that accompany this editorial. The first plot is inches of precipitation at the Geneva weather station from April 15 to near the end of October for years 1988–1992. The second plot shows the accumulation of heat units as degree days during the same period at Geneva. Rainfall in 1988 was certainly low, a real drought, followed closely by last year's precipitation. The heavy line shows 1992 by comparison. Note that precipitation through early July was "normal", or even slightly below that of most other years. The real water problems came in later July to early August, a period in which Geneva got 10 inches of rain. From mid to late August, rain in the Geneva area continued at a brisk rate of about one inch per week, right into harvest and beyond.

The number of heat units received in 1992 was the lowest of the years shown, and served to compound the problem of too much rain. Days were not just overcast, but they were never very warm the entire season. Last year, however, degree day accumulations were extremely high. We had sunny dry weather nearly all year. It is of interest to note that, although 1988 was a drought year, it really never had more degree days than those for 1989 and 1990; there was just not enough rain for most crops in New York during 1988.

So, like a pendulum, we can expect real swings in the weather for any given growing season. Let's just hope that next year the weather swings somewhat the other way — but not too much. My thanks to Dr. Thomas Bjorkman, the vegetable crops physiologist at the Geneva experiment station, for coaxing the plotted weather data out of our mainframe computer. ■





LAKE ERIE GRAPE INDUSTRY ADVISORY COMMITTEE NAMED

Fifteen grape industry representatives from New York and Pennsylvania have been named to the Lake Erie Regional Grape Industry Advisory Committee. The group was formed as part of an agreement between Cornell University and Penn State, announced in April, to combine grape research and extension programs.

"The advisory committee's goal is to help guide the efficient delivery of extension programming for growers, while suggesting ways that needed research information can be integrated into growing practices," says committee chair Doug Moorhead of Moorhead Vineyards, North East, Pennsylvania.

In addition to advising Cornell and Penn State on grape industry needs, the committee will assist in identifying industry funding for specific programs. "In the face of shrinking public support for research and extension, we have to find alternative sources of funding and do more with less," Moorhead says.

The Lake Erie grape-growing region encompasses about 20,000 acres in western New York and 11,000 acres in Erie County, Pennsylvania. Most grapes grown in the region are native varieties such as Concord or Niagara that are used mainly for non-fermented juices, concentrates, and jams.

Moorhead says to remain competitive with growers in other regions of the United States and the world, Lake Erie area producers must be willing to invest in an aggressive research and extension effort. "We need to find ways to add value to our product, increase yields, and cut production costs.

"That will require research on such things as mechanization, breeding for disease and insect resistance, and canopy management to make the best use of sunlight for optimal growth." He says the industry advisory committee can enhance the delivery of research-based extension programs by fostering cooperation between growers, researchers, and extension specialists in the two states.

The agreement to form the Lake Erie Regional Center for Grape Research and Extension also called for establishment of a centrally located facility to house research and extension activities; a coordinated research effort with existing faculty from Cornell and Penn State, carried out by an on-site research staff; formation of an extension team to conduct educational programs in the combined production area; addition of an extension farm management specialist to meet the changing needs of the industry; and increased industry support for research and extension.

The center was established officially on July 1, 1992. Members of the Lake Erie Regional Grape Industry Advisory Committee are:

Stephen Baran, Westfield, NY
Edward Barger, Jr., Westfield, NY
Robert Betts, Westfield, NY
Thomas Davenport, Westfield, NY
A. J. Falcone, Jr., Silver Creek, NY
James Gloss, Dunkirk, NY
Greg Lehman, Girard, PA
Fred Luke, North East, PA
Doug Moorhead (Chair), North East, PA
John Pero, North East, PA
Dennis Rak, Fredonia, NY
Jeffrey Schultz, Ransomville, NY
David Sherwood, Sanborn, NY
Danny Sprague, Irving, NY
David Vercant, Fredonia, NY. ■

ANNOUNCEMENTS UPCOMING EVENTS

The 1993 Annual Meeting of the New York State Horticultural Society will take place January 12 and 13, at Riverside Convention Center in Rochester, NY. On the morning of the 12th, grape researchers will explain their progress and propose 1993 research to the Grape Production Research Fund, which provides significant research funds that are matched by dollars generated through the New York Wine and Grape Foundation. In the afternoon of the 12th, the Horticultural Society will provide a session on bird control and a program for small winery owners , followed by a wine tasting and an evening banquet. On the 13th there is a morning session presented by Cornell grape personnel on New Zealand and Australian viticulture, resveratrol in wine, and a report on the national program for grower certification in pesticide use. A sizable trade show will be a part of the offerings. For further information on the Horticultural Society's full program, contact Ray Van Zandt, phone 716-227-5078, or Fax 716-227-1728.

Wineries Unlimited to Host 17th Annual Vineyard & Winery Technical Seminar on February 7–9, 1993, at Adam's Mark Hotel, Philadelphia, PA. For information, contact Vineyard & Winery Management, Box 231, Watkins Glen, NY 14891. Telephone 607-535-7133. Fax 607-535-2998.

The 18th International Symposium on Grapevine Grafting will be held February 9–11, 1993, in Wiesbaden Germany, sponsored by the Geisenheim

Station. For information contact Heinrich-Birk-Gesellschaft, Geschaftsfuhrung, Oberflecken 14, W-6223 Lorch-2, Germany.

The 1993 Wine Industry Workshop will be a multi-day meeting, held March 8, 9 and 10, at Jordan Hall, New York State Agricultural Experiment Station, Geneva, NY. The workshop covers enological topics as well as viticultural aspects important to juice and wine quality. For more information, contact Dr. Thomas Henick-Kling, Department of Food Science & Technology, NYSAES, Geneva, NY 14456. Phone 315-787-2277; Fax 315-787-2397. ■

Gary E. Howard Retires

The grape industry of New York State will be without one of its most notable characters with the retirement of Gary Howard at the end of October of this year. As research support specialist in Dr. Robert Pool's viticulture program at Cornell's New York State Agricultural Experiment Station, Geneva, Mr. Howard is well known across the state and nation for his work on grape culture. As Senior Research Support Specialist, he has been responsible for professional level technical support to Cornell's viticulture programs, including supervision of project staff, statistical analysis, scientific and popular writing on viticultural topics, visiting vineyards, fielding questions from growers, and conducting Cornell's on-site research in growers' vineyards in many parts of the state. He has often been sought out to speak on such topics as grape rootstocks, grafting, and vineyard performance under various management techniques at both scientific and grower-oriented meetings.

Mr. Howard was raised in Niagara County along the Niagara River on the family fruit farm. He holds a Cornell University degree in pomology. He came to the experiment station at Geneva in 1968, from a position as field representative for Empire State Sugar Company. He served his first decade in viticulture at Cornell working as a research support specialist under Nelson J. Shaulis, now Professor Emeritus of Viticulture. After Dr. Shaulis retired in 1979, Mr. Howard became the chief research support person in Dr. Pool's viticulture program. ■

Mary-Howell Martens Leaves Grape Breeding Program

Mary-Howell Martens, who held the position of Research Support Specialist in Cornell's Grape Breeding and Genetics program for nine years, resigned from her position at the New York State Agricultural Experiment Station, Geneva, effective October 1992. Mary-Howell is returning to the family dairy farm, which will demand her full-time attention. Many growers and industry leaders are familiar with Mary-Howell, who has given numerous presentations to grower conventions, experiment station visitors and student groups. In working in Dr. Bruce Reisch's program, her recognized skills in the operation of the field breeding program were complemented by her capability in laboratory genetics and tissue culture research. She has also been a capable writer, having authored several publications during her tenure. Her contributions to the breeding program will be felt for many years to come. ■

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Question: _____

Gratitude is expressed to those organizations whose support makes possible ongoing and valuable research activities for the benefit of the State's grape industry. Major funding is provided by the **New York State Wine & Grape Foundation; the Grape Production Research Fund, Inc.; and, the J.M. Kaplan Vineyard Research Program.**

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Got A Question? We are trying to address the many questions from grape growers and processors that come to Cornell's grape research community. We invite you to write to us at *Grape Research News* to bring to our attention any questions you have about grapes. We will see to it that those questions are answered by someone knowledgeable in the area of your concern.

Save yourself a long distance phone call. Put it in writing on the back of form below, cut it out, and send it to us.

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