M I C H I G A N
GRAPE&WINE NEWSLETTER

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One last hoorah by mother nature... hopefully

News you can use

Experimental Winegrape Variety Tasting at Spartan Cellars. Pour, taste, and talk about new wines and potential varieties for Michigan; June 1, 1:00-4:30PM at Spartan Cellars, MSU Campus.

NW Grape Grower Meeting. Vine training, pruning, and tying demonstration; May 6, 3:00-5:00PM at NWMHRS, Leelanau County.

SW Grape Grower Meeting. Updates from Rufus and Annemiek, plus Bernie Zandstra and Matt Grieshop will talk about chemical and mechanical weed control, respectively; May 11, 12:00-3:00PM at the Berrien County MSUE Office.

Economic survey for Michigan wineries. Brent Ross, MSU Ag Economics, is conducting a survey to identify the challenges that face small-medium wineries in cool climate wine regions. This should arrive in your mailbox soon, so please help provide important information for this study.

MICHIGAN STATE UNIVERSITY | Extension

GROWING DEGREE DAYS

Base 50 from April 1		2011	2010	2009	2007	5-yr Avg*
Lawton	*4/13*	69	113	11	24	40
	4/20	72	163	41	48	83
forecast	*4/27*	98	195	116	108	137
Benton Harbor	*4/13*	52	113	8	17	37
	4/20	56	158	34	31	75
forecast	*4/27*	83	178	100	87	124
Leelanau	*4/13*	33	70	0	5	20
	4/20	33	107	26	17	50
forecast	*4/27*	42	122	57	58	79
Old Mission	*4/13*	29	65	0	5	18
	4/20	29	101	20	13	43
forecast	*4/27*	38	113	50	46	69

**5-yr Avg = 2006 to 2010*

See enviroweather.msu.edu for more information.

New (and old) faces at MSU

Brent Ross
Assistant Professor, Department of Agricultural, Food, and Resource Economics

R. Brent Ross joined Michigan State University in June 2008 as an Assistant Professor in the Department of Agricultural, Food, and Resource Economics and is affiliated with MSU Product Center. He received his Ph.D. from the University of Illinois in Food and Agribusiness Management, where he also received a M.Sc. degree in Agricultural Finance. Since joining the faculty at MSU, Dr. Ross has taught courses in food marketing, business strategy and economics. His research focuses on entrepreneurial behavior in the agri-food system. In particular, he has an interest in emerging agri-food systems and strategies that can be used to enhance the entrepreneurial performance of agri-food firms. With colleagues from two other Midwest universities, Dr. Ross is currently conducting a study to identify the challenges that face small and medium-sized wineries in cool climate wine regions. Findings from this work are expected to generate strategies for overcoming barriers to growth in this important emerging industry.

Dan McCole
Assistant Professor, Department of Community, Agriculture, Recreation and Resource Studies (CARRS)

Dr. Dan McCole, a faculty member in the Department of Community, Agriculture, Recreation and Resources Studies (CARRS), joined MSU in 2009. He earned his Ph.D. at University of Minnesota and holds a Masters in Business Administration (MBA) from Michigan State. Dan's teaching, research, outreach and consulting focus on the factors that lead to the successful development and operation of tourism organizations. His work combines the foundations and principles of business management with an understanding of the role leisure plays in people's lives. As a social scientist, Dan brings together business fields of study (marketing, human resources, organizational development, finance and operations) with other social sciences related to the field of leisure (e.g., psychology, sociology and economics). Further, he uses research methods to bring a scientific approach to solving problems related to the development and management of tourism and recreation organizations. Dan's recent research areas include business and industry collaboration efforts and the use of social media.

Dan is part of a team that has recently applied for a USDA grant to study cold hardy wine grapes. If funded, Dan's research would involve developing profiles of tasting room visitors and potential visitors in Michigan and best practices for collaborative efforts involving the wine industry. Dan has a strong interest in and love for Michigan wines!

Paul Jenkins
Grape & Wine Integrator
Michigan State University

In alignment with the MSU Extension redesign philosophy of getting greater focus, Paul was appointed last January as the Grape and Wine Integrator at MSU, with 100% of his appointment focused on Extension and Outreach. Paul is charged with providing statewide leadership and coordination of Extension and outreach efforts for grape production and enology education, working with Extension Educators, Specialists, Faculty, and our industry partners.

In lieu of the changes occurring at MSU, our partner organizations, and the industries we serve, the MSU Grape Team is working to determine how we can continue to effectively deliver research-based information to our clientele. The industry has a need for information and access to expertise, and Paul is working with MSU Grape Team to determine how we can best meet these expectations with the resources available. This emphasizes the need for us to work together with you, our partner stakeholders, in collaboration to define and meet shared goals.

Erin Lizotte
Extension Educator
North Region

As a result of the reorganization of MSU Extension, Erin will now focus her efforts on tree fruit and pest management across all commodities, state-wide. This is a change from her previous assignment as she no longer has winegrape specific responsibilities. Although these personnel changes have occurred, Erin remains committed to supporting the industry in the future.

Joanne Davidhizar, Extension Educator & Innovation Counselor, MSU Product Center
Joanne will be assisting individuals with new ventures in food, agriculture, and the bioeconomy. She is also working on winery development statewide.

NORTHWEST

Duke Elsner
Grand Traverse County MSU Extension

Our "spring" weather has been erratic, bouncing from relatively mild, sunny days to cold, wind and snow- and back again. Much of our growing area received 6 to 9 inches of snow on Tuesday night into Wednesday morning!! (Fig. 1). Growers have been able to slip in some pruning and tying on the good days, and work seems to be progressing well in the region.

We do not think there was any significant winter injury to buds from our winter extreme lows (most sites did not get below -5 F. this winter) although we may have had some injury from some very cold days in early December. Our recent cold snaps have not been significant, in the opinions of growers and consultants. I'll be checking some bud samples in the next few weeks to see if we are accurate.

Don't put away your boots if you grow grapes in NW Michigan!, April 20; *Photo: D. Elsner.*

Southwest

Diane Brown
Berrien County MSU Extension

We are in a developmental "holding pattern" in southwest Michigan, as daytime temperatures remain in the 40'-50's and nighttime temperatures are in the 30's to 40's. Snow began to fall overnight Sunday, and by Monday several inches of snow accumulated on the ground that remained for most of the day. Tuesday night brought thunderstorms with intermittent pea-sized hail in some areas. Grapes are at first swell for Concord, Niagara and some wine grape varieties. Other wine grape varieties are at scale crack. We are not expecting much acceleration of bud development until temperatures warm up more consistently. Now that we are in scale crack to early bud swell grapes can withstand temperatures into the low 20s or high teens. At first swell, a temperature of 13°F will kill 10% of Concord grape buds, and a temperature of -3°F for 30 minutes will kill 90%. By the time Concord grape buds reach full swell, a temperature of 21°F will kill 10% of Concord grape buds, and a temperature of 10°F will kill 90%. As grapes begin to grow and the sap rises in the vine they lose the ability to handle really cold temperatures. Once growth progresses further, temperatures just below freezing will cause little damage but temperatures below 28°F can cause severe damage.

Temperature resulting in 50% bud kill under wet conditions for 1-hr duration

Growth Stage	Degrees F	Degree C
Scale crack	22	-5.5
First swell, S-1	24	-4.5
Full swell, S-2	26	-3.5
Bud burst	27	-3.0
Expanded shoot	28	-2.5

Information about freezing tests on wine grape varieties at early growth stages is difficult to find. Freezing tests done on grape buds and canes at Prosser, Washington in 1997 showed Cabernet Sauvignon at first swell sustained no damage down to 25°F. Merlot at full swell showed slight damage to the buds, phloem, and xylem at 25°F. More serious damage to the phloem and xylem occurred at 23°F. Chardonnay at budbreak showed slight damage to the buds and phloem at 27°F. More serious phloem and xylem damage occurred at 25 F. Buds were seriously affected at 24°F. Clearly there are varietal differences but they are not large.

Research conducted by Dr. Stan Howell at MSU found that, in general, grape buds under wet conditions sustained freeze damage at warmer temperatures than dry grape buds. This would correspond to freezes that occur at or below the dewpoint compared with freezes that occur when the dewpoint hasn't been reached. Later work on wine grape varieties supported this conclusion (Mills et al. 2006). Wine grape varieties differ in their deacclimation patterns, making some more susceptible to spring frosts. It is safe to say that once the bud burst stage has been reached, significant injury is likely to occur if temperatures dip down in the 26-27°F range. A partial summary of freeze susceptibility at different growth stages can be found in the table below. Mark Longstroth compiled a reference of grape growth stages here.

References: http://wine.wsu.edu/research-extension/weather/cold-hardiness/

Mills, L.J., Ferguson, J.C., and Keller, M. 2006. Cold-Hardiness Evaluation of Grapevine Buds and Cane Tissues, Am. J. Enol. Vitic. 57:2 (2006) pp. 194-200.

New frost alarm now available on Enviro-weather

Beth Bishop
Enviro-weather Coordinator, MSU

If you'd like to receive advanced warning of potential frost-freezes, Enviro-weather's new Frost Alarm may be just what you are looking for. This new, premium service is now available by subscription. For $100 per year, you can monitor weather at one or more Enviro-weather stations and choose the exact weather conditions you wish to be notified for. If the selected station(s) records weather data meeting specified conditions, an alarm is generated and you are notified by phone call, text message, and/or email.

For each station chosen, users can select a combination of temperature, dew point, wind speed and temperature drop (Figure 2).

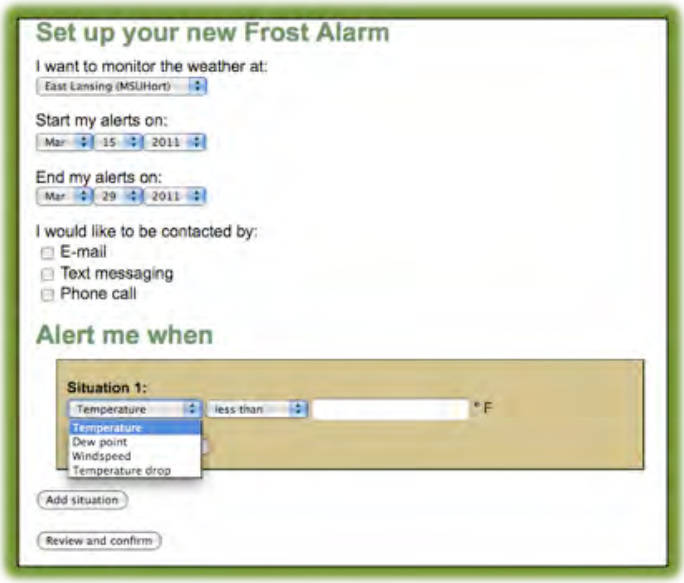
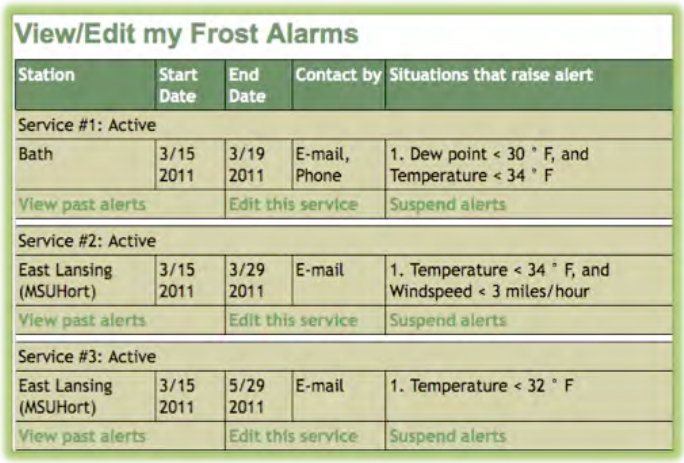


Figure 2. Setting up your frost alarm; selecting weather stations and conditions to generate alarm.

Users can combine as many weather conditions (temperature, temperature drop, wind speed and dew point) as they wish for one alarm. For example, users can choose to be notified if the temperature is less than 35F AND the dew point is less than 32F. In that case an alarm would be generated if the temperature was 34F and the dew point was 29F. However, it would not be generated if the temperature was 34F and the dew point was 33F.

Users can also can also create multiple "situations" (unique combination of conditions) for a station. Each "situation" will generate a separate alarm when conditions are met. Users can choose to monitor conditions at as many stations as they wish (Figure 3).



View/Edit my Frost Alarms

Station	Start Date	End Date	Contact by	Situations that raise alert
Service #1: Active				
Bath	3/15 2011	3/19 2011	E-mail, Phone	1. Dew point < 30 ° F, and Temperature < 34 ° F
View past alerts		Edit this service		Suspend alerts
Service #2: Active				
East Lansing (MSUHort)	3/15 2011	3/29 2011	E-mail	1. Temperature < 34 ° F, and Windspeed < 3 miles/hour
View past alerts		Edit this service		Suspend alerts
Service #3: Active				
East Lansing (MSUHort)	3/15 2011	5/29 2011	E-mail	1. Temperature < 32 ° F
View past alerts		Edit this service		Suspend alerts

Figure 3. This user has set conditions for three different situations that could generate a frost alarm. He has chosen to be notified by email AND by phone if the Bath weather station registers dew points less than 30F and temperatures less than 34F. He will also receive an email notice if the temperature at the East Lansing (MSU Hort) station is less than 34 F with a windspeed of less than 3 miles per hour. He will receive an email alarm if the temperature at this station is less than 32F.

The frost alarm service is available now. For more information or to sign up, go to: http://www.enviroweather.msu.edu/frostalarm.php, click on "Sign up beginning March 1" then select "Enviroweather Frost Alarm."

Please contact me, Beth Bishop, at bishopb@msu.edu or (517) 432-6520 with your questions, comments and suggestions.

VINEYARD MANAGEMENT

Paolo Sabbatini, Department of Horticulture, Michigan State University
Stan Howell, Professor Emeritus, Michigan State University

Assessing grapevine cold hardiness status

I am writing this article while outside it is snowing and it is almost the end of April. Students in the Viticulture and Enology program here at MSU were complaining about the weather this morning. I reminded them that (1) an early spring is always associated with a long and warm growing season (GOOD!) but it also associated with a potential of spring frost (BAD, 2010 docet!) and (2) they will have more time to prepare for their vineyard experiments. While they don't really accept explanation (1) ("*where are the numbers?*" they said, sarcastically), they took in serious consideration explanation (2) ….."*maybe they are not ready yet for their summer experiments*", I guessed (sarcastically), but I am probably wrong.

While we are waiting for spring, I will review in this article some of the work done by my predecessor at MSU, Dr. Howell and his graduate students (Drs. Striegler, Smithyman and Wolpert) on vine cold hardiness.

In nature a plant species' survival depends upon adaptation to and accommodation of environmental limits to growth and reproduction. Similarly, accommodation of environmental stresses on cultivated plants is determined by the mix of genotypic adaptation and the expression of that genetic constitution under conditions of culture. In the northern temperate zone and in numerous geographic locations where altitude can influence low temperature depth and frequency, adaptation to winter cold and spring frost episodes determine commercial potential for viticulture. Cold hardiness expression is a genetically complex physiological/morphological phenomenon and grape cultivars possess different levels of resistance to cold stresses based on their genetic composition. This expression of a cultivar's genetic capacity varies with the (a) dormancy status of the vine, (b) the environmental conditions (primarily temperature) preceding the cold stress, and (c) vine condition when entering the winter, resulting from the past season of culture, influencing the vine's metabolic ability to support the genetic capacity. For example, the accumulation of carbohydrates has been closely associated with the cold hardiness of woody plant tissues, including grapevines.

Specific levels of freezing tolerance in scientific experiments have been commonly measured by subjecting vine tissues to a range of freezing temperatures such that the warmest in the range causes no damage and the coldest is lethal. Such assessments must be done at different times in the dormant season since varying environmental conditions over the dormant period will influence the level of hardiness of a specific tissue and by extension vine hardiness as well. These assessments require specialized equipment, and are impractical for most grape growers to employ.

Typical assessments by grape producers commonly consider bud mortality and expressions of cane, cordon and trunk injury/damage as expressed by collecting numerous samples and evaluating discoloration (browning) of critical tissues, splitting and/or vine collapse early in the growing season. Several morphological indicators can be used to get an estimation of cold hardiness of vines. The impact of cane exposure to the sky during the growing season (indicated by darkest periderm color as compared to shaded, lighter colored canes) is extensively documented in literature and exposed, dark colored canes are much more cold resistant.

From these researches we gained several practical considerations: (1) darker periderm indicates optimum exposure to the sky during the growing season and higher stored CH_2O of localized tissues, (2) darker periderm indicates lower tissue water content and (3) darker periderm indicates greater cold hardiness of bud and cane tissues on that cane. The assessment of cane color can be expanded to include vigor assessment as indicated by cane diameter and the presence or absence of persistent laterals. From this observation we could gain other several important information: (1) inadequate or excess vigor (expressed as either cane diameter or internode length or few mature nodes) indicates lower hardiness, (2) a high pith:cane diameter ratio indicates lower hardiness, (3) canes with <5 mature nodes are least hardy in bud and cane and (4) presence of persistent laterals indicates lower hardiness. Persistent laterals are associated with genetic constitution – some cultivars are more likely than others to produce persistent laterals. Lateral development is also associated with high vigor, often resulting in within canopy shading. Lateral growth at ~90º angle is a genetic evolutionary mechanism for the vine-liana to achieve sunlight exposure on foliage in a shaded canopy. Moreover, (5) lateral extension and escape from canopy shade is associated with high vigor and shade status and (6) a large number of mature nodes (>10) on a lateral, regardless of cultivar, is indicative of excess shoot vigor. Finally, (7) main shoots with

persistent laterals exceeding 14 mature nodes possess inferior cold hardiness than those exhibiting less vigor, i.e. no lateral or a small lateral.

So, how many of these seven cane characteristics can be employed to help grape producer assess the impact of different cultural practices on bud, cane and vine hardiness? In Table 1, I prepared a summary of several years of data collected in *Labrusca* varieties grown in Michigan (Striegler and Howell, 1991). I like to consider the parameters collected in this study as a new tool, a Cane Classification Tool (CCT) with the potential for use as an adjunct to vineyard management efforts where cold hardiness is of interest (Sabbatini et al., 2010). You can see from the data the impact of three morphological characteristics on cold hardiness and how the impact on canes tends to be always higher than on buds.

Table 1.	Mortality (%)			
Wood color	Dark	Light		Δ
Cane	48 a	75 b		27
Bud	25 a	29 a		4
Cane diameter	4-5 mm	6-7 mm	9-11 mm	Δ
Cane	33 b	25 b	60 a	35
Bud	38 a	21 b	25 b	15
Lateral	Absent	Small	Large	Δ
Cane	46 c	67 b	100 a	54
Bud	12 b	37 a	34 a	25

Table 1. Impact of wood color, cane diameter and lateral persistence on cold hardiness of buds and canes in Concord (V. labrusca). Bud mortality is higher in light colored canes and color impact is higher in canes than in buds. Small diameters (4-5 mm) or higher (9-11 mm) e the presence of laterals are related to reduced cold hardiness. Means within a row followed by the same letter are not significantly different at P = 0.05 by the Tukey HSD test.

Fig 1. Impact of shading on wood color. Bud mortality is higher in light colored canes (right); *Photo: P. Murad.*

Here some conclusions, some speculations and some potential application for our viticulture efforts at the environmental limits of vine survival.

- The culture of a cultivar under conditions of minimal limits of soil, water, temperature, light intensity, GDD, biotic stresses and nutrients will result in reduced impact of a vine cold stress. Under such conditions heavier crops can be satisfactorily matured with no negative response associated with inadequate accumulation of CH_2O reserves.
- By contrast, limits to one or more of the above stated cultural conditions will reduce the ability of a vine's gene expression concerning fruit initiation and differentiation and will similarly reduce tolerance to a stress condition, such as freezing cold. In a mild climate, if the winter temperature never declines below a threshold for any bud or cane damage, then the differences proposed above will not be expressed.
- The CCT allows the assessment of the range of freezing tolerance within a single vine and to characterize the visible vine morphology associated with varying levels of tolerance. CCT provides an opportunity to employ this tool for practical use, especially during winter pruning. Equally important is the close relationships that CCT derived qualities also have with bud fruitfulness the following season. CCT links different levels of vine hardiness (bud, cane and potentially, perennial wood) to a readily visible and easily measured vine characteristic and would allow the grape growers to use that/those characteristic(s) to assess the impact of any cultural practice (e.g. crop level, rootstock choice, training system choice, canopy

Fig 2. The presence of persistent laterals is related to reduced cold hardiness, a consequence also of excessive vigor; *Photo: P. Murad.*

management, vineyard floor management, nutritional program, etc.) based on a within-vine frequency distribution of the characteristics most predictive of tissue cold hardiness. This speculation, though logical, must be subjected to rigorous critical evaluation because the potential for producing useful grapevine culture information is considerable.

Looking forward to another great viticulture season!

Literature Cited

Striegler, R. K. and G. S. Howell. 1991. The influence of rootstock on the cold hardiness of Seyval grapevines. I. Primary and secondary effects on growth, canopy development, yield, fruit quality and cold hardiness. Vitis 30:1-10.

Sabbatini P, G. S. Howell, R.K. Striegler and J.A. Wolpert. 2010. Assessing Grapevine Cold Hardiness Status Using Cane Morphology Indicators. CONAVI Meeting, Fondazione Edmund Mach, San Michele All'Adige (Trento), 5-9 July (Italy).

Rufus Isaacs, Department of Entomology, Michigan State University

Monitor grape buds for climbing cutworm and flea beetles

Two important insect pests of grapevines become active around the time of bud swell, and both have the potential to cause damage to early growth if populations are high. The cool weather this spring may result in buds swelling over an extended period, and this can place buds at risk of feeding by climbing cutworm for a longer period than normal. Cool nights are ideal for activity of cutworms, with warm sunny days being more suited for activity of flea beetles. The coming weeks will be good times to scout vineyards for these two pests, to determine whether management is needed.

Cutworms. The term cutworm covers many species in the moth family Noctuidae, and as their name suggests, these insects are nocturnal. Vineyards on light-textured soils are often the most heavily infested. Both the adults and the larvae are only active at night, and the larvae can climb up onto vines during very cool night-time conditions. During the day, cutworms hide in the soil or leaf litter, and can be found in the top layer of soil. Many of these insects feed on weeds, but some climb the stems of plants to feed on buds and other young foliage. These climbing cutworms are the ones causing damage to grapevines. Direct observation of feeding by the larvae requires a late-night trip to the vineyard, but their damage is quite easy to see. In Michigan vineyards, the spotted cutworm, Amathes c-nigrum, is our main pest species, and the larvae feed on buds and may also feed on leaves until the shoots are 10 to 15 cm long. However, it is the feeding on small buds that has the greatest potential for economic damage.

Cutworm feeding on a bud can reduce the crop by 1-2 clusters so the high potential for rapid damage by cutworms requires that growers make good management decisions. Even 2% percent bud injury is an economic threshold for an insecticide treatment to prevent further damage, so vineyards should be scouted during the period of bud swell to identify regions with cutworm pressure (see below).

Flea beetle (Steely beetle). This insect attacks buds of both wild and cultivated grape, and is another early season grape pest. The adult insects move to the vines at bud swell, and usually are localized within the vineyard. Sites near overwintering habitats such as woods or abandoned vineyards are especially at risk. Beetles are most easily seen during warm sunny weather when they tend to be on the top of vines, usually mating or feeding on canes and buds.

Adults are shiny blue, about 4-5 mm long, and have strong hind legs that enable them to jump if disturbed (hence the name). The overwintering adults cause the greatest damage by boring into the developing bud and hollowing out the inside, while the larvae and summer adults feed on leaf tissues. Bud feeding is similar to that caused by cutworms, with similar effects to the vine (see above cutworm description).Wherever possible, cleaning up overwintering sites (wasteland and woodland) near to vineyards can help combat grape flea beetle.

Scouting for bud damage. Growers should watch for damage by cutworms and flea beetle, especially if the vines remain in the susceptible bud swell stage for a while with cooler weather. Cutworms tend to be more of a problem in sandy sites, so these should be prioritized for scouting. Both cutworms and steely beetle can cause damage quickly if the temperatures warm up, and since they are difficult to catch “in the act,” regular scouting for the first signs of damage is essential to prevent significant bud loss.

An action threshold of 2% damaged buds is recommended in juice grapes, and this can be determined by sampling 10 buds on each of 10 vines spread through the vineyard. Thresholds in winegrapes may be lower due to the higher value of the crop, but there has been little formal research on this topic. Still, it is clear that the potential damage justifies scouting and management if cutworm damage is detected.

Once the shoots get past bud burst and into the 1-3 inch range the danger from flea beetles and cutworms is diminished significantly.

Cultural control. Vineyards that are weedy tend to have more cutworm problems, presumably because the larvae have more places to hide and conditions are better for them. Weedy vineyards also provide more places for the cutworms to hide from sprays applied for their control, so improving weed control is one component of an IPM program to reduce cutworm damage.

Although it may be too late for this year if you have finished pruning, leaving some extra buds is a potential strategy for hedging your risk against cutworm (and frost) injury. Scouting is still required though, to make sure the damage doesn’t exceed the number of extra buds left behind.

Chemical control. An appropriate insecticide application should be considered if scouting shows significant damage is occurring, and assessments of damage should include wooded borders where flea beetle pressure may be higher, and areas where cutworms have been a recurring problem.

Lorsban Advanced is labeled for cutworm at 1 quart per acre, in at least 50 gallons of water per acre. There are also a number of pyrethroid insecticides registered for use against cutworms including Mustang Max (2-4oz/acre), Danitol (10.6oz/acre), and Brigade (3.2-6.4oz/acre) that provide excellent control of cutworms and flea beetle. Sevin is also registered for use against flea beetles and has performed very well in observations of treated vineyards at 2 qts/acre.

Recent research in Washington State vineyards has shown excellent protection against cutworms using only trunk sprays of a pyrethroid. This approach targets the spray to the trunk surface, and larvae have to climb up through the residue to reach the buds. This approach significantly reduces the cost of application, but it is important to realize that this will not protect the upper canopy from flea beetle feeding.

For photos of grape flea beetle and cutworm damage to grapes, see the pages at the grapes.msu.edu website:

www.grapes.msu.edu/cutwm.htm

www.grapes.msu.edu/fleabeetle.htm

Annemiek Schilder, Department of Plant Pathology, Michigan State University

There is still time for dormant sprays in grapes

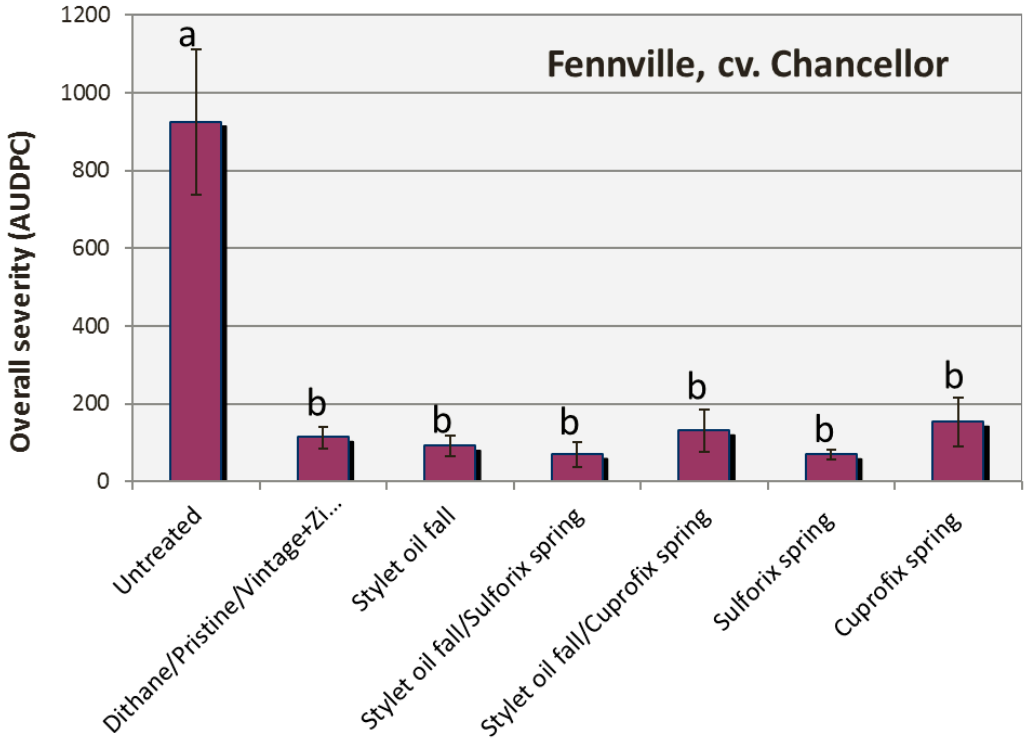
There is still time to apply dormant sprays in grapes. The goal of the dormant spray is to eliminate fungal pathogens that overwinter in or on the woody parts of the vine. While it is not possible to eradicate all inoculum, dormant sprays can kill or debilitate the fungus so it produces fewer spores, reducing disease pressure during the growing season. Dormant sprays are useful for management of Phomopsis, powdery mildew, black rot, and anthracnose. In some years, we have even seen a reduction in downy mildew as well but only with copper sprays. Since the downy mildew pathogen overwinters in leaf residue on the soil, this may have been caused by copper residues which landed on the soil surface. In most years we have seen a benefit from dormant sprays, but the degree has varied (from 10-70%). Results were not as good in very wet springs, which probably led to washing off of the dormant spray before it was able to do its job. To cover your bases, two dormant sprays may be applied, in early and late spring, or fall and spring. If bud burst has occurred, you can still apply dormant spray materials or mancozeb at 1-2" of shoot growth for Phomopsis control. Dormant sprays should not be used as a stand-alone disease control measure.

Products used as dormant sprays are Lime Sulfur or Sulforix, Cuprofix or other copper product, Sulfur (liquid form recommended), and JMS Stylet Oil or other oil. Formulations that "stick" to the wood are best. To get the maximum benefit out of dormant sprays, it is important to ensure thorough coverage of the trunk and canes by focusing nozzles of spray equipment, lowering air intake, slowing down and spraying at a moderately low volume (e.g., 20-30 gpa) which allows good coverage of the canes while keeping the product fairly concentrated. Using a high volume in this case only results in dilution of the product and run-off. Spraying every row is advised. Small vineyards are better sprayed with a hand pump sprayer.

Dormant spray trial to control powdery mildew. In a replicated small-plot trial in cv. Chancellor in Fennville, MI, in 2009/2010, the following treatments were applied with a backpack-style sprayer in an effort to reduce cleistothecium production in the fall and reduce viability of cleistothecia in the spring.

Powdery mildew was monitored on a weekly basis during the growing season and first was seen on 21 July in the untreated control plots, on 4 Aug in the Stylet Oil Fall spray plot, and on 14 Aug in the other treatments. The area under the disease progress curve (AUDPC), a measure of disease severity throughout the season, was significantly reduced in all treatments and the season-long program was not better than a single dormant spray. It should be pointed out that some powdery mildew strains at TNRC are resistant to strobilurins, which could have reduced the efficacy of the seasonal program. This suggests that dormant sprays can significantly reduce powdery mildew through most of the growing season and can be cost-effective. It did not make a difference whether sprays were applied in the fall or in the spring, although the treatments that included a spring Sulforix spray tended to have the lowest disease levels.

Treatment	Rate/acre	Timing
Untreated	-	-
JMS Stylet Oil (paraffinic oil)	1 gal	2 September 2009
JMS Stylet Oil (paraffinic oil) Sulforix (calcium polysulfide)	1 gal 2 qt	2 September 2009 5 April 2010
JMS Stylet Oil (paraffinic oil) Cuprofix Ultra (copper sulfate)	1 gal 3 lb	2 September 2009 5 April 2010
Sulforix (calcium polysulfide)	2 qt	5 April 2010
Cuprofix Ultra (copper sulfate)	3 lb	5 April 2010
Standard seasonal program: Dithane Rainshield (mancozeb) Pristine (pyraclostrobin + boscalid) Vintage (fenarimol) + Ziram (ziram)	 3 lb 12 oz 4 fl oz, 3 lb	 10-12 inch shoot, immed. prebloom 1st postbloom, 3rd postbloom 2nd postbloom, 4th postbloom



Dormant spray trial to control Phomopsis. In 2005, we compared different timings of "dormant" sprays for control of Phomopsis in 'Niagara' grapes, including sprays after bud burst (Table 1). The difference in spray timing was only 11 days that year. A reduction in rachis infection at harvest was seen for both Sulfur 6L and Cuprofix in all cases. While Cuprofix at 1-2" shoot appeared somewhat less effective, it was not statistically different from the other treatments, which means that they could have ben due to natural variation in the vineyard. The season-long fungicide spray program was the most effective at reducing Phomopsis at harvest.

Trial in 'Niagara' grapes in Lawton, MI, 2005

Treatment, rate/A	Application timing*	Phomopsis rachis infection at harvest		
		Severity (%)		Control [%]***
Untreated.....		26.9	a**	
Sulfur 6L 10 pt.....	Budswell (single spray)	10.6	b	[61]
Sulfur 6L 10 pt.....	1-2" Shoot growth (single spray)	9.6	b	[64]
Cuprofix Disperss 3 lb.....	Budswell (single spray)	7.4	b	[73]
Cuprofix Disperss 3 lb.....	1-2" Shoot growth (single spray)	12.2	b	[55]
Dithane Rainshield 3 lb Abound 2.08 SC 12 fl oz Ziram 76 DF 3 lb.....	1", 6-10", 10-16" shoot Bloom 2nd postbloom 1st postbloom 3rd postbloom	2.7	c	[90]

*Budswell spray: April 14, 2005; 1-2 inch shoot spray: April 25, 2005

**Values in the same column that share a letter are not significantly different from each other at the 95% confidence level.

***Percent control relative to the untreated check.

We did not see any phytotoxicity as a result of the treatments in 'Niagara' grapes, even when applied at 1-2 inch shoot growth. 'Niagara' and 'Concord' are only slightly copper sensitive. The risk of copper phytotoxicity to green leaves is greater under cool, wet, slow-drying conditions which allow copper ions to be absorbed by the leaves. Concord is sulfur sensitive, but sulfur phytotoxicity is much more likely at temperatures above 85-90°F which are unusual at this time of the year. We have seen no phytotoxicity from sulfur dormant treatments in Concord.

Newer fungicide chemistries for grapes

There are various trends in crop protection worldwide that are changing the landscape for grape fungicides. We have seen an overall increase in new fungicide registrations over the past two years. One distinct trend is that there are more downy mildew fungicides on the market due to outbreaks of cucurbit downy mildew in the United States. Since these fungicides also work well against downy mildew in grapes, we are now seeing a range of new products for grapes, e.g., Presidio, Revus, Tanos, Forum, Reason and Ranman. Some of these have yet to be evaluated in Michigan. The threat of soybean rust, an invasive disease of soybeans, has speeded up the review of sterol inhibitor fungicides by the EPA and led to the registration of several new SI products for grapes, including Mettle and Inspire Super. Growers may also have noticed that commonly used fungicides, like mancozeb and copper have become more expensive – one of the reasons is the increasing price of copper worldwide. Furthermore, the number of natural fungicide products, including biological control agents and plant extracts (e.g., Regalia), has been steadily increasing. This has increased the number of disease control options for organic grapes.

Generic fungicides are now becoming more common since the patents have run out on a number of older fungicides. Examples of these are Legion, Nevado, Orius, TebuStar, AgriStar Sonoma and Tebuzol. In order to extend fungicide patents, companies have also started developing pre-mixes of different fungicide active ingredients. These pre-mixes have a broader spectrum of activity than single-ingredient products and are convenient to use. An example is Adament, which is a pre-mix of Flint and Elite. Pre-mixes are available for specific disease complexes, for instance powdery mildew and downy mildew or powdery mildew and Botrytis bunch rot. That way, these products can be tailored to specific cultivars or times of the growing season.

Below are a number of new(er) grape fungicides described that you may or may not have heard of. Those fungicides that have shown at least moderately good activity in field trials in Michigan are given an efficacy rating in the grape section of E-154 (Michigan Fruit Management Guide). Those that have not been tested in Michigan (yet) or showed poor efficacy in trials are simply listed here for your information. More products are in the pipeline and may become available this season. You will be updated on new grape fungicides as they get registered for use in Michigan. For fungicide labels and material safety data sheets, go to the following website: www.cdms.net (look under the "Services" tab, then "Labels/MSDS").

Adament (tebuconazole and trifloxystrobin) is a mixture of a systemic (tebuconazole) and surface-systemic (trifloxystrobin) fungicide. It is a broad-spectrum fungicide that is labeled for control of multiple diseases on grapes, cherries, peaches, and nectarines. Adament is rainfast when dry, generally within 2 hours. Adament is effective against cherry leaf spot, brown rot, and powdery mildew on cherries, and powdery mildew in grapes. It has excellent efficacy against powdery mildew (where fungicide resistance is not present) and black rot, and is moderately effective against Botrytis bunch rot. Adament is best used as a protectant. Do not apply this product on Concord grapes, as crop injury may result due to the trifloxystrobin (Flint) component. Do not make more than two consecutive applications or a total of six applications in grapes per season.

Forum (dimethomorph) is a new, systemic fungicide for control of downy mildew in grapes. Use Forum as a preventive application before infection occurs. The minimum application interval is 7 days. Performance may be improved by using Forum in a tank mix with another fungicide. The addition of a spreading/penetrating adjuvant is prohibited. Do not make more than 5 applications per year, and no more than one application before switching to a fungicide with a different mode of action. The REI is 12 hours and the PHI is 28 days. Forum will be evaluated for disease control in Michigan this summer.

Inspire Super (difenoconazole and cyprodinil) is labeled for control of powdery mildew, Botrytis bunch rot, black rot and anthracnose. It has preventative, systemic, and curative properties against. Difenoconazole belongs to the sterol inhibitor class of fungicides, whereas cyprodinil is active ingredient in Vangard. The application rate is 16-20 fl oz per acre. For all diseases, apply before the onset of disease. Apply on a 10-14 day schedule, with no more than 2 consecutive applications before alternating to a fungicide with a different mode of action. Do not apply more than 80 fl oz of Inspire Super per acre per season and no more than 0.46 lb a.i. difenoconazole and 1.4 lb a.i. cyprodinil. Avoid spray overlap as crop injury may occur. The PHI is 14 days, and the REI is 12 hours.

Mettle (tetraconazole) is a new sterol inhibitor fungicide. It is a systemic fungicide labeled for control of powdery mildew and black rot in grapes. When a post-infection application is used for black rot, it is recommended within 72 hours of an infection period. Mettle is absorbed quickly into the plant tissue and is rainfast within 2 hours of application. Do not make more than two applications of Mettle to grapes per year. The maximum amount of Mettle allowed per season is 10 fluid ounces and there must be at least 14 days between applications. Do not apply Mettle through any kind of irrigation system. The REI of Mettle is 12 hours and the PHI is 14 days. Mettle had performed similarly to Elite in Michigan trials.

Nutrol (monopotassium phosphate; 50% P_2O_5 and 32% K_2O) is a water-soluble fertilizer (0-52-32) as well as a

fungicide against powdery mildew. This product is labeled for control of powdery mildew in apples, stone fruits, and grapes. It is a salt and acts primarily as a contact fungicide. Nutrol will not cause phytotoxicity, even at high concentrations. Nutrol is a non-toxic, environmentally friendly product that is exempt from residue tolerances. It can also be used as a pH buffer to prevent alkaline hydrolysis of pesticides. A 1% solution will have a pH between 4.5 and 6.0. Nutrol is compatible with most commonly used agricultural chemicals. The PHI is 0-days. This product has not been evaluated in Michigan.

Presidio (fluopicolide) is a new systemic fungicide which is active against diseases caused by downy mildews and other oomycetes in grapes. This fungicide has a novel mode of action and has protective, curative, eradicative, and antisporulant properties. Presidio is locally systemic and translaminar and moves systemically via xylem tissue. Furthermore, Presidio is compatible with many fungicides and insecticides and is rainfast in 2 hours. The PHI for grapes is 21 days; no more than two sequential applications are allowed. A tankmix with another fungicide with a different mode of action must be used with Presidio for resistance management. Presidio has worked well against downy mildew in trials in Michigan.

Quadris Top (azoxystrobin and difenoconazole) is labeled for control of powdery mildew, downy mildew, black rot, anthracnose, and minor foliar diseases; and suppression of Botrytis bunch rot. It is systemic and has preventative, systemic and curative properties. This fungicide has not been evaluated yet in Michigan, but the individual components have, and efficacy is expected to be excellent. It will be evaluated this growing season. Quadris Top can be applied at 10-14 fl oz per acre on a 10-14 day schedule. No more than two consecutive sprays are allowed and a total of 56 fl oz per acre per season. The PHI is 14 days and the REI is 12 hours. Due to the azoxystrobin component, Quadris Top is extremely phototoxic to certain apple varieties.

Ranman (cyazofamid) is a new fungicide for control of downy mildew in grapes. Ranman has limited systemic activity, so should be applied in a preventive mode. Make fungicide applications on a 10-14 day schedule when conditions are favorable for disease development. Do not apply more than 6 sprays of Ranman per season and no more than 3 consecutive sprays before switching to fungicides with different modes of action for the next three applications. Do not use any surfactant with Ranman. Application water volumes for ground application should at least be 100 gal per acre. Ranman may be applied through irrigation systems with restrictions (for instructions see the label). The REI is 12 hours and the PHI is 30 days. This product has not been evaluated for disease control in Michigan.

Reason (fenamidone) is a new systemic fungicide for control of downy mildew in grapes. Reason is related to the strobilurins (Group 11), which means that cross-resistance may occur. Reason can be applied at 10-14-day intervals during periods of disease susceptibility. Do not make more than one application of Reason before switching to a fungicide with a different mode of action. Do not apply more than 8.1 fl oz of Reason per acre per growing season. The REI is 12 hours. Do not apply within 30 days of harvest. Reason has not been evaluated in Michigan yet, but has shown good control of downy mildew in other states.

Regalia (extract of *Reynoutria sachalinensis* = giant knotweed) is a plant extract-based biofungicide that is OMRI approved for organic production. It is labeled for broad-spectrum disease control in grapes. The proposed mode of action is by increasing the plant's natural defenses. This induced resistance is not systemic throughout the plant but limited to the leaf it is applied to. The resistance reaction takes 1 to 2 days to develop. Light is required for best results. Regalia should therefore be used as a preventative treatment. Applications have to be repeated every 7-14 days to protect new growth. Regalia is labeled for control of in grapes. Regalia has a 0-day PHI and a 4-hour REI. In past trials in grapes with a different formulation, Regalia showed moderate to good control of powdery mildew and moderate control of downy mildew and Botrytis bunch rot. Regalia will be evaluated this year in grape trials in Michigan.

Revus (mandipropamid) is a new systemic fungicide for control of downy mildew in grapes. It has preventative and limited curative properties. A maximum of four sprays and two sequential sprays is allowed. The addition of a spreading/penetrating type adjuvant such as a non-ionic based surfactant or crop oil concentrate is recommended. The PHI is 14 days for grapes. This product has shown good efficacy against downy mildew in grape trials in Michigan. Revus is also available in a pre-mix called Revus Top with difenoconazole (a sterol inhibitor).

Revus Top (mandipropamid + difenoconazole) is labeled for control of downy mildew, powdery mildew, Phomopsis, black rot, anthracnose, and minor foliar diseases. It has preventative, systemic and curative properties. In Michigan trials, Revus Top gave excellent control of powdery mildew, downy mildew, and black rot; and moderate control of Phomopsis. For powdery mildew control, Revus Top can be applied on a 10-21 day interval. For downy mildew control, a 10-14 day interval should be used. Revus Top rapidly bonds to the wax layer on the plant and is rainfast as soon as the droplets have dried. Addition of a non-ionic surfactant, crop oil concentrate, or blend is recommended. No more than two sequential applications should be made before alternating with a fungicide with a different mode of action. Do not apply more than 28 fl oz/acre (= four applications) of Revus Top per season. The PHI is 14 days and the REI 12 hours. Due to the risk of

phytotoxicity, Revus Top is not recommended for Concord, Concord Seedless, and Thomcord grapes. Precaution is advised on other Labrusca-type grapes and Labrusca hybrids, as adjuvants or other components in the tank-mix may increase phytotoxicity potential. The risk of phytotoxicity may be enhanced during rapid growth which may result in tender tissues and a thin wax layer on leaves.

Sonata (*Bacillus pumilis* QST 2808) is a protectant biofungicide that is OMRI listed and therefore can be used in organic production. Sonata is labeled for use against powdery mildew in grapes. Sonata has a 0-day pre-harvest interval and a 4-hour re-entry interval. Adding a terpene-based spray adjuvant, such as Nu-Film-P can improve coverage and control. If disease pressure is high, alternate or tank mix this product with other effective fungicides. Sonata has shown moderate to good efficacy (when tank-mixed with Nu-Film-P) against powdery mildew, downy mildew, and Phomopsis in grape trials in Michigan.

Sporan (rosemary oil, clove oil, thyme oil, wintergreen oil, lecithin, butyl lactate) is a broad-spectrum protectant fungicide for use in grapes. Sporan is OMRI listed so it can be used in organic production. Sporan has no re-entry interval and a 0-day pre-harvest interval. Diseases listed on the label are: powdery mildew, downy mildew, black rot, Botrytis bunch rot, and Eutypa dieback in grapes. In trials in Michigan, Sporan gave fair control of downy mildew and black rot.

Tanos (famoxadone and cymoxanil) is a new, broad-spectrum fungicide for control of downy mildew in grapes. It has curative and locally systemic properties against downy mildews. Tanos rapidly penetrates into plant tissues and is rainfast within 1 hour of application. It must be tank-mixed with a contact fungicide labeled for that crop (e.g., mancozeb, captan or copper). A maximum of 9 applications of Tanos including other group 11 (strobilurin) fungicides is allowed per season. The PHI is 30 days for grapes. Tanos will be evaluated in Michigan this growing season.

Vivando (metrafenone) is a fungicide with a new and unique mode of action and the first in its chemical class. No cross-resistance is known with other fungicides but its specific mode of action not known. It is labeled for powdery mildew control and is a good choice in vineyards with (suspected) fungicide-resistant strains. In a Michigan trial in 2010, Vivando had excellent activity against powdery mildew and also suppressed black rot and downy mildew (these diseases are not on the label, however). This fungicide prevents infections and limits fungal growth, sporulation, and spore viability. Since Vivando does not have curative activity it should be applied preventively. It can be applied at 10-15 fl oz any time after budbreak on a 14-day or 21-day schedule. With longer spray intervals, a higher dose should be used. Vivando is rainfast within 1 hour and redistributes across the plant surface, providing improved coverage. Use of a silicone-based surfactant is recommended. A maximum of two consecutive and a total of three sprays is allowed. The PHI is 14 days and the REI 12 hours.

GENERIC FUNGICIDE OPTIONS

In the past few years, patents have run out on a number of proprietary fungicide products and "generic" versions are now available for some common fungicides. Generic products by law have to have the same amount of active ingredient as the original fungicides. However, they may have different inert ingredients or different formulations.

Generic products may be more economical than brand name products, but most have not have been separately evaluated in Michigan and may not be specifically recommended in the E-154 Fruit Management Guide. However, they are described in the "Fungicides and Bactericides for Fruit Crops" section. For more information on individual products, you can check out their labels and material safety data sheets on the following website: www.cdms.net. Generic products are expected to be similar in disease control efficacy to their brand name counterparts. However, there may be minor variations in efficacy, behavior or even potential phytotoxicity due to different formulations.

Read the fungicide label carefully as you would for any new product. Do **not** assume that the labels of generic products are exactly the same as the brand name fungicides that you are used to. Sometimes there are differences in the crops that the product is labeled for or in the label instructions or restrictions. An example of this is Iprodione, which is labeled for blueberries, whereas the brand name product Rovral is not. The table below lists generic products of common fungicides.

Brand name Product	Active Ingredient	Generic Products
Aliette	fosetyl-Al	Legion
Aliette	phosphites (same breakdown product as fosetyl-Al)	ProPhyt, Phostrol, Agri-Fos, Rampart, Fosphite, Fungi-Phite, Topaz
Elite	tebuconazole	Orius, Tebuzol, TebuStar
Rally	myclobutanil	AgriStar Sonoma
Rovral	iprodione	Iprodione, Nevado
Topsin M	thiophanate methyl	Thiophanate Methyl

2011 NW Wine Grape 'First Friday' Meetings

Sponsored by Parallel 45 Vines & Wines
Info: Jay Briggs, 231-499-0763; Duke Elsner, 231-357-8353
Please note that all meetings to not fall on a Friday this year due to holidays.

May 6
3-5PM
NWMHRS - Leelanau
Topics: Vine training, pruning, tying

June 3
3-5PM
Crane Hill Vineyards - Leelanau
Topics: Shoot thinning, leaf pulling

June 30 ***(Thursday)***
3-5PM
Leorie Vineyard - Old Mission
Topics: Crop estimation

August 5
3-5PM
2 Lads - Old Mission
Topics: MSU cover crop trials

Experimental Winegrape Variety Tasting

Sponsored by MSU Extension
Info: Paolo Sabbatini, 517-355-5191 X1302; Paul Jenkins, 517-648-5099

June 1
1-4:30PM
Spartan Cellars - East Lansing
$20 per person
In 2008, research trials were established in Southwest and Northwest Michigan to evaluate the potential for new winegrape varieties (National NE1020 Project). More than 20 experimental wines were made from these new varieties, and this is the first opportunity to critically examine their potential for commercial production. Please note this is not a consumer event; it is targeted to commercial winemakers and growers.

2011 SW Grape Grower Meetings

Sponsored by MSU Extension
Info: Diane Brown, 269-605-6305

This year, the juice grape and wine grape meetings will be combined, and will feature topics of interest to both groups. RUP recertification credits will be available for the meetings. Registration includes lunch, and is 15.00 per person/meeting, paid in advance, 20.00 paid the day of the meeting. If you prefer to write one check to pay for the three meeting series in advance, the total cost for all three will be 40.00. So we may plan meal counts, please register in advance with Linda Gustafson at the Berrien County MSUE office (269-944-4126). Checks should be made out to Berrien County MSUE and mailed to 1737 Hillandale Rd, Benton Harbor, MI 49022.

May 11
12-3PM
Berrien County MSUE Office
Registration: $15/$20 per person, lunch provided
Topics: Insect management, disease management, chemical and mechanical weed control

June 8
12-3PM
Cronenwett Farms - Lawton
Registration: $15/$20 per person, lunch provided
Topics: Shoot thinning, leaf pulling

July 27
Viticulture Field Day - SWMREC
Topics: To be announced
Info: Tom Zabadal, 269-944-1477

August 10
6-9PM
Dongvillo Vineyards - Berrien
Registration: $15/$20 per person, dinner provided
Topics: Insect management, spray coverage comparisons using UV dye.