Northern Grapes News

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Herbicide Drift – A Strong Defense is Your Best Offense

Michael White, Iowa State University Extension and Outreach Viticulture Specialist

A discussion of herbicide drift into vineyards comes up often when "viners" and/or "winers" get together. These conversations can become very emotional. An underlying theme of these conversations often centers upon the conventional farmer or commercial applicator who really does not care about herbicide drift. My past experience as a sales manager of a large ag dealer working with aerial, farm field and turf application services in Iowa instilled in me a completely different real-world mindset. Following up on herbicide drift calls during my 13-year stint as a regional ISU Extension Agronomist provided even more insight into herbicide drift and showed me that:

photo: Bruce Bordelon, Purdue University

Dicamba injury on a grape cluster. Symptoms include elongated growth, failed blooms, and abnormal fruit set.

1. Commercial applicators *do not* want to deal with herbicide drift complaints. Settling a herbicide drift complaint can be very time consuming and very costly.

2. Out-of-court and in-court settlements typically compensate those drifted upon in excess of the herbicide damage incurred.

3. More *awareness* and *common sense* by the pesticide applicator would probably have eliminated 80% of the herbicide drift cases on which I have consulted.

Which herbicides are problematic? There are many herbicides and/or herbicide combinations that can potentially harm a vineyard. The *big three* that are most commonly found drifting into vineyards seem to be 2,4-D, dicamba (e.g. Banvel), or glyphosate (e.g. Roundup). Brush killers, which are typically composed of one to three phenoxy-type herbicides in combination, would probably come in a strong number *four.* The typical phenoxy-type herbicide(s) found in these brush killers could include 2,4-D, dicamba, MCPA, clopyralid (e.g. Stinger or Transline), triclopyr (Crossbow or Garlon) or picloram (Tordon, Transline, Grazon). These are increasingly becoming more of a problem with vineyards as people spray road ditches, fence lines, rights-of-way and pastures during the heat of the growing season. These phenoxy herbicides all have the potential to volatize into the air after an application.

New herbicide technology. Attention is now being focused on 2,4-D- and dicamba-tolerant soybeans and the potential for off-site herbicide damage. Dow AgroSciences plans to debut their Enlist program for corn in 2013 and for soybeans in 2015. The Enlist program consists of a new 2,4-D choline chemistry which is pre-mixed with glyphosate for genetically-modified, herbicide tolerant corn, soybeans and cotton. The 2,4-D choline chemistry is shown to have 90% less volatility than the conventional 2,4-D low-volatile esters that are commonly used today.

photo: Tim Weigle, Cornell University

2,4-D damage on Baco Noir in western New York. The fan-shaped leaves are almost always seen with 2,4-D damage.

In 2005, Monsanto signed a licensing agreement with the University of Nebraska to produce and market dicamba-tolerant soybeans. BASF Crop Protection is the manufacturer of dicamba. Working together, both BASF and Monsanto plan to introduce separate herbicide programs to be used on dicamba-tolerant soybeans in 2014. BASF will introduce "Engenia," a new low volatile dicamba. Engenia will use BAPMA, N, N-Bis-(aminopropyl) methylamine. BAPMA "is a tridentate amine that provides strong and effective binding of dicamba spray residues." BASF says that it is 40% less volatile than current dicamba formulations. Monsanto plans to offer a Roundup Ready Xtend herbicide program for their Roundup- and dicamba-tolerant soybeans. Monsanto says that the low volatile dicamba & Roundup with a polyplastic polymer in a mix will reduce volatility of the new dicamba by over 90%.

photo: Tim Martinson, Cornell University

Severe glyphosate carryover injury (seen here on Cayuga White from spot applications made under the trellis the previous August) can occur when glyphosate is applied mid-season or later; after the canopy is developed, the herbicide will be translocated into the vine. Glyphosase applications made early in the season or after the vines are dormant is safe.

Some have concerns that the debut of 2,4-D- and dicamba -tolerant soybeans will create a tidal wave of herbicide drift issues with nearby sensitive plants. I do not believe that the use of 2,4-D- and dicamba-tolerant soybeans will create this problem. I think it may well reduce the potential of 2,4-D and/or dicamba drift cases as these new low volatile herbicides are licensed and labeled to replace the more volatile 2,4-D and dicamba formulations currently on the market. I find it difficult to believe that either Dow AgroSciences, BASF Crop Protection, Monsanto, the commercial applicators or the farmer applicators will be interested in using a spray program that increases their liability to herbicide drift lawsuits and settlements.

Protect yourself. Vineyard owners may be best served by being proactive in their defense against herbicide drift. Here are some common sense steps you can use to reduce the potential of herbicides drifting into your vineyards:

1. Register your vineyard location for free on your state's Sensitive Crops or Drift Watch website. Pesticide applicators use these sites to locate potential drift hazards. Most Midwestern states now have this service available through their departments of agriculture.

2. Don't establish a vineyard next to areas where phenoxy herbicides are constantly being applied for broadleaf weed control. Examples could include schools, golf courses, athletic turf areas or cemeteries.

3. Signs. A sign along the road or property fence with the simple word "vineyard" is worth a thousand words.

4. Buffers are good. Shrubs, trees, physical barriers or just distance can all be used to shelter vineyards from nearby herbicide applications.

5. A simple aerial map of your property showing the vineyard location can be shared with neighbors and commercial pesticide applicators to heighten their awareness.

If drift occurs. However, your best defense may not guarantee that pesticide drift will not ever affect your vineyard. Here are some key steps you may want to consider if you are affected by drift:

1. Identify area affected.

2. Document the date, time and growth stage of the grapes.

3. If possible, identify the source of the drift and make a determination if you want to settle the problem between friends or foes.

4. Contact your state department of agriculture ASAP if you cannot determine the source of the drift and/or you want to formalize the complaint (30 - 45 day deadline in many states).

5. Flag both affected and unaffected plants, take high resolution pictures weekly until symptoms subside and measure final yields per plant.

6. Severe injury settlements should be delayed until after next season's harvest. Photo and yield documentation should be continued.

Insurance companies often become involved in pesticide drift settlements. Experience has shown me that the typical insurance adjustor will do everything he or she can to settle as soon as possible. They do not want to increase their administrative cost of carrying over the claim into another season or take that chance of increasing their liability by waiting until the next season to settle. Unless the settlement offered

seems exceptionally lucrative, I would suggest delaying any settlements until after next season's harvest.

Here are some potential sources of technical support if you find that you need an experienced consultant to support your case:

1. University weed specialist
2. State crop consultant association
3. National Alliance of Independent Crop Consultants
4. National Association of Insurance Adjusters
5. State horticulture or nursery & landscape associations
6. Experienced vineyard managers
7. State arborist association
8. American Association of Agronomy Certified Crop Advisor or Certified Professional Agronomist
9. Online search for "pesticide drift consultant"

On a final note, remember that pesticide spray drift can travel both into and out of a vineyard. Most vineyard operators follow a very intensive pesticide spray schedule. Vineyard operators should also be practicing good pesticide sprayer husbandry.

Additional Resources

1. *Effective Vineyard Spraying*, 260 page book by Dr. Andrew Landers of Cornell University, approximately $66 delivered by mail: http://www.effectivespraying.com/

2. *Protecting Pesticide Sensitive Crops*, University of Nebraska publication G2179: http://www.ianrpubs.unl.edu/epublic/live/g2179/build/g2179.pdf

3. *Protecting Oklahoma's Vineyards from Phenoxy (Hormone) Herbicide Effects*, Oklahoma Dept. of Agriculture: http://www.oda.state.ok.us/forms/cps/grapebroc.pdf

4. EPA's *Pesticide Registration (PR) Notice 2001-X Draft: Spray and Dust Drift Label Statements for Pesticide Products:* http://www.epa.gov/PR_Notices/prdraft-spraydrift801.htm

5. *Leaf Index and Severity Rating for Phenoxy Herbicide Damage to Grapes,* Washington State University Extension: http://feql.wsu.edu/eb/index.htm#/EB/se5.jpg

NGP Team Profile: Patricia McManus

Patty is a professor in the Department of Plant Pathology UW-Madison, where her work focuses on the etiology and integrated management of diseases of fruit crops important to the economy of Wisconsin. Patty is a member of the vineyard studies team on the Northern Grapes Project.

1. How did your interest in plant pathology develop?
It began with my love for nature and biology, which my mother nurtured by taking us kids into the woods to identify wildflowers and see what was lurking under wet logs. A turning point came in 5th grade, when the teacher dumped a bucketful of cows' eyes onto the table and told us to start dissecting. I nearly puked and knew at that moment that I would never be a physician or any kind of animal biologist. So, I got a BS degree in botany, but I was also interested in microbiology. Plant pathology is the happy marriage of those two disciplines, and it focuses on economically important problems, which is important to me. My MS research was on water movement in chestnut trees afflicted with chestnut blight, and my PhD research was on fire blight of apple trees.

2. You've worked on a variety of fruit crops during your career at the University of Wisconsin. What do you find most exciting about working with grapes, which are a relatively new crop for you?
In Wisconsin we are lucky to have a core group of county-based Extension agents who are passionate about grapes, even though they have major responsibilities for soybeans, corn, and cows, which are the current "staples" of Wisconsin agriculture. I am very excited to have such talented, motivated collaborators within Wisconsin as well as across states with the Northern Grapes Project.

3. What do you find most challenging about working with grapes?
The community of grape researchers worldwide is huge compared to some other crops I work on (e.g., cranberry, tart cherry). While it's great to have access to all this knowledge and expertise, the challenge will be to find a productive research niche where we can develop knowledge that is useful to growers but that is also novel and exciting from a scientific standpoint. This will be essential for obtaining grant dollars. So if anyone out there has some cool ideas, let me know!

4. Part of your work on the Northern Grapes Project involves sensitivity to copper- and sulfur-based fungicides. Even though you only have one year of data in-hand, do you have any interesting observations to share?
I hesitate to say much with only the 2012 season under our belt, especially considering how unusual the weather was in spring and summer of 2012. But one thing of note is that in Wisconsin we saw more phytotoxicity with copper than sulfur, but in New York it appears the reverse happened. Likewise, in Wisconsin there were some pretty striking differences among varieties, but this was not so pronounced in New York. We knew coming into this that environment and weather are very important factors in phytotoxicity, and this is why we will need more years of research conducted over multiple locations to draw sound conclusions.

5. In your opinion, what is the most exciting research-based information that will come out of the Northern Grapes Project?
This is a hard question! Our project is truly integrated, with many interdependent parts. As I biologist, I should probably comment on something directly related to crop or wine production. I do think finding the best trellising system will be very important for growers to consistently produce high-quality fruit. But actually, I think research into the economic viability of northern grapes and building sustainable businesses might, in the end, yield the most exciting results. We biologists can fine-tune production systems till the cows come home, but unless people can make money selling northern grapes and wine produced from northern grapes, our efforts will have been in vain!

NGP Team Profile: Rebecca Harbut

Rebecca is an assistant professor in the Department of Horticulture at UW-Madison. Her research and extension program in fruit crops is focused on fruit quality and production practices. She works closely with commercial fruit producers across the state. Her role in the Northern Grapes Project is to conduct research on crop load management and training systems.

1. You mentioned that you grew up as a "city kid" in Vancouver, B.C. How did you find your way to a career in fruit horticulture?
I started my college career in human kinesiology with plans to be a physical therapist. During my first two years I had two important experiences that changed that trajectory: one was doing an internship at a physical therapy clinic and the second was volunteering with the Horticultural Therapy program at Vancouver General Hospital. I came to the realization that I loved working with plants and that they often play an important role in human well-being. I changed my major to plant science and did a research internship with a professor working on fruit crops. That was all it took…I was hooked! Since then I have continued to conduct research in fruit cropping systems and plant physiology.

2. As the Fruit Extension Specialist for the University of Wisconsin-Madison, you have responsibility for all fruit crops throughout the entire state. Do you focus more on some crops than others?
Wisconsin is the largest cranberry producing state and produces over 60% of the nation's cranberry crop. As a result, I do spend the majority of my time working with the cranberry industry. My research program has been focused on improving water use efficiency as well as conducting research on flower bud development and regulation. I also do research on high tunnel raspberry production with a focus on organic nutrient management and hold several field days and workshops for the berry growers in the state. While I do not currently conduct research in tree fruits, I have an active extension program that serves the tree fruit industry across the state with workshops, field days and demonstration trials. Needless to say, we do not have a many boring days in our lab!

3. What have you enjoyed most about working with the relatively new grape industry in Wisconsin?
Working with the grape industry in Wisconsin has been a wonderful experience and I have greatly appreciated their support and enthusiasm in partnering with me to build the research program. There are many things that I enjoy about working with the industry, but the one thing that sticks out

the most is the people! Many of our growers come from very diverse backgrounds (dairy farmers, lawyers, graphic artists, etc.) they are an extremely interesting group and bring unique perspectives when addressing challenges and developing strategies for the future and their excitement and passion for grapes and wine is infectious! It has wonderful to have the opportunity to participate in the development of this new industry in Wisconsin.

In addition to working with the great individuals involved in the industry, as a scientist, it is very fun to be part of the early stages of building an understanding of the basic physiology and biochemistry of these cold hardy grapes and how they respond to the environment.

4. What have been the biggest challenges about working with a crop that is so new to the state?
As an extension specialist, the biggest challenge is helping people make decisions on their vineyard when there are still so many unknowns about these cold hardy grapes. I have such great respect for the 'pioneers' of cold climate grape production that have established vineyards and wineries all over Wisconsin and have played such a critical role in developing the industry.

5. In your opinion, what is the most exciting research-based information that will come out of the Northern Grapes Project?
I think that the most exciting thing about the Northern Grapes project is the amount of integration from field to bottle. I am very excited about developing a comprehensive understanding of how management techniques in the vineyard can be optimized to manipulate berry composition and the influence those field practices have on the final product.

VitisGen: Mapping the Way to the Next Generation of Grapes

Elizabeth Takacs and Hans Walter-Peterson, Cornell University

The *VitisGen* Project was launched in September 2011 after being awarded a five-year grant by the USDA-NIFA Specialty Crops Research Initiative. The *VitisGen* project is a collaborative effort among 11 research institutions* and is supported by an Industry Advisory Panel with 25 grape growers, winemakers, processor representatives and others from private industry.

The vision for the *VitisGen* Project has four primary elements:

- To identify high priority vine performance and fruit quality traits with documented economic value to the grape industry and to the consumer;
- To discover, identify, and improve high priority traits using both traditional and modern biological approaches;
- To implement this strategy through development of molecular trait markers and improved grape varieties; and
- To enhance communication regarding the value of improved knowledge of grape genomics, new varieties, new technologies, and evolving needs of the grape industry and consumers.

So what does all of that really mean? In a nutshell, we are trying to develop new genetic markers that are closely associated with certain traits such as powdery mildew resistance, low temperature responses, and various fruit quality characteristics. The genetic markers can be used to identify or select plants as seedlings that have these high priority traits. This will help to speed up the breeding and evaluation process, so these traits can get incorporated into new grape varieties more quickly, benefiting both consumers and the grape industry.

Project Leadership. The *VitisGen* Project is headed by a five-member Executive Committee, each of whom leads one of five project teams. The **Breeding Team** is led by Dr. Bruce Reisch of Cornell University and includes nine breeders from

Glossary

Genetic markers: pieces of DNA with a known location on a chromosome

Molecular-trait markers: genetic markers linked to traits of interest

Genomics: the study of genomes or an organism's complete hereditary information

Genotype: the genetic make-up of an organism

Genotyping-by-sequencing (GBS): a new technology used to analyze an organism's DNA

Phenotype: the observable characteristics of an individual organism

Progeny: offspring

Mapping population: a group of related organisms used to construct a genetic map

around the country (California, South Dakota, Missouri, Minnesota, Florida, and New York). The major roles of this team are to maintain the plants that make up the *VitisGen* mapping populations and to provide this plant material to the Genetics Team, which is responsible for the genetic analysis of the plants, and to the Trait Evaluation Team, who evaluate plants with those potential markers for the traits in which we are interested. Altogether, 12 *Vitis* species are represented in the populations maintained by the breeding team. In the project's first year, the breeding team submitted a combined total of more than 7,000 samples to the Genetics and Trait Evaluation Teams. Locally, breeders are also evaluating traits such as flower type; flowering time; resistance to fungal diseases, foliar phylloxera, and nematodes; and several fruit attributes (e.g., berry size, berry shape, berry color, skin color, and seedlessness).

The Trait Evaluation Team is led by Dr. Anne Fennell of South Dakota State University. The team established three "centers," or sets of scientists in different locations, to evaluate the mapping populations for low temperature responses, powdery mildew resistance, and fruit quality. The group focused on low temperature responses is based in South Dakota, and measures freezing tolerance, chilling fulfillment, and the rate of budbreak.

The powdery mildew center is based at Cornell. This group maintains a genetically diverse collection of grape powdery mildew populations and looks at how effective plants with different genetic profiles are at preventing fungal infection.

Grape varieties that can resist disease and tolerate cold weather often have undesirable aromas and flavors. The scientists at the fruit quality center, also based at Cornell University, are working on how characteristics like negative aroma and flavor compounds, organic acids, and other undesirable characteristics in fruit are influenced by genetics.

The Genetics Team is led by Dr. Lance Cadle-Davidson of the USDA-ARS Grape Genetics Research Unit and centered at Cornell University. This group is able to take advantage of advanced laboratory and computational facilities such as the Cornell University Life Sciences Core Laboratories Center, the Institute for Genomic Diversity, and the Cornell University Computational Biology Service Unit. The Genetics Team includes molecular biologists, plant geneticists, and computational biologists, and is trying to discover new genetic markers that are closely associated with certain traits using a new technology called genotyping-by-sequencing (GBS). In just the first year of the project, the Genetics Team processed 7,200 GBS samples, generating more than one billion data points. In addition to generating this large amount of data for new markers, the genetics team also generated data for markers already known to be associated with traits that breeders were using. This data set was returned to breeders and is already being used to improve the speed and efficiency in grape breeding programs.

The Trait Economics Team is lead by Dr. Julian Alston of the University of California, Davis. Their main focus is to identify top priority traits and document their value. To accomplish this, the trait economics team is conducting research on the value of disease resistance in viticulture and developing surveys for grape breeders, growers, industry, and consumers. Thus far, the research has concentrated on powdery mildew disease resistance. Determining the value of powdery mildew resistance in viticulture is twofold. First, the prevalence of powdery mildew across different segments of industry and the country must be identified. Second, the consequences in terms of yield losses, investment in preventative efforts, or other costs imposed are determined. The first *VitisGen* survey was aimed toward identifying grape breeder's perceived priorities in grape genetics research. Future surveys are being developed for grape growers, industry members, and consumers.

The Extension and Outreach Team is led by Hans Walter-Peterson from Cornell Cooperative Extension. This team is responsible for educating consumers and the industry about the project and the benefits that this work will have for both the industry and consumers. So far, the group has been working with a small team to develop materials for the project, including a logo and project brochure, and is working on a new website for the project as well. In the near future, the group will be developing more materials highlighting certain aspects and accomplishments of the project, including online videos, webinars, newsletters, and more.

photo: Elizabeth Takacs, Cornell University

Steve Luce (left) and Bruce Reish of Cornell University harvest leaft samples from grape seedlings to submit to the genotyping center. The goal is to identify plants with genetic markers linked to powdery mildew resistance.

How do all five of the teams work together? The breeding, trait evaluation, and genetics teams function together as a research and development unit. The phenotypic and genotypic data are integrated to generate new trait-associated markers. Breeders use these markers to screen progeny and discard those that don't have the desired trait(s). This reduces the overall costs related to vineyard establishment and vine evaluation. The trait economics team identifies top priority traits through breeder, grower, industry, and consumer surveys, which help to steer the focus of the research and development unit. The extension and outreach team communicates with industry and consumers to provide education about new technologies and genomic resources. Overseeing the entire project is an Industry Advisory Panel, which provides guidance and non-federal matching funds to support the *VitisGen* project. This type of collaborative effort will result in the development of new tools and techniques that will lead the way in developing the next generation of grape cultivars.

**The 11 research institutions involved in VitisGen are: Cornell University, USDA-ARS, University of Minnesota, South Dakota State University, Florida A&M University, University of Missouri, University of California Davis, Oklahoma State University, Oklahoma City University, Mississippi State University, Nova Scotia Agricultural College*

Farming for Flavors: Understanding Genetics Underlying Maturity and Flavor Development

Anne Fennell, South Dakota State University

What are cold climate wine grapes? They are complex hybrids derived from *Vitis vinifera* and several native North American species including *V. aestivalis*, *V. labrusca*, *V. riparia*, and *V. rupestris,* with *V. riparia* generally introduced more recently in their lineage. They are cosmopolitan grapevines; a look at their background will show familiar cultivar names, old cultivars that are no longer popular and numbered selections from European and North American breeding programs. The unique ability of cultivars such as Frontenac and Marquette to withstand extreme low winter temperatures is due to the *V. riparia* parentage. However, other species in their backgrounds also contribute many traits that determine their character.

Cold climate cultivars are new. We are only beginning to appreciate and refine the wine potential of the cold climate cultivars and we have many unanswered questions about their diverse fruit characteristics. What are the flavors and attributes that are signatures of the individual cultivars? Can we define optimum parameters for maturity, flavor and ripeness? Is it possible to maximize flavors without excessive sugar or acidity? What is the basis (chemical and genetic) of these characters and can we use the information to help make harvest, cultural and breeding decisions? These are challenging questions and fortunately we have new and evolving tools that can be used to provide insights and answers.

Measures of fruit quality. Currently, sugar content (based on soluble solids estimated as °Brix), pH, and total or titratable acidity (TA) are basic measures used to monitor fruit ripening and maturation. These indices are only weakly correlated with flavor maturation, which can be quite variable across cultivars. Also, the pulp of the grape berry is the biggest contributor to the °Brix, pH, and TA measurements, even though the skin and seeds provide pigments, tannins, and aroma components that are highly important to the grape flavor and ultimately, the character of the wine. The vast number of changes that occur in skin, seeds, and pulp during the ripening process have been extensively studied in traditional *V. vinifera* cultivars. Therefore, we know that different cultivars and tissues have distinct molecular profiles, affecting fruit flavor, aroma, phenolics, and anthocyanins. However, we have very little information about fruit chemical composition and the ripening process in the complex hybrids, native species, and new cold climate cultivars; therefore, we are using new tools and approaches to learn more about these processes in Frontenac and Marquette.

photo: Jacek Koziel, Iowa State University

A Marquette cluster in encolosed polyvinyl film (Tedlar) bag with stainless steel cage. Volatile compounds are collected through the solid phase microextraction (SPME) port and are taken to the laboratory for analysis.

Advances in science. For the first time, we have the capability to determine which genes in the plant's DNA are turned on and what they are producing. The development of high throughput gene expression (identifying which genes are turned on) and chemical compound analyses allows us to identify and measure the expression of thousands of genes and hundreds to thousands of compounds simultaneously from berry skin and flesh. Using these technologies, teams from the Fennell (SDSU), Hegeman (UMN), Koziel (ISU) and Vickers (UMN) laboratories are analyzing samples of Frontenac and Marquette from veraison to harvest. Grape berries are collected from NE1020 vineyards in Iowa and South Dakota at several time points and fruit samples are distributed to the various laboratories. In the participating labs, graduate and undergraduate students will conduct studies that will link berry tissue gene expression (Vedbar Khadka, SDSU) with minor and major metabolites (e.g., anthocyanins, amino acids, organic acids, phenolics, tannins, and antioxidants) (Somchai Rice, ISU and Soon Li Teh, UMN), and relating them to sensory changes (Emily Del Bel, UMN) during the ripening period to identify key fruit ripening factors.

What are the technologies that provide this opportunity? In 2007, the grapevine genome sequence was released; it was the first fruit crop and fourth plant genome to be sequenced. Currently ~22,000 of the 29,000 total genes have been annotated with a "known" function. Of these, over 13,000 were integrated into molecular networks thereby defining the chemical and regulatory functions within the grapevine. Therefore, we can take grape berry pulp, seeds, and skins at different stages of ripening, determine which genes are turned on and what they are making at that point in time. This allows us to begin to understand the chemical pathways involved in the ripening process as we compare results across the various ripening stages.

photo: Somchai Rice, Iowa State University

Jason Vallone, a senior chemistsry student at Iowa State University, analyses in vivo gas emissions from Frontenac grape clusters at 24º Brix using simultaneous chemical and sensory analysis.

At the same time, we are extracting non-volatile compounds from grape berry skin and pulp samples and are separating, identifying, and quantifying them using a technique called liquid chromatography-mass spectrometry. Grape clusters also contain volatile chemicals that contribute to aroma. These volatile compounds are captured from the grape cluster throughout ripening and are subjected to simultaneous chemical and sensory analysis using gas chromatography mass spectrometry-olfactometry. By identifying these compounds that change in concert during maturation and ripening stages, we hope to pinpoint molecular events key to the development of fruit flavor and aroma characters. These instrumental analyses will be linked with sensory analysis of the similar berry samples. This comprehensive approach will help us establish baseline gene, metabolite, volatile aroma and sensory components that define the signature characteristics of ripeness in Frontenac and Marquette. All of this information can then be used as biomarkers for stages of berry maturity, negative and positive fruit characters and optimal ripening characters.

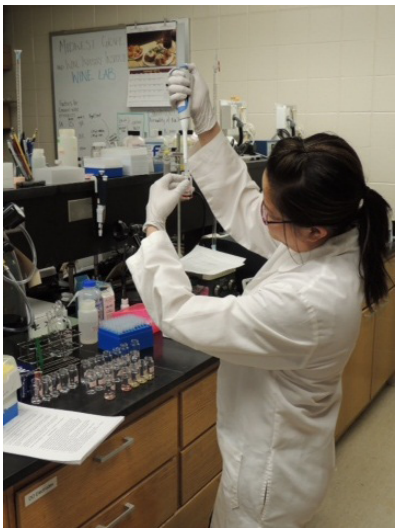

photo: Jennifer Savits, Iowa State University

Somchai Rice is quantifying polymeric pigments and tannins from Marquette and Frontenac skin and seeds at veraison and harvest. Somchai is a PhD student at Iowa State University.

Vision for the future. The information we generate from this research will provide viticultural science with new baseline information on the genetic and molecular basis of fruit composition. From a practical standpoint, the information will identify biomarkers (genes, metabolites or proteins) that can be used to 1) track fruit maturity and ripeness to support harvest and winemaking decisions; 2) identify the impact of vineyard cultural practices on fruit quality; and 3) help select high quality cultivars in ongoing breeding programs. All of the approaches we are using to identify and track berry ripening development and to identify timing and development of flavor composition and its genetic basis will allow growers and wineries to more fully exploit the genetic potential of the cold climate cultivars. In addition, these new fruit maturity parameters will be useful for developing new equipment to use in addition to the refractometer and pH meter for tracking berry ripeness.

The Northern Grapes Project is on Facebook!

We post updates about workshops, field days, webinars, newsletters, and more!

Upcoming Events

What: Minnesota Grape Growers Association Cold Climate Conference
When: 2/21/13 to 2/23/13
Where: Crowne Plaza St Paul Riverfront- St Paul, MN

What: 16th Nebraska Winery and Grape Growers Conference
When: 2/28/13 to 3/2/13
Where: Holiday Inn, Kearney, NE

What: Iowa Wine Growers Association Annual Conference
When: 3/14/13 to 3/16/13
Where: West Des Moines Mariott

What: South Dakota Specialty Producers Association Annual Meeting
When: **3/18/13**
Where: Spearfish Canyon Lodge
*contact Rhoda Burrows for more information (605-394-2236)

What: University of Minnesota Winemaker Roundtables
When: March 18, March 25, April 8, and April 29
Where: Various locations, see link for more information
** roundtables are aimed at wine-makers currently working for bonded wineries in Minnesota*

Cornell University

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eViticulture.org is the national online viticulture resource containing the latest science-based information for viticulturists.

Visit us on-line at **www.northerngrapesproject.org**

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