NORTHERN GRAPES PROJECT

Viticulture, enology and marketing for cold-hardy grapes

Northern Grapes News

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Does Production Region Matter?

Bill Gartner, University of Minnesota

In the world of wine, there are so many varietal wines, proprietary blends, producers, and places of origin to choose from that many consumers simplify their choice criteria. Maybe they concentrate on a particular grape cultivar or have a favorite producer, while others choose wines in a certain price point. For producers interested in branding their wine, it is important to know how their customers choose the wine they purchase. Perhaps of more importance, however, is knowing what potential customers focus on when making a wine selection. To help answer some of these questions, a wine branding study was conducted in February 2014 as part of the *Northern Grapes Project.*

Study location. The venue for the study was the Hotel ICON in Hong Kong, which is a boutique property owned by the Hong Kong Poly University and home to the School of Hotel and Tourism Management. The hotel itself is operated by an executive team with extensive hotel management experience, and has received many awards and high marks on sites such as Trip Advisor. It was deemed a good place to encounter sufficient upscale taste testers for a wine assessment study; the sample population for this study therefore consisted of Hotel ICON clients and a few professors from the school.

Study design. The study was constructed to examine the acceptance of cold-hardy wines produced in the northern United States against some *vinifera* wines produced in more traditional wine regions. Three reds and three whites were obtained and subjected to testing (see chart 1), with one cold-hardy red (a Marquette from Wisconsin) and one cold-hardy white (a Brianna from Iowa).

The first 200 taste testers were given no information regarding the wines they were sampling. They were simply asked to taste the wines and rate them in order of preference. Once the baseline rankings were obtained, another 200 participants tasted all six wines, but before doing so, they were told where each wine was produced. Finally, a third set of 200 tasters were asked to evaluate the wines, but this time they were told where the wines were produced and a little bit about each grape cultivar prior to tasting.

In order to determine acceptance of each wine, we asked each taster to tell us how much they would be willing to pay to purchase the wine, and what characteristics they used to base their choice. Tasters were given seven attributes and asked to rate them on a seven-point Likert type scale with 1 being 'Very Undesirable' and 7 being 'Very Desirable.' The scores in Table 1 are an average across all scored attributes. Using a Willingness to Pay Hedonic Price Model, we found that those who valued body and mouth feel, as well as flavor and finish, were willing to pay significantly more for a wine that ranked highly for these characteristics. Younger consumers were also willing to pay more for their preferred wine as were females when compared to males. We also found that Asian consumers were willing to pay more for wine than tasters from other parts of the world.

The research team, including NGP team member Bill Gartner (fourth from left), and colleagues celebrate at a Hong Kong restaurant at the end of the study.

In This Issue:

Findings. What was most meaningful, in terms of the *Northern Grapes Project*, was the finding that when tasters were told where the wines were produced prior to tasting, the Iowa (Brianna) and Wisconsin (Marquette) wines were rated significantly lower than they were when tasters did not know place of origin. Also of interest, wines from Argentina were similarly ranked lower when origin was revealed. The characteristics that tasters valued (e.g. mouth feel, aftertaste, etc.) did not seem to matter that much when region of origin was known. In the third round, when tasters knew the grape variety prior to tasting, it did not seem to further affect the rankings. To summarize: Production location does matter!

Branding. What do these results tell us about branding cold-hardy wines? First, the outcome for Argentina is interesting because it tells us that wines from this country do not command high brand acceptance that would translate into increased expenditures by consumers. The country is a big wine producer and has a large variety of wines, from the bargain variety to high-end, high-priced bottles. Its most well-known wines come from the Mendoza region. But in the minds of the consumers who took part in this study, it appears the bargain wines dominate and have lowered the overall perception of quality for the entire country's producers. In brand equity terms, we refer to wines from Argentina as having carved out a value dimension. In the context of brand equity, value is just one dimension along with awareness, image, loyalty and quality, but it is often the one relied upon when the other dimensions are unfavorable when compared to competitors. But a value dimension is not what we have in the *Northern Grapes* region, as high production costs mean wines cannot be sold at a value price to compete against the likes of Australian wine. Therefore, we must work at carving out a different, higher-quality brand dimension for cold-hardy wines. The results of this study tell us that cold-hardy wines produced in the northern US are not as highly valued as those from other parts of the world. So what do we do?

If the goal of cold-hardy wine producers is to expand their market, their first order of business should be to work diligently to brand their particular line of wines. But almost in concert, work should commence on marketing the region where the grapes are sourced and the wines produced. There are characteristics of any viticulture area that give a wine its uniqueness. Those characteristics need to be emphasized in the marketing material produced by individual producers as well as state associations. Competition is also a good thing, as more cold-hardy wines are winning awards, even in competitions that include *vinifera* wines. As awards pile up, awareness and recognition on the part of new consumers will follow. However, the importance of production region should be recognized as contributing to the quality of the wine. A *Northern Grapes* winery owner has the task of helping customers navigate through the maze of wines available for purchase, but that should not be the end of the educational journey. Each wine has a particular story behind it. The winemaker is obviously instrumental in giving a wine its appeal, but the grapes that were used had to come from somewhere. That is also part of the story.

Table 1. *Average attribute rating scores obtained during a wine branding study conducted at the Hotel ICON in Hong Kong in February 2104.*

Wine	Tasting Group*	Mean	Number of tasters	Standard Deviation
Chardonnay, South Africa	1	4.029	206	2.193
	2	3.796	196	2.195
	3	3.868	197	2.066
	Total	3.9	599	2.151
Brianna, USA (Iowa)	1	4.675	206	2.558
	2	3.612	196	2.36
	3	3.662	198	2.583
	Total	3.993	600	2.548
Riesling, Germany	1	4.755	200	2.42
	2	3.952	189	2.305
	3	4.13	193	2.302
	Total	4.287	582	2.366
All White	1	4.032	585	2.482
	2	3.51	545	2.346
	3	3.604	570	2.34
	Total	3.721	1700	2.401
Tempranillo, Spain	1	3.945	200	2.39
	2	3.878	188	2.514
	3	3.784	190	2.266
	Total	3.87	578	2.388
Marquette, USA (Wisconsin)	1	3.874	191	2.541
	2	2.95	179	2.051
	3	3.344	189	2.26
	Total	3.399	559	2.325
Malbec, Argentina	1	4.278	194	2.511
	2	3.685	178	2.349
	3	3.681	191	2.475
	Total	3.888	563	2.46
All Red	1	4.484	612	2.413
	2	3.785	581	2.288
	3	3.884	588	2.331
	Total	4.058	1781	2.365
Overall	1	4.263	1197	2.456
	2	3.652	1126	2.319
	3	3.746	1158	2.339
	Total	3.893	3481	2.388

** The first group did not have any information about the wines prior to tasting, the second group were told where the wines were produced prior to tasting, and the third group was told where the wines were produced and a little about each grape prior to tasting.*

Further research. We will be repeating the 2014 study this year at the Oregon Wine Experience in mid-August, and will test a cold-hardy white wine and a cold-hardy red wine against wines produced in Washington and California. The tasters will be more similar to the customers one will likely encounter in a winery selling cold-hardy wines. Will they also value production region? Our guess is that they will, and if they do, this lends more credence to the argument that region does matter when branding and marketing cold-hardy wine.

NGP Team Profile: Mike White

Mike is a viticulture specialist with Iowa State University Extension and Outreach and a team member of the Midwest Grape & Wine Industry Institute. He provides technical assistance and educational training to vineyards and wineries in Iowa and neighboring states and has been working with the cold climate winegrape industry since 2000. His role in the Northern Grapes Project has been to assist with educational extension and communications with the project.

1. Your background is in forestry and agronomy. What initially drew you to forestry as a college major?
I think it was my formative teenager years when visiting the forested areas of Minnesota, Colorado and Montana. I really enjoyed these areas along with the hunting, fishing and hiking that went along with them. I also think I just wanted to get out of Iowa, live on a mountain and eat "Grape Nuts" like Euell Gibbons. (Note: for those of you under 50, just Google "Euell Gibbons.")

The wrench in the plan came when I graduated from ISU with a B.S. in Forestry and minor in Agronomy. My wife, now of 38 years, informed me that I was staying in Iowa. I quickly changed the plan and hooked up with the then Soil Conservation Service (now NRCS) in Iowa for about five years before changing my path and becoming a full-time agronomy salesman. I then continued my agronomy career while obtaining a Masters of Agriculture degree at ISU in 1989 and began my ISU Extension career in 1994.

2. When and how did you start working with grapes?
This grape gig started back in about February of 2000 when Ron Mark of Summerset Winery (located approximately four miles north of my home) asked if ISU Extension could help him put some grape grower meetings on at his winery. He needed grape growers to supply him with grapes. At the time, Iowa had 13 wineries, of which only two were wineries with vineyards making predominately grape wines. My extension supervisor at the time allowed me to work with Ron as long as it did not affect my day job in agronomy. The end result was three years of monthly viticulture meetings at Summerset Winery with large audiences from all over the state attending. We borrowed heavily on the expertise of people in other states during those three years.

The industry grew rapidly. By 2002 ISU Extension allowed me to carry two titles: Area Crops Specialist and Iowa Viticulture Specialist with no increase in pay. It was not until 2007 that I started to work only with vineyards and wineries. Iowa now has 100 wineries and 315+ vineyards covering 1,250+ acres. We have come a long way!

3. You spent several years working in agricultural sales prior to taking a job as an Extension Agronomist with Iowa State. What do you think is most similar about extension and sales?
Many folks do not like "sales" because it makes them think of a "peddler." Peddlers sell their goods and then move on. There is no service after the sale. A true salesperson fills a need, sells a product and services that product after the sale. There is an old sales axiom that rings universally true "nothing ever happens until the sale is made." I enjoy sales and I think it is an honorable profession! A big part of my extension job is to sell a service that makes things happen. My sales experience has helped me be successful in my extension career.

4. What do you like most about working with vineyard and winery owners?
As a group, vine/wine folks are completely different than farmers. Most farmers tend to come from similar backgrounds here in Iowa. They tend to think alike, complain alike, and look at each other to do things alike. Not true for vine/wine folks. Vine/wine folks come from all walks of life, are often not native to the area and typically are successful people with higher educations and incomes. There is no run-of-mill vine/wine person. Variety is the spice of life. It is a lot of fun working with them. I learn from them as much as they learn from me.

5. In your opinion, what is the most exciting research-based information that will come out of the *Northern Grapes Project*?
I think all the information of the *Northern Grapes Project* is exciting. Whether it be marketing, viticulture or enology - very hard to divide them up. The two most exciting aspects of the *Northern Grapes Project* to me are: (1)The multistate working relationships that have been formed amongst our clients, researchers and extension staff and (2) The webinars and WWW presence we have to share all the information now and into the future.

NGP Team Profile: Paul Read

Paul is a Professor in the Department of Agronomy and Horticulture at University of Nebraska. He joined the deparment as chair in January 1987 and resumed the role of professor of Horticulture and Viticulture in July 1997. His current research interests are in tissue culture for horticulture crop improvement and on vineyard management issues in support of Nebraska's developing grape and wine industry.

1. What sparked your interest in extension agriculture and horticulture?
A combination of experiences contributed to my interest in horticulture, including growing up on a mixed crops and dairy farm in the Finger Lakes region of New York. As the youngest of three boys, I often was assigned to tend the garden while the "big boys" (my older brothers) helped my father with the "real work" of haying, crop management, and such. Ultimately, I took pride in what was growing in the garden and exhibited various vegetables in the County Fair 4-H competitions. Another huge factor in my horticulture development was having the opportunity to serve as a Teaching Assistant in horticulture classes at Cornell, both during my undergraduate days and while pursuing my Master's degree, also at Cornell. Professors Art Pratt and Ray Sheldrake (during my B.S and M.S., respectively) both encouraged and inspired me in many ways, ideas and inspiration that I still use in teaching my classes at the University of Nebraska today.

2. You spent much of your early career in horticulture working in plant propagation and tissue culture. What prompted the move into viticulture?
I had been working with woody plant tissue culture, including grapes, and of course growing up in the Finger Lakes region, perhaps it was fulfilling my destiny. More importantly, the modern grape and wine industry in Nebraska was just emerging and the potential to be part of this exciting growth industry really piqued my interest. The opportunity to serve a need, that is, to serve as the resource person for Nebraska's developing grape and wine industry stimulated me to change research direction. It also gave me a chance to get back to my extension roots, while conducting applied research that could really make a difference.

3. How did the time you spent on a Faculty Development Leave in Australia influence your viticulture research in Nebraska?
It greatly expanded my viticulture and wine I.Q. I had the opportunity to work with Rob Walker, Peter Klingeleffer and George Kerridge at the CSIRO Horticulture research station near Merbein in northwest Victoria's "Sunraysia" region, which produces a large amount of Australia's Shiraz and Chardonnay grapes. These gentlemen were great examples of the forward thinking Australian grape and wine industry's research focus that led the Australian industry to gain a significant share of the United States wine market. I worked in CSIRO's vineyards on several research projects and learned a great deal as I worked – it was almost as though I was back as a graduate student again, a wonderful opportunity.

4. You've had the chance to work with the Nebraska grape and wine industry from the start. What are the major challenges and opportunities of this industry, and how has it changed (or not) over the years?
Some of the challenges are those faced by the industry in many parts of the world, such as black rot, downy and powdery mildew, phomopsis, botrytis and other biotic factors. In addition, the continental climate exacerbates the cold weather challenges, with the roller coaster ride that takes place in the fall and spring, not to mention mid-winter temperature swings and absolute cold temperatures. Early bud break is a continuing problem and development of cultivars with delayed bud break and research to study techniques that can be employed to delay bud break are ongoing. The search for grape cultivars that will produce a quality red wine continues, although our white wines are world class, in my opinion. Marketing will continue to be an ongoing challenge as our growers produce more and better quality grapes and our winemakers become more adept at crafting them into exceptional wines.

5. In your opinion, what is the most exciting research-based information that will come out of the *Northern Grapes Project*?
That's a tough question. It will be important to develop better vineyard management strategies and winemaking practices, which will enhance our ability to make the most exciting high-quality wines from the current list of cold-climate grape cultivars. In some cases, exciting new niches are being explored such as fortified wines, sparkling wines and Rosé wines. The *Northern Grapes Project* is a contributing factor as we find the best way to grow and vinify cold climate grape cultivars, especially high acid cultivars such as Frontenac. Adapting cultivars to the best trellis systems for a particular location is another success story, in my opinion. Helping growers grow better grapes and winemakers produce better wines is happening because of the *Northern Grapes Project*, and awakening the wine consuming public to these great wine values is exciting indeed.

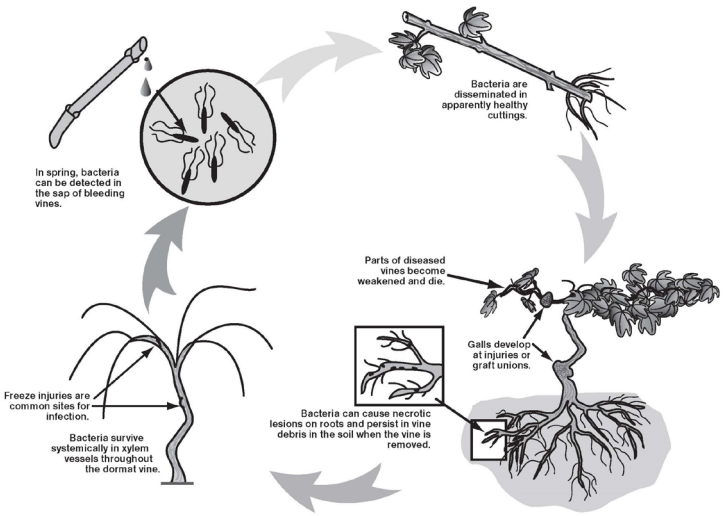
I Have Galls in my Vineyard: Should I Call my Nursery?

Tim Martinson and Tom Burr, Cornell University
Reprinted from *Appellation Cornell* Issue 21, May 2015

After two back-to-back winters with extreme winter low temperatures, many grape growers are seeing trunk injury affecting the phloem, xylem, and cambium layers just under the bark tissue. As the vine starts to repair and regenerate these injured tissues, growers will inevitably see more galls forming in their vineyards due to the presence of *Agrobacterium vitis* (the bacterium that causes crown gall), and environmental conditions that trigger gall formation. Are nurseries to blame for spreading this bacterium? If so, why haven't they eliminated it?

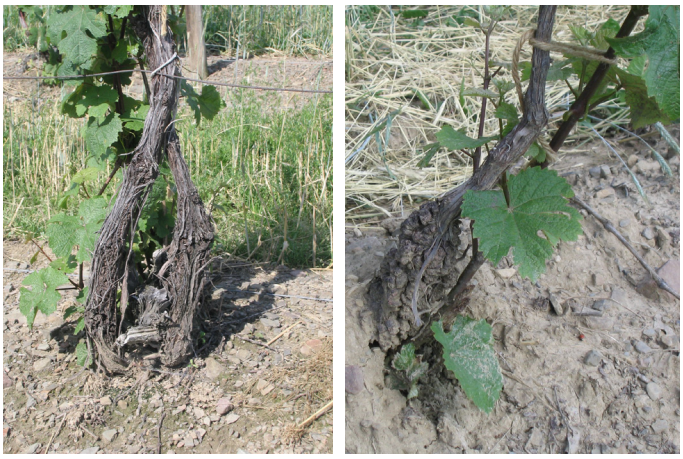
What to expect. In the spring, the vascular system in vines reconnects from shoot tips downward through the trunks, reactivating the vascular cambium and generating new xylem and phloem tissue. Expect to see galls forming from bloom through mid-summer.

How *A. vitis* forms galls. The *A. vitis* bacterium can survive in xylem tissue and grapevine roots in the soil for years without causing galls. The gall-forming process begins when the bacterium transfers an element of its DNA into the plant. This generally occurs in actively dividing cells at wound sites, where callus tissue is forming to repair damaged tissue. The DNA transferred to these callus cells from the bacterium is expressed and causes the tissue to form galls instead of organized conductive tissues (e.g. phloem, cambium, and xylem tissues) to repair the injury.



The disease cycle of Agrobacterium vitis.

Crown gall and planting material. *A. vitis* can remain present (but hidden) in grapevines for many years without galls being formed. Since gall-formation is triggered mainly in damaged tissue in response to cold injury or in graft unions (where tissue is intentionally damaged and callus tissue forms at the union to bond the rootstock and scion together), *A. vitis* is hard to detect and eliminate. Grown in moderate climates, vines with *A. vitis* may never express crown gall symptoms. It is most prudent for growers to assume that *A. vitis* is present in at least some nursery stock.



Crown gall on a trunk (left) and at the graft union (right) in a vineyard in the Finger Lakes area of New York.

Crown gall elimination: Is it possible? A concerted effort has been made to eliminate the crown gall bacterium through tissue culture from shoot tips, because *A. vitis* was thought to be absent from meristem tissue at the shoot tip. But a new, more sensitive testing method called *magnetic capture hybridization* (1,000 times more sensitive) has questioned that assumption. In 2013, the Burr laboratory found that *A. vitis* was detectible in about 20% of the 48 shoot tips and meristems they tested, even though the material should have been free of *A. vitis,* if the assumption that it is not in shoot tips were true. However, in follow-up tests in 2014, none of the 49 shoot tips collected from infected vines had detectable *A. vitis*. So while elimination of crown gall bacteria is possible with shoot tip culture, it is not as reliable a procedure for ensuring crown-gall free vines as was previously thought.

Crown gall in the environment. With this new, more sensitive test, we are finding that the strain of *A. vitis* that forms tumors is more common in the environment than previously thought. In infected vineyards, *A. vitis* was found in 11 of 30 shoot tips in 2013, and 16 of 240 shoot tips tested in 2014. It was also detected for the first time on leaf surfaces in the vineyard. Further tests on wild vines revealed *A. vitis* in 45 of 154 samples of *V. riparia* in New York, and 7 of 34 samples collected from wild vines in northern California. In short, gall-forming *A. vitis* is more common in the environment than was previously thought. It can be found on wild vines both in the western and eastern U.S., and surviving on the surface of leaves and shoots.

Keeping vineyards and nurseries clean. Even if crown gall-free foundation plants can be generated, it will be a challenge for nurseries and growers to prevent them from being reinfected after planting. Experience with a tissue-cultured block of Niagara vines planted in virgin soil in New York state showed that some vines were infected within three years. Another complicating factor is that *A. vitis* can survive on infected roots for several years after an infected vineyard is removed. Given these factors, it will be challenging for nurseries to establish and maintain increase blocks that remain free of crown gall.

Grape root with necrosis caused by Agrobacterium vitis.

Management. At this time, crown gall is difficult to remove from nursery stock, and the potential for eventual reinfection in the field is high. But its expression in the vineyard is associated with environmental events that trigger gall formation – such as cold events associated with trunk injury that were widespread throughout the Great Lakes region and northeast this past winter. Growers can minimize the impact of crown gall by:

- **Site selection.** Avoid or leave a buffer from potential frost pockets, such as adjacent to tree lines downslope of the vineyard block.
- **Hill up grafted vines.** Burying graft unions in the winter will protect them from fluctuating temperatures and preserve scion buds for trunk renewal.
- **Multiple trunks.** Maintaining multiple trunks allows for faster trunk renewal, and the chance to eliminate an injured trunk without replacing the entire vine.
- **Drainage.** In heavier soils, sub-surface drainage tiles may prevent soils from being saturated with water in the winter, and mitigate trunk injury caused by expansion of water during the freezing process.
- **Manage vigor.** Crown gall is often more prevalent in over-vigorous vines that keep growing actively past veraison. Balanced vines with appropriate cropping levels and moderate vigor should be less prone to developing crown gall.

Nurseries and crown gall. Given our current knowledge of crown gall, nurseries today are not able to promise to deliver 'crown gall-free' vines, and it is likely that within a matter of years after planting at least a portion of the vines will eventually become reinfected with the pathogen. This stands in contrast to virus testing and elimination – which has and will continue to be successful in helping growers avoid virus infection. We are optimistic that, in the future, nurseries will have the capacity to reliably deliver crown gall-tested material. By doing so, growers will have the needed tool to avoid problems with young vines during vineyard establishment, and potentially forestall crown gall until vines are mature and better able to recover from crown gall injury.

For more information:
Burr, T. and T. Martinson. 2015. Grape Crown Gall, Factsheet of the National Clean Plant Network – Grapes.
http://ncpngrapes.org/files/211121.pdf

Cold Climate Wine Quality Assurance Program

Murli Dharmadhikari, Jennifer Savits, and Tammi Martin; Iowa State University

The development and release of cold-hardy wine grape cultivars, beginning in the 1990s, has resulted in the rapid development of a grape and wine industry in the Upper Midwest and Northeast United States. Many of these varieties are new to growers and pose many challenges to winemakers, and the wines are new to consumers. These factors pose significant challenges to producers and marketers of cold-climate wines.

Quality of cold-climate wines. Based on the number of awards that the cold-climate wines have won in, it is obvious that these grapes can produce high quality wines with distinct characteristics. However, producing consistently high quality wines throughout the region has been a challenging task. This is due, in part, to a shortage of research-based information on vineyard management and winemaking practices for cold-climate grapes, coupled with a vast number of novice growers and winemakers entering the business. Additionally, the cold-climate wines are new to the marketplace and their sales constitute a small portion of the total wine market. In order to garner a larger market share by building a reputation of superior wine quality, Objective 4d of the *Northern Grapes Project* proposes the establishment of a voluntary and industry-led wine quality assurance program.

Establishment of a cold climate wine quality alliance. As outlined in the *Northern Grapes Project* proposal, a voluntary cold climate wine quality program will be created by industry leaders from the various states involved in the project. Uni-

versity extension programs will assist the industry as needed in structuring the organization, and also provide educational outreach aimed at reducing wine flaws.

In March 2015, a survey was conducted to determine the number of states and industry organizations that have interest in creating a regional wine quality assurance program. We had a great response. Thirty people from 12 states expressed interest. A proposal was then sent to begin establishing the organizational structure, guidelines, and operation policy. Response to this has been limited. Representatives from just three states stepped forward and specific suggestions on how to form the voluntary organization were lacking.

In order to move the process forward and fulfill the requirements of Objective 4d, we proposed using the guidelines of the Iowa Quality Wine Consortium (IQWC) program in order for interested parties to gain hands-on experience with an existing program. Each state is being invited to submit a limited number of 'benchmarking' samples via the IQWC. We project that five samples from five different wineries in the 12 participating states will be assessed for a total of 60 samples representing 60 different wines across the region. Participants can then use this experience to better understand if and how they would like to proceed in the creation of their own regional organization.

Jennie Savits measures ethanol by volume with use of an ebulliometer.

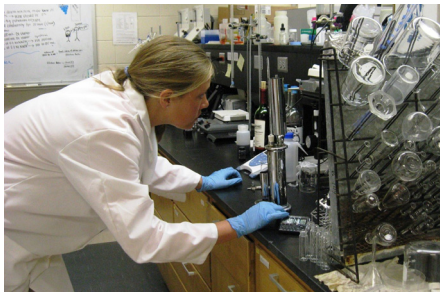


photo: Tammi Martin, Iowa State University

Benchmarking trials. In the benchmarking trials, finished wines will be evaluated using established IQWC standards. The cumulative data obtained from wine evaluation of the participating cold-climate states will be used to identify the most common wine quality faults and guide effective outreach education programs to improve wine quality.

Analysis procedures. Submitted wine sample must pass both chemical laboratory analysis and sensory evaluation of wine by the trained sensory panel. Wines that fail the chemical analysis tests will not undergo sensory evaluation.

Laboratory analysis. The laboratory analysis will test for the following items:

1. Alcohol: At least 7%
2. Volatile Acidity Limits: White, 1.20 g/L. Red, fruit and other non-grape wines, 1.4 g/L
3. Total Sulfur Dioxide Limit: 350 mg/L
4. Stability Test: Cold stable at 30˚F

Sensory evaluation. Wines that pass laboratory analysis will undergo an organoleptic evaluation by a panel of five trained individuals. This will be a blind test including coded numbers, void of any reference to the manufacturer, and grouped according to variety, vintage, and sugar content. Wines will be presented individually (one wine at a time) and evaluated on a 20-point modified Davis scale scoring system. The panel members will sit in an isolated booth and evaluate wines without discussion.

Potential sensory panelists for the Iowa Quality Wine Consortium take part in a two-day intensive tasting training workshop. Following the training, they are invited to take a test to be part of the panel.

photo: Tammi Martin, Iowa State University

Wine sensory scorecard used by panel:

1. Appearance & Color (clarity and appropriateness of color): 0-2 pts.
2. Aroma/Varietal Character (characteristic, intensity, complexity, varietal-regional-stylistic): 0-6 pts.
3. Flavor by Mouth (varietal-regional-stylistic expression of flavor characteristics): 0-5 pts.
4. Balance (acid/sweetness, bitterness/astringency, mouth feel): 0-3 pts.
5. Absence of Faults (marked fault/unpleasant to no fault/clean wine): 0-4 pts.

Total possible points = 20

Quality categories: Superior 17-20, Standard 13-16, Below standard 9-12, Unacceptable <8. Wine must receive a median score of at least 13 points out of 20 to be receive a quality designation.

Absence of Faults is the primary score card modification. This category was added and others were combined in order to focus attention on the screening of defects. Wine faults include:

1. Off Odors: Lactic spoilage, fusel, vegetal etc.
2. Oxidized: Acetaldehyde resulting from ethanol oxidation. Excessive oxygen exposure and/or growth of film yeast, concentrations greater than 75 mg/L, which are perceived as bruised apple-like, walnut-like or sherry-like.
3. Acetic Acid and Ethyl Acetate: Vinegar-like, smell of finger nail polish remover, or airplane glue. Acetic acid can magnify the sensation of acidity and bitterness. Wine must comply with the legal limit.
4. Sulfur-containing Compounds: Collectively, these add odors of sulfur, rotten eggs, onions, wet rags, cauliflower, etc. White wines with more than 0.7 mg/L sulfur derivatives are impaired. Sensory threshold for red wines would be slightly higher.

a. Sulfur Dioxide: Smell and taste of sulfur, burnt match

heads.
b. Hydrogen Sulfide: Smell of rotten eggs.
c. Mercaptans: Smell of onions, rotten cabbage.
d. Dimethyl Sulfide: Smell of boiled cauliflower, cooked cabbage.

5. Brett and 4-Ethylphenol: A volatile phenolic compound responsible for animal, leather, and horse manure-like odors. Wines with a concentration greater than 4 mg/L are sensorial-impaired.
6. Moldy/Earthy: The result of poor sanitation and the extraction of organic compounds into the wine. Wines smell and taste of beet root and/or mushrooms.
7. Cork: Moldy-type smells and taste due to 2, 4, 6-trichloroanisole (TCA) and several alcohols. Due to environmental TCA, this is not always a cork closure issue.
8. Physical Instability: Haze and/or precipitate due to fermentation, protein, bitartrate, tartrate or carbon dioxide formation.

Once the benchmarking trials have been completed and data analyzed, we will revisit the issues of establishing the cold climate regional organizational structure, guidelines, and operational policies. Should the regional quality program become established, possible funding sources are entry fees and possibly a levy on the sale of certified wines.

We are currently in the process of sending invitations to selected wineries for participation in the benchmark trials. Laboratory and sensory testing will be conducted over the next several months. Preliminary findings will be shared at the *Northern Grapes Symposium* in Kalamazoo, Michigan in February.

The end-of-project survey will be distributed in late fall of 2015.

We value your response!

MICHIGAN Grape & Wine INDUSTRY COUNCIL

Save the Date

for the 2016 ***Northern Grapes Symposium***, offered as a pre-conference option at the Michigan Grape and Wine Conference.

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