Year 1 Progress Report
September 2011 - September 2012

Northern Grapes:
Integrating Viticulture, Winemaking, and Marketing of New Cold-Hardy Cultivars Supporting New and Growing Rural Wineries

USDA Specialty Crops Research Initiative Coordinated Agricultural Project (CAP) #2011-51181-30850

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The *Northern Grapes Project* officially started in September 2011. In this first year of a five-year project, our project team has completed the first season of field studies (49 experiments involving field studies at 12 universities and several commercial sites), and winemaking trials (203 fermentation lots) are underway. Data from the project baseline survey of growers and winery owners was collected from 600 respondents, and economists have initiated studies of tasting room customer satisfaction, consumer profiles, and tourism associated with wineries. The first *Northern Grapes Symposium* at the Minnesota Grape Growers Association Cold Climate Conference, six outreach webinars, three newsletters, 26 presentations and 25 field days reached over 1850 participants in the 12 states involved in the project and beyond. Outreach information is posted on the project website and the eXtension Grape Community of Practice.

The project is currently funded through September 2013 and the project team hopes to submit a renewal for the remaining three years of the project, pending completion of a new farm bill by the US Congress.

Project Goals and Rationale

The project is a coordinated agriculture project (CAP), with objectives encompassing the three Specialty Crop Research Initiative (SCRI) focus areas of production (viticulture), processing and distribution (winemaking) and consumers/markets (winery business management and marketing). Its focus is the new cold-hardy varieties developed by the University of Minnesota and private breeders that have made possible grape and wine production in cold-climate areas where it was previously not feasible to grow grapes. These new cultivars have spawned an emerging industry in the upper Midwest and cooler portions of the Northeast and New England composed of over 300 wineries, 3,300 acres of grapes, and 1300 growers.

The project's goals are to enhance and support growth and development of this industry through a coordinated research and outreach effort focused on varietal performance, specific viticultural and winemaking practices, and marketing/consumer studies.

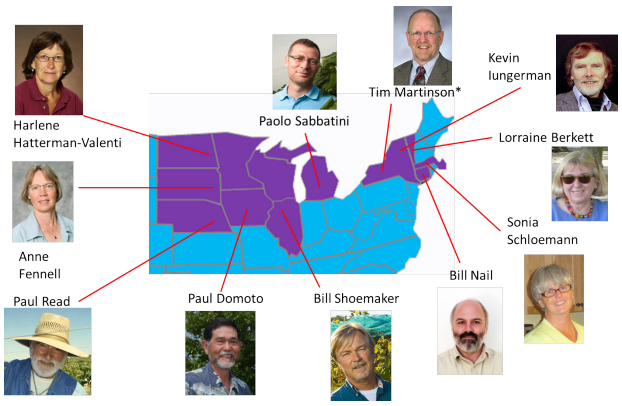
To accomplish these goals, multi-disciplinary studies are addressing:

- Varietal performance and resulting fruit and wine flavor attributes in different climates.
- Applying appropriate viticultural practices to achieve consistent fruit characteristics for winemaking.
- Applying winemaking practices to the unique fruit composition of cold-climate cultivars to produce distinctive, high quality wines that consumers will like and purchase.
- Understanding consumer preferences and individual/regional marketing strategies that will increase sales and growth of wines made from cold-climate cultivars and result in sustained profitability of wineries and vineyards.

The project is a partnership among multi-disciplinary research and extension personnel at 12 universities and 19 regional/state winery and grape grower associations. It is governed by a seven-member executive committee, and a project advisory council (PAC) encompassing industry, research, and extension personnel.

Objective 1: Document cold climate varietal performance in variable climates and understand the resulting sensory characteristics of the fruit and wines.

Evaluate cold-climate cultivar performance under a wide range of climates throughout upper Midwest and Northeast.



Cooperators and locations for the variety trials included in the Northern Grapes Project.

Vine performance was evaluated in 15 locations in 12 states, including 13 variety trials that are part of the USDA NE-1020 coordinated variety trial project which started in 2007. Standardized data has been collected from each block, including evaluations of bud mortality, phenology (dates of budburst, bloom, veraison), disease ratings, yield components, and fruit composition. Five cultivars (Frontenac, Frontenac gris, Marquette, La Crescent, and St. Croix) were selected for additional fruit composition data collection, with samples sent to Iowa State University for analysis of organic acids (tartaric and malic acid), titratable acidity, sugars and pH. Weather data (hourly temperature records and rainfall) was recorded at each site.

Yield and fruit composition at each site will be correlated with several metrics of heat unit accumulation. Nine cultivars are being used in winemaking trials at Cornell University. Juice and wine aroma profiles from a selection of the sites are being characterized using solid phase microextraction and multidimensional gas chromatography coupled with mass spectrometry-olfactometry for simultaneous chemical and sensory analysis. Pigment and tannins will be assayed beginning in November 2012.

Nail (CT), Dharmadhikari, Domoto and Nonnecke (IA), Shoemaker (IL), Schloemann (MA), Sabbatini (MI), Hatterman-Valenti (ND), Read (NE), Iungerman, Mansfield, and Martinson (NY), Burrows and Fennell (SD), Berkett (VT)

Characterize changes in fruit composition during the ripening phase and how they influence grape chemistry/quality at harvest.

photo: Tim Martinson

Somchai Rice, PhD student in aroma chemistry, bags a grape cluster with a probe that captures volatile compounds in the 'headspace' around this 'Frontenac' cluster at the Iowa State University coordinated variety trial. Fruit is sampled at regular intervals during the ripening process.

A multidisciplinary team from Iowa State University, South Dakota State University, and the University of Minnesota has started a detailed characterization of northern grape cultivar ripening from gene expression, to metabolites produced by the grapes, to sensory characteristics of the berry. The aim is to understand ripening dynamics and to use this information to develop novel maturity indices that guide cultural practices and harvest timing.

The focus in 2012 was on developing and testing equipment and protocols, collection of volatile metabolites and fruit samples for 'Frontenac' and 'Marquette', and transcriptome and metabolome analysis for 'Frontenac'. Methods for transcriptome analysis of hybrid cultivars, LC-MS quantification of organic acid and polyphenols using liquid chromatography-mass spectrometry, and volatile sampling equipment and analysis protocols were developed. Skin and pulp samples for transcriptome and metabolome analysis were collected at five time points from véraison to harvest in the South Dakota NE1020 research block and samples for sensory evaluation were collected at 22, 24, 26-28° brix. Fruit sampling through the ripening period was completed September 12, 2012 and fruit, pulp and skin samples are being processed for respective berry analyses at Minnesota (metabolome, sensory) and South Dakota (transcriptome). Volatile emissions were sampled in-vivo seven times during fruit ripening in the Iowa and South Dakota NE1020 research blocks. Volatile head space samples were subjected to simultaneous chemical and sensory analysis using GC-MS-Olfactometry in Iowa to identify and quantify specific aromatic compounds. Data analysis and correlation with grape chemistry/quality at harvest is ongoing.

Koziel and Rice (IA), Hegeman, Cook and Vickers (MN), Fennell, He, and Ye (SD)

Objective 2: Develop and extend research-based vineyard management practices that allow sustained production of high quality fruit from cold climate cultivars.

Evaluate crop and canopy management strategies to minimize fruit acid content and improve fruit composition.

photo: Paul Domoto

Iowa State University graduate students Dylan Rolfes and Leah Riesselman measuring photosynthetically active radiation (PAR) in a 'Frontenac' canopy.

Studies to identify vineyard training systems best suited for cold climate cultivars have been initiated in previous years in Connecticut and Nebraska, vineyards are being converted in Iowa, Michigan, and New York, and a vineyard was established in 2012 in Wisconsin with plans to evaluate various training systems. Training systems being evaluated include single curtain bi-lateral cordon, Geneva double curtain, umbrella kniffen, mid-wire cordon with shoot positioning, and two divided canopy catch-wire systems (Smart-Dyson and Scott-Henry). Cultivars being evaluated include 'Frontenac', 'La Crescent', 'Marquette', and 'St. Croix'. Once the training systems are established, data will be collected on labor costs of cultural practices, light distribution within the canopy, yield and fruit quality.

Canopy management trials were initiated in grower vineyards at two sites for different cultivars in Iowa and at two sites in Wisconsin. Studies are evaluating all combinations of non-count shoot thinning, axillary shoot removal and shoot positioning. Treatments were monitored for time required to conduct the various cultural practices, light distribution in the grapevine canopy, and fruit quality indices at harvest. Cultivars being evaluated include 'Frontenac', 'La Crescent' and 'Marquette'. However, 'Marquette' was not included in the Iowa study due to severe injury to primary shoots following an early April freeze.

Studies to evaluate the influence of adjusting the crop load were planned in for Iowa and New York in grower vineyards. However, due to the early April freeze, the study could not be conducted in Iowa. In New York, a study was to be conducted in 'Frontenac' and 'La Crescent' on timing of cluster thinning and severity of crop reduction. However, an early April freeze severely affected 'La Crescent', so the study was altered to evaluate the influence of crop load on individual vines following the freeze. The study was conducted as planned in 'Frontenac'.

Nail (CT), Domoto and Nonnecke (IA), Sabbatini (MI), Read (NE), Martinson (NY), Harbut (WI)

Determine optimal mineral nutrition and soil management practices for cold climate cultivars.

photo: Carl Rosen

Undergraduate research technician Zach Miller separates leaf blades from petioles during the bloom-time leaf sampling of a 'La Crescent' study block in Minnesota.

Our goal is to determine the relationships between soil characteristics, leaf petiole and blade nutrient contents, and fruit yield and juice characteristics of 'Frontenac', 'La Crescent', and 'Marquette', and to determine the optimal nutrient conditions to maximize fruit yield and quality. Sixteen study sites are located in commercial vineyards in five states: North Dakota (2 sites), South Dakota (4 sites), Minnesota (4 sites), Iowa (5 sites), and New York (1 site). Three study blocks of 15 vines were selected for each variety in each site. In each block, soil cores were collected at two depths (0 – 8" and 8 – 16") and analyzed for nutrient content, organic matter, texture, cation exchange capacity, and pH. Leaf tissue samples were collected at bloom, 30 days later (except in the Dakotas), and at veraison, from all sites except two in South Dakota, where the vines were severely weather-damaged. Yield data was also collected. Berry cluster samples from most sites were collected. Due to timing issues with grower harvest, clusters were not collected for at least one variety in a total of five sites in North Dakota, South Dakota, Minnesota, and Iowa. Clusters will be analyzed for brix, pH, total acidity, and yeast-assimilable nitrogen. Data on juice characteristics will be obtained from growers where clusters were not collected. Statistical analyses will be performed to find correlations between soil and tissue traits and fruit yield and quality to determine optimal soil and tissue characteristics for maximum fruit yield and quality.

Domoto and Nonnecke (IA), Rosen (MN), Hatterman-Valenti (ND), Martinson (NY), Burrows (SD)

Develop sustainable pest management recommendations based on cold-climate cultivar copper and sulfur sensitivity and disease resistance.

photo: Patty McManus

Discoloration of a leaf of cultivar 'Brianna' treated with sulfur in Sturgeon Bay, WI.

One of the greatest challenges of growing grapes in the Midwest and Northeast is extreme disease pressure and the need to protect vines from diseases starting at budbreak and continuing through harvest. Disease IPM is based on knowing the relative resistance of cultivars to disease and timely applications of fungicides. This multi-state collaboration seeks to evaluate the relative resistance of cold-climate cultivars to various diseases in replicated, multi-year field trials. Two new vineyards were established in 2012 in Wisconsin and established vineyards are being used in New York and Vermont. A second objective underway is to evaluate the response of several cold-climate cultivars to copper and sulfur fungicides, which although highly effective, have been associated with leaf injury in certain grape cultivars. The exact response of these new cultivars to sulfur- and copper-based fungicides is currently unknown.

Berkett (VT), McManus (WI), Iungerman (NY)

Objective 3: Develop and optimize winemaking practices to sustainably produce and market distinctive, high quality wines from cold climate cultivars.

Assess yeast strains for selected cold-hardy cultivars.

photo: Katie Cook

Frontenac gris grapes were divided by weight into equivalent lots and fermented using several yeast strains at the University of Minnesota's HRC Research Winery.

The most common question Northern winemakers ask is "What yeast should I use for fermentation?" To answer this question, enologists at the University of Minnesota and Cornell are performing replicated yeast trials with 'Frontenac', 'Marquette', 'La Crescent' and 'Frontenac gris', using yeasts selected for their ability to enhance desirable aromas in each cultivar. This year, 24 different wines were made, in duplicate. Replicating trials in the Midwest and Eastern US allows researchers to tease out the effects of yeast on wine aroma from those specific to growing region. Sensory characteristics of experimental wines produced with different yeast strains will be evaluated later in the project in both research and extension settings.

Cook (MN) and Mansfield (NY)

Optimize deacidification methods for cold climate cultivars.

photo: Anna Katharine Mansfield

Chris Gerling and Dr. David Manns make sure deacidification additives dissolve completely in the initial stage of deacidification trials at the Cornell Enology Extension Lab.

Balancing high acid is one of the biggest challenges faced in northern wine production, and the sensory effects of biological and chemical methods traditionally used for deacidification have not been fully explored. In 2012, enologists at the University of Minnesota and Cornell are assessing the reduction of tartaric and malic acids that can be achieved with malo-ethanolic fermentation, full and partial malolactic fermentation, amelioration, blending, and chemical deacidification. This year, 28 different wines were made, in duplicate. Data from initial trials will be used to design a cross-regional trial in the following years of the project.

Cook (MN) and Mansfield (NY)

Characterize yeast assimilable nitrogen profiles of cold-hardy cultivars.

photo: Anna Katharine Mansfield

'Frontenac gris' and 'Marquette' harvested in a collaborator's vineyard in Trumansburg, NY.

The free amino acids and ammonium in the grape, collectively known as yeast assimilable nitrogen (YAN), are essential for complete fermentation and the prevention of sulfur-based off-aromas. Current research suggests that nitrogen type and content varies widely by grape variety, with potentially dramatic impact on wine sensory characteristics. This year, a sampling of cold-hardy cultivars grown in different regions and microclimates will be screened for YAN and concentration of individual amino acids; this data will provide the basis for studies in 2013 and 2014 that will track the influence of nitrogen source on varietal character.

Mansfield (NY)

Enhancement of red wine structure and mouthfeel through addition of enological tannins.

photo: Murli Dharmadhikari

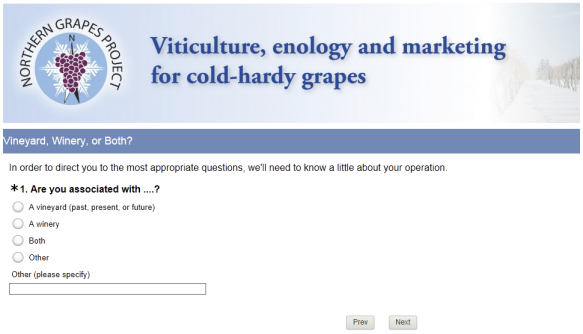
'Marquette' grapes are destemmed and crushed for the enological tannin trial at the Tassel Ridge Winery in Leighton, IA

Tannins play an important role in structure, mouthfeel and overall quality of a red wine, and the addition of enological tannins to improve wine structure and quality is an increasingly common winemaking practice. To better understand these effects, enologists at Iowa State are collaborating with members of the Iowa industry to assess the concentration of tannins in 'Frontenac' and 'Marquette' grapes and to determine the impact of enological tannin additions during processing on the sensory attributes of the resulting red wines. Six different treatments, replicated three times, are being evaluated this year in both cultivars.

Dharmadhikari (IA)

Objective 4: Identify strategies to support sustainable development of businesses based on cold climate cultivars, from the individual winery to regional agri-tourism.

Quantify current economic impact of the cold climate grape and wine industry on rural communities and assess impacts of state policy and law that impede or advance its development.



Growers in the 12 participating states were sent a detailed electronic baseline survey to determine acreage and practices used in the vineyard and winery, and to estimate economic impact of the Northern Grapes wine industry.

The *Northern Grapes Baseline and Economic Impact Survey* was distributed in March to project clientele in 14 states through cooperating state winery associations and the project's 12 state extension representatives. The survey gathered data on acreage, wine production, economic impact, and current production practices from over 600 respondents. It will provide the basis for an economic impact analysis, expected to be complete by the end of November, and also will serve as our project evaluation instrument when repeated in Year 5 of the project.

Preliminary results reveal that survey respondents represented 330 vineyards and 1,498 acres of grapes, with an average of 4.5 acres in production. The 130 winery respondents reported production of 1,352,670 gallons of wine, averaging 10,400 gallons per winery. This represents 563,000 cases, with a conservative retail value (at $10/bottle) of $67.5 million.

The state policy research gathered policy information from over 35 staates related to wine operations. Numerous differences were found among states ranging from subsidies for local production to distribution regulations and fees. Results to date were described in *Policies Affecting the Domestic Production of Grapes and Wine in the United States*, published in the 3rd issue of *Northern Grapes News.*

Gartner (MN)

What tasting room marketing strategies produce customer satisfaction and loyalty?

photo: Kristina Randazzo-Ives

Customer surveys administered by tasting room staff are exploring the link between tasting room experience and wine sales. Coyote Moon Vineyards (above) in Clayton, NY was a participant in this study.

During the period November 2011 – March 2012, we visited wineries in Iowa and in two New York regions (1,000 Islands and Lake Champlain) and invited them to participate in the Tasting Room Study. In June 2012, we started data collection in seven tasting rooms (3 in Iowa and 4 in New York). These surveys ask tasting room visitors to rate their perception of twenty-five consumer satisfaction attributes, which relate to their tasting room experience. In addition, respondents are asked to rate their overall satisfaction with the visit, as well as the amount of wine they intended to purchase. These questions allow for a direct analysis of the factors that drive customer satisfaction. They also make it possible to evaluate whether overall customer satisfaction influences the decision to purchase wine. After 3 months, a total of 350 surveys have been completed and processed. Based on this excellent response rate, the target of 600 surveys should be reached by November 2012. These data will allow us to shed light on successful marketing strategies for wineries in cold climate regions.

Gomez (NY)

Growing winery profits and rural economies through enhanced knowledge of customers and expanded collaborations.

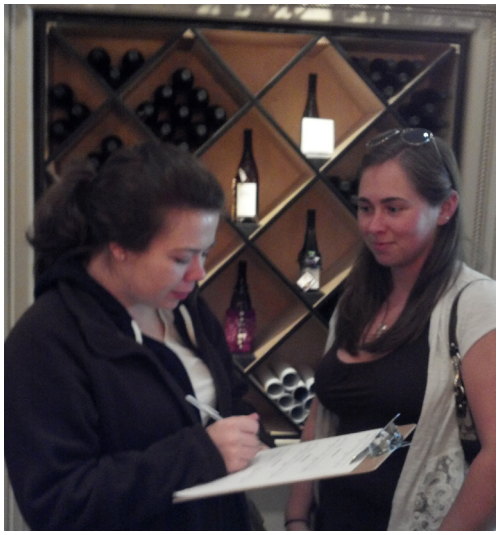


photo: Dan McCole

Kelly Donohue, a graduate student at Michigan State University, surveys a tasting room visitor to construct the consumer's profile and tourism characteristics.

A research team from Michigan State University is surveying tasting room visitors to construct consumer profiles and tourism characteristics of visitors to tasting rooms in a northern wine region. To date, researchers have distributed web-based or paper surveys to 2,136 participants recruited by tasting room operators from 15 wineries. Thus far, 930 completed surveys have been entered into a database and are awaiting analysis upon the completion of data collection. Results will help winery marketing efforts and will inform the work being done to identify best practices for collaboration among wineries and between wineries and the tourism system. The tasting room visitor survey was informed by telephone interviews with 53 winery owners in Michigan. Additionally, a comprehensive literature review has been done to identify best practices for collaboration in wine regions throughout the world. This information was shared with stakeholders during a March webinar. Interviews have also been conducted with 15 wine trail coordinators and destination marketing organization directors in northern wine regions. These interviews, and preliminary analysis of the tasting room visitor data, have informed the ongoing development of an instrument that will be used to identify opportunities for and barriers to collaboration in emerging northern wine regions.

Holecek and McCole (MI)

Northern Grapes Project Outreach Efforts

Northern Grapes Project outreach is not a separate objective, but rather integrated with our research effort, as detailed in the Project Management and Evaluation plan (p.7) appendix of our original grant proposal. In year 1, the project provided outreach to an estimated audience of 1800, through the *Northern Grapes Symposium*, *Northern Grapes Enterprise Workshops, Northern Grapes Webinars*, and the *Northern Grapes News*. We also established a project website and Facebook page, and linkage with the eXtension grape community of practice.

The Northern Grapes Symposium

The project kicked off with the first *Northern Grapes Symposium*, held on February 23, 2012, in conjunction with the Minnesota Grape Growers Association Cold Climate Conference in St. Paul. Approximately 200 attended, with six presentations followed by five "bar camps," which were small group discussions focused on economics and marketing, enology, fruit composition and genetics, pest management, and viticulture.

The presentations given at the *Northern Grapes Symposium, "From Vine to Cash Register: What the Northern Grapes Project Will Do to Help Develop the Cold Climate Grape and Wine Industry"* are as follows, and are available on the project website:

photo: Chrislyn Particka

Attendants of the first Northern Grapes Symposium participate in the enology "bar camp" session. The bar camps allowed audience members to interact with project team members and learn more about the project's goals and objectives.

Luby, J. *Introducing the Northern Grapes Project.* Northern Grapes Symposium. St. Paul, MN. 23 Feb., 2012.

Lasley, P. *Northern Grape Project Focus: Integrating Viticulture, Enology, Marketing, and Community for Sustainable Growth.* Northern Grapes Symposium. St. Paul, MN. 23 Feb., 2012.

Domoto, P. *Viticulture: Addressing Climate, Soils, Nutrition, Pest Management to Achieve Consistent Quality.* Northern Grapes Symposium. St. Paul, MN. 23 Feb., 2012.

Fennell, A. *Fruit Composition: Farming for Flavors.* Northern Grapes Symposium. St. Paul, MN. 23 Feb., 2012.

Mansfield, A.K. *Optimizing Winemaking for Northern Grapes.* Northern Grapes Symposium. St. Paul, MN. 23 Feb., 2012.

Gartner, W. *Marketing/Consumers: It Takes a Village.* Northern Grapes Symposium. St. Paul, MN. 23 Feb., 2012.

Other Presentations

Members of the *Northern Grapes Project* gave several presentations throughout the year. Many were given at the Minnesota Grape Growers Association Cold Climate Conference.

photo: Tamara Martin

Dr. Murli Dharmadhikari discusses the types of wine faults at a wine tasting workshop.

Cook, K. *Blending Theory and Practice to Optimize Cold Hardy Wines.* MGGA Cold Climate Conference. St. Paul, MN. 25 Feb., 2012.

Domoto, P. *Vineyard Soil Fertility Management.* MGGA Cold Climate Conference. St. Paul, MN. 24 Feb., 2012.

Domoto, P. *Vineyard Frost Prevention.* MGGA Cold Climate Conference. St. Paul, MN. 25 Feb., 2012.

Gartner, W. *Policy Project and Baseline/Economic Impact Monitoring.* Department of Applied Economics Centennial Celebration. St. Paul, MN. 21 Sept., 2012.

Gomez, M. *Entrepreneurship in Growing Wine Regions.* Monthly meeting of the Upper Hudson Valley Wine and Grape Growers Association. Plattsburgh, NY. 3 Nov., 2011.

Gomez, M. *Customer Satisfaction Drivers and Performance in Wine Tasting Rooms.* Northern NY Grape Growers Association meeting. Watertown, NY. 28 Nov., 2011.

Gomez, M. *Overcoming the Threats of "Newness": Challenges and Strategies for Entrepreneurship in Emerging Wine Regions.* MGGA Cold-Climate Conference. St. Paul, MN. 24 Feb., 2012.

Gomez, M. *Customer Satisfaction Drivers and Performance in Wine Tasting Rooms in the Finger Lakes.* MGGA Cold-Climate Conference. St. Paul, MN. 24 Feb., 2012.

Haggerty, L. (Graduate student with J. Luby). *Ripening Chemistry of Northern Varieties.* MGGA Cold Climate Conference. St. Paul, MN. 25 Feb., 2012.

Hemstad, P. *Introduction to Vine Balance.* MGGA Cold Climate Conference. St. Paul, MN. 25 Feb., 2012.

Lenerz, C.C. (Graduate student with A. K. Mansfield) *Phenolic Extraction in Red Hybrid Winegrape Production.* MGGA Cold-Climate Conference. St. Paul, MN. 25 Feb., 2012.

Mansfield, A.K. *Optimizing White Wine Aroma.* MGGA Cold-Climate Conference. St. Paul, MN. 25 Feb., 2012.

Mansfield, A.K. *Wine Chemistry 101.* MGGA Cold-Climate Conference. St. Paul, MN. 24 Feb., 2012.

Martinson, T. *A Cut Above: How the Northern Grapes Project will Foster Growth and Development of the Cold-Climate Wine Industry.* MGGA Cold Climate Conference. St. Paul, MN. 23 Feb., 2012.

Martinson, T. *Canopy Management; Balancing Costs and Results.* MGGA Cold Climate Conference. St. Paul, MN. 25 Feb., 2012. (Keynote address.)

Schloemann, S. *Overview of Cold Climate Wine Grape Culture and Cultivar Review.* University of Massachusetts Extension Fruit Program Twilight Meeting. UMass Cold Spring Orchard Research and Education Center. 17 April, 2012.

Schloemann, S. *Overview of Cold Climate Wine Grape Culture and Pruning Principles and Practices.* UMass Stockbridge School of Agriculture Pruning Class. UMass Cold Spring Orchard Research and Education Center. 19 April, 2012.

Stafne, E. *eViticulture and Other Online Resources.* MGGA Cold Climate Conference. St. Paul, MN. 24 Feb., 2012.

Stafne, E.T., E. Hellman, R.K. Striegler, T. Martinson, B. Reisch, and J-M. Peltier. 2012. *A Collaborative Research and Extension Outreach Model: the Grape Community of Practice.* Amer. J. Enol. Viticul. 63(3):464A.

Vickers, Z. *How We Acquire a Liking for Wine.* MGGA Cold Climate Conference. St. Paul, MN. 25 Feb., 2012.

White, M. *Intro to Sprayers and Spraying.* MGGA Cold Climate Conference. St. Paul, MN. 24 Feb., 2012.

Northern Grapes Enterprise Workshops

The *Northern Grapes Project* sponsored or co-sponsored 25 enterprise workshops, with participation by over 1050 people, this year. Many events were part of university field days, while others were stand-alone meetings. Topics varied from the Oak Barrel and Wine Workshop held in Iowa, to a pruning workshop in Massachusetts, to a bus tour in North Dakota. Most speakers at these events were *Northern Grapes Project* team members, but some featured speakers from outside the project as well.

photo: Jennie Savits

Francis Durand, Master Cooper, fits the final hoop on the barrel during the Oak Barrel and Wine Workshop held on July 6-7 at Tassel Ridge Winery in Leighton, IA.

Gomez, M., N. Bills, and K. Iungerman. *Regional Wineries and the Goals of the Cold Climate Grape Rural Wine Entrepreneurship Research.* 18 Jan., 2012. Topics: Gomez and Bills visited with owners of the new, small-scale operations in the area, plus evening presentations covering wine entrepreneurship and Northern Grapes Project resources. Attendance: 22

Schloemann, S. *Cold Climate Grape Pruning Workshop*. 26 March, 2012. Umass Cold Spring Orchard, Belchertown, MA. Topics: Overview of cold climate winegrape cultivars and principes and practices of cold climate winegrape pruning. Attendance: 35

Iungerman, K. and R. Lamoy. *Hands-on Learning and Pruning Workshop with Cold Hardy Cultivars on Various Commercial Training Systems.* 7 April, 2012. Hid-in-Pines Vineyard, Morrisonville, NY. Topics: Pruning, training, Northern Grapes Project resources. Attendance: 20

Iungerman, K. *Dormant-Pruning "Working Seminar" sessions with Cold Climate Grapes.* 11-14, 19-21, and 28 April and 5 May, 2012. Willsboro Wine Grape Trial, Cornell Baker Farm, Willsboro, NY. Topics: One-on-one instruction in pruning and training, including balanced pruning and crop load management, combined with the intent of pruning the trial plot. Attendance: 15

Gerling, C. and T. Martinson. *Planning and Establishing Vineyards and Wineries in North Central New York.* 4 May, 2012. Little Falls, NY. Topics: Vineyard site selection and preparation, cold-hardy grapes and wines, planting and trellising options, pest management, equipping a winery, economics and business models. Attendance: 27

Hatterman-Valenti, H., T. Plocher, S. Sagaser, and M. Vining. *Wine and Warbirds.* 14 June, 2012. NDSU and Fargo Air Museum. Topics: Grape breeding to develop cold-hardy cultivars, winemaking basics and testing of NDSU grapes; NDSU germplasm enhancement project; grape crossing process; tour of greenhouse, field nursery, and native grape preservation plot; wine tasting and evaluation. Attendance: 85

Dharmadhikari, M., Durand, F. and D. Brick. *Oak Barrel and Wine Workshop*. 6-7 June, 2012. Tassel Ridge Winery, Leighton, IA. Topics: Barrel construction, toasting, cleaning/sanitation, storage/maintenance, and repair; types of oak; barrel alternatives; wine tasting (reds produced with different oak aging techniques). Attendance: 32

Iungerman, K. *Crop Load Management, Phase II: Hands-On Primer Covering Shoot Selection, Thinning, and Apportionment.* 8 June, 2012. Topics: Primary, secondary, tertiary, and basal buds, bud selection and removal, combined with one-on-one instruction. Attendance: 7

Martinson, T., C. Particka, A.K. Mansfield, J. Trezise, M. Hunter, K. Iungerman, D. Fralick, and P. Randazzo. *Cold Climate Grape Field Day.* 25 June, 2012. Coyote Moon Vineyards, Clayton, NY. New growers "Meet and Greet," view and discuss field studies, Northern Grapes Project, goals and resources crop size estimation, worker protection standard, importance of grapes and wine to the economy in Northern New York. Attendance: 60

Iungerman, K. *Cornell Baker Farm Research Projects Information Open House*. 10 July, 2012. Willsboro Wine Grape Trial, Cornell Baker Farm, Willsboro, NY. Topics: History and purpose of Willsboro grape trial, brief viticulture and enology basics, increase in cold-climate grape and wine production, Northern Grapes Project purposes and resources. Attendance: 65

Harbut, R. *Southern WI Vineyard Walk.* 12 July, 2012. Staller Estate Winery, Delavan, WI. Topics: Nutrient management, vineyard establishment, crop load. Attendance: 25

Schloemann, S. *Massachusetts Fruit Growers' Association Summer Meeting.* 16 July, 2012. UMass Cold Spring Orchard, Belchertown, MA. Topics: Overview of cold climate winegrape culture and cultivar review. Attendance: 100

Volenberg, D. *Northeastern WI Vineyard Walk.* 21 July, 2012. Himmelgarten Vineyard, Newton WI. Topics: Disease management, vineyard establishement. Attendance: 12

Harbut, R. *Northeast WI Vineyard Walk*. 25 July, 2012. Spirit Creek Vineyards, Spooner, WI. Topics: Training systems, crop load management, canopy management. Attendance: 61.

Sabbatini, P. and T. Zabadal. *23rd Annual Viticulture Field Day and Steak Cookout.* 25 July, 2012. Southwest Michigan Research and Extension Center, Benton Harbor, MI. Topics: Viticulture performance of several cold-hardy cultivars, training systems and impact of spring frost on yield and fruit quality. Attendance: 120

Hart, M. *Southern WI Vineyard Walk.* 4 Aug., 2012. Viriditas Vineyard, Viroqua, WI. Topics: Grape varieties, management. Attendance: 24

Iungerman, K., N. Asma, G. Barnhart, M. Barnhart, P. Cousins, E. Kalmer, J. Kowalski, and R. Lamoy. *Area Vineyards "Meet and Greet" Event Featuring Vineyard and Research Project Updates.* 6-7 Aug., 2012. Victoryview Vineyard, Easton, NY; Hid-in-Pines Vineyard, Morrisonville, NY; Four Oaks Vineyard, Champlain, NY; Willsboro Wine Grape Trial, Cornell Baker Farm, Willsboro, NY. Topics: Walk-through "seminars" where participants could pose questions related to vineyard management at each site. Attendance: 25

Iungerman, K. and J. Kowalski. *Seasonal Netting and Electric Fence Crop Protection at Veraison to Prevent Crop Loss.* 13 Aug., 2012. Willsboro Wine Grape Trial, Cornell Baker Farm, Willsboro, NY. Topics: Veraison, need for bird netting and electric fence, demonstration of improved battery-powered fence charged by a solar panel, hands-on working demonstration of bird netting application. Attendance: 5

Berkett, L., T. Bradshaw, S. Kingsley-Richards, and T. Martinson. *University of Vermont Vineyard Field Day.* 23 Aug., 2012. UVM Horticulture Research Center, South Burlington, VT. Topics: Northern Grapes Project overview, key insects and diseases, fungicide toxicity study overview, current vineyard issues, variety performance. Attendance: 70

Harbut, R., P. McManus, and J. Reith-Rozelle. *University of WI Wine and Table Grape Field Day.* 23 Aug., 2012. West Madison Agricultural Research Station, Madison, WI. Topics: Table grape tasting, training systems, canopy managmenet, pest management. Attendance: 35

Sabbatini, P. and D. Elsner. *Annual Open House*. 23 Aug., 2012. Northwest Michigan Horticultural Research Center, Traverse City, MI. Topics: Cultivar trial update, tasting of cold-hardy wines, training systems, crop estimation, canopy management. Attendance: 45

Iungerman, K. and J. Kowalski. *Willsboro Grape Trial Harvest Sessions.* 6, 7, 15, 16, and 21-23 Sept., 2012. Willsboro Wine Grape Trial, Cornell Baker Farm, Willsboro, NY. Topics: Volunteers assist in grape harvest, including data collection, in exchange for a share of the harvest; participants then make wine, and later have group tasting and evaluation. Attendance: 8

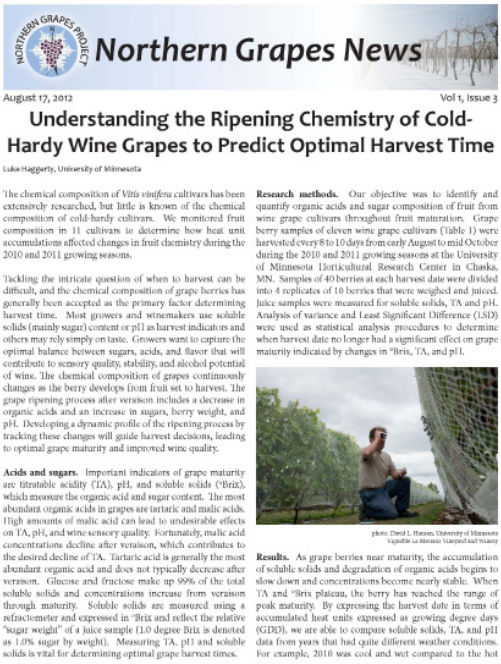
Cook, K., P. Hemstand, J. Thull. *University of Minnesota Grape Open House.* 8 Sept., 2012. University of Minnesota Horticultural Research Center, Victoria, MN. Topics: Review of cold climate grape cultivars, experimental selections, tasting of 100+ cultivars, common grape diseases, vineyard tour (trainings systems, canopy management, floor management, pest/disease management), experimental wine tasting, use of yeast to enhance varietal aroma. Attendance: 70

Hatterman-Valenti, H., T. Rongen, J. Larson, P. Aguirre, M. Bullock, J. Wagar, M.J. Wagar, R. Ballinger, S. Ballinger. *North Dakota Grape Growers Association Summer Tour.* 15 Sept., 2012. Vineyards, nurseries, and wineries throughout ND and MN. Topics: Stops at Kittelson Creek Vineyard, Larson's Vineyard, Richwood Winery and Vineyard, Campbell Beach Vineyard, Bearcreek Winery and Vineyard, discussed the Northern Grapes Project tasted/evaluated over 30 cultivars. Attendance: 50

Hatterman-Valenti. *NDSU Horticulture Research Field Day.* 25 Sept., 2012. NDSU Horticulture Research Site and Dal Herman Research Arboretum. Topics: Grape cultivars for North Dakota and grape samples from the cultivar trial were

Northern Grapes News

Three issues of the *Northern Grapes News* have been published so far this year (February, May, and August) with one more slated for November. Articles have covered the history of cold hardy cultivars, ripening chemistry, profiles of team members, and announcements. As the project continues, we will include more information generated from our research studies.


Northern Grapes News

August 17, 2012 Vol 1, Issue 3

Understanding the Ripening Chemistry of Cold-Hardy Wine Grapes to Predict Optimal Harvest Time

Luke Haggerty, University of Minnesota

The chemical composition of *Vitis vinifera* cultivars has been extensively researched, but little is known of the chemical composition of cold-hardy cultivars. We monitored fruit composition in 11 cultivars to determine how heat unit accumulations affected changes in fruit chemistry during the 2010 and 2011 growing seasons.

Tackling the intricate question of when to harvest can be difficult, and the chemical composition of grape berries has generally been accepted as the primary factor determining harvest time. Most growers and winemakers use soluble solids (mainly sugar) content or pH as harvest indicators and others may rely simply on taste. Growers want to capture the optimal balance between sugars, acids, and flavor that will contribute to sensory quality, stability, and alcohol potential of wine. The chemical composition of grapes continuously changes as the berry develops from fruit set to harvest. The grape ripening process after veraison includes a decrease in organic acids and an increase in sugars, berry weight, and pH. Developing a dynamic profile of the ripening process by tracking these changes will guide harvest decisions, leading to optimal grape maturity and improved wine quality.

Acids and sugars. Important indicators of grape maturity are titratable acidity (TA), pH, and soluble solids (°Brix), which measure the organic acid and sugar content. The most abundant organic acids in grapes are tartaric and malic acids. High amounts of malic acid can lead to undesirable effects on TA, pH, and wine sensory quality. Fortunately, malic acid concentrations decline after veraison, which contributes to the desired decline of TA. Tartaric acid is generally the most abundant organic acid and does not typically decrease after veraison. Glucose and fructose make up 99% of the total soluble solids and concentrations increase from veraison through maturity. Soluble solids are measured using a refractometer and expressed in °Brix and reflect the relative "sugar weight" of a juice sample (1.0 degree Brix is denoted as 1.0% sugar by weight). Measuring TA, pH and soluble solids is vital for determining optimal grape harvest times.

Research methods. Our objective was to identify and quantify organic acids and sugar composition of fruit from wine grape cultivars throughout fruit maturation. Grape berry samples of eleven wine grape cultivars (Table 1) were harvested every 8 to 10 days from early August to mid October during the 2010 and 2011 growing seasons at the University of Minnesota Horticultural Research Center in Chaska, MN. Samples of 40 berries at each harvest date were divided into 4 replicates of 10 berries that were weighed and juiced. Juice samples were measured for soluble solids, TA and pH. Analysis of variance and Least Significant Difference (LSD) were used as statistical analysis procedures to determine when harvest date no longer had a significant effect on grape maturity indicated by changes in °Brix, TA, and pH.

photo: David L. Hansen, University of Minnesota Vegetable Le Moinois Vineyard and Winery

Results. As grape berries near maturity, the accumulation of soluble solids and degradation of organic acids begins to slow down and concentrations become nearly stable. When TA and °Brix plateau, the berry has reached the range of peak maturity. By expressing the harvest date in terms of accumulated heat units expressed as growing degree days (GDD), we are able to compare soluble solids, TA, and pH data from years that had quite different weather conditions. For example, 2010 was cool and wet compared to the hot

23 Feb, 2012. Vol 1, Issue 1

Gartner, B. and P. Lasley. 2012. *Baseline Survey Slated for This Spring.* Northern Grapes News. 1(1): 4.

Martinson, T. 2012. *Introducing the Northern Grapes Project.* Northern Grapes News. 1(1): 1-2.

Particka, C. 2012. *Managing Acidity in the Winery Kicks Off Northern Grapes Webinar Series.* Northern Grapes News. 1(1): 3.

18 May, 2012. Vol 1, Issue 2

Cook, K. and C. Particka. 2012. *NGP Team Profile: Katie Cook.* Northern Grapes News. 1(2): 6-7.

Domoto, P. 2012. *Vineyard Studies: Improving Management Practices for Northern Grapes.* Northern Grapes News. 1(2): 4-6.

Particka, C. 2012. *Northern Grapes Project Launched at MGGA's Cold Climate Conference.* Northern Grapes News. 1(2): 2.

Shoemaker, W. 2012. *What are Northern Grapes?* Northern Grapes News. 1(2): 1-2.

17 August, 2012. Vol 1, Issue 3

Cook, K. 2012. *Yeast Selection Trials for Cold-Hardy Grapes.* Northern Grapes News. 1(3): 11-13.

Haggerty, L. 2012. *Understanding the Ripening Chemistry of Cold-Hardy Wine Grapes to Predict Optimal Harvest Time.* Northern Grapes News. 1(3): 1-3.

Hong, C. and B. Gartner. 2012. *Policies Affecting the Domestic Production of Grapes and Wine in the United States.* Northern Grapes News. 1(3): 9-10.

Holecek, D. and C. Particka. 2012. *NGP Team Profile: Don Holecek.* Northern Grapes News. 1(3): 5-6.

McCole, D. and C. Particka. 2012. *NGP Team Profile: Dan McCole.* Northern Grapes News. 1(3): 6-7.

Sabbatini, P. and C. Particka. 2012. *NGP Team Profile: Paolo Sabbitini.* Northern Grapes News. 1(3): 8-9.

Stafne, E. and L. Greer. 2012. *eViticulture and the Northern Grapes Project.* Northern Grapes News. 1(3): 4.

Web Presence


Viticulture, enology and marketing for cold-hardy grapes

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Home

The Northern Grapes Project was funded in 2011 by the USDA NIFA Specialty Crops Research Initiative. The emergence of cold hardy, *Vitis riparia*-based wine grape cultivars in the 1990s created a new and rapidly expanding industry of small vineyard and winery enterprises in more than 12 states in New England, northern New York, and the Upper Midwest, boosting rural economies in those regions. Read more.

What's New:

The third issue of the *Northern Grapes News* is now available!

In this issue:

-Understanding the Ripening Chemistry of Cold-Hardy Wine Grapes to Predict Optimal Harvest Time

The *Northern Grapes Project* Website was launched in February 2012. It contains information about upcoming events, detailed information about the project, webinar registration information and recordings, current and past issues of the *Northern Grapes News*, and copies of presentations given by project members.

We also created a Facebook page in April 2012, which is primarily used to notify followers when registration opens for a new webinar and when new content is posted to the project website.

Northern Grapes Webinar Series

The *Northern Grapes Project* hosted six webinars this year from January through June. Webinars were presented on the second Tuesday of each month, at noon and again at 7pm (eastern). All webinars were recorded and are archived on the Recorded Webinars tab of the project website.

Webinar registrants were from 37 US states and Canada. Our webinar email list currently contains 897 unique email addresses, which was developed as people registered for webinars or asked to be added to the list. Post-webinar surveys indicate that participants are finding the series to be educational: an average of 75% said their awareness and 81% said their knowledge of the subjects changed at a moderate or higher level.

Mansfield, A.K., and M. Dharmadhikari. *Managing Acidity in the Winery.* Northern Grapes Project Webinar Series. 10 Jan, 2012. Participants: 125

White, M. and T. Martinson. *Nuts and Bolts of Canopy Management.* Northern Grapes Project Webinar Series. 14 Feb, 2012. Participants: 135

Gartner, W. and D. McCole. *Setting the Stage for Future Growth: Winery Collaboration and Economic Impacts.* Northern Grapes Project Webinar Series. 13 March, 2012. Participants: 50

McManus, P. and W. Wilcox. *Grape Disease Management Basics (and All About Anthracnose).* Northern Grapes Project Webinar Series. 10 April, 2012. Participants: 90

Gerling, C. *Keep a Cork in It: Stabilizing Sweet Wines for Bottling.* Northern Grapes Project Webinar Series. 8 May, 2012. Participants: 77

Worobo, R. *Introduction to Winery Sanitation: Options and Applications.* Northern Grapes Project Webinar Series. 12 June, 2012. Participants: 48

Summary of Year One Grape Community of Practice Activities Related to the Northern Grapes Project

During the first year of the *Northern Grapes Project*, the eXtension grape community of practice (GCoP) has been involved in training project members and promoting the project through eXtension.org and eViticulture.org. The training was done by Dr. Eric Stafne (Project Director of the GCoP, Mississippi State University and Co-PI, *Northern Grapes Project*) and Dr. Lane Greer (Project Manager of the GCoP, Oklahoma State University) at the *Northern Grapes Symposium* which was held in conjunction with the Minnesota Grape Growers Association Cold Climate Conference held in St. Paul, Minnesota in February 2012. Two videos from the Symposium have been posted on the eViticulture YouTube channel. All webinars have been linked from the eXtension page and on the eXtension calendar of events. In addition, a direct link to the *Northern Grapes Project* was added on the main eXtension grapes page. Webinars are other news events related to the *Northern Grapes Project* have been included in the social media efforts of the GCoP, including tweets, facebook posts, and YouTube videos. Dr. Stafne and Dr. Greer have also maintained contacts with the *Northern Grapes Project* Leader and Coordinator (Dr. Tim Martinson and Dr. Chrislyn Particka, respectively) including phone conferences and face-to-face meetings.

Stafne (MS), Greer (OK), Particka (NY)

Other Newsletters, Blogs, and Websites Associated with the Northern Grapes Project

Berkett, L. *Vermont Grape IPM Updates.* Time-sensitive IPM updates sent out during growing season via email and archived on Cold Climate Grape Production website. Thirteen issues in 2012 sent to 245 people via email, archive accessed over 700 times in past year.

Berkett, L. *U. Vermont Vineyard Website*. Provide quick grower access to data collected in cold climate grape research vineyard.

Kingsley-Richards, S. and L. Berkett. *U. Vermont Cold Climate Grape Production Website.* Provide relevant and time-sensitive information to cold climate winegrape growers in Vermont and beyond.

Martinson, T. *Northern New York Grape Production Update*. Blog distributed to 70 Northern New York growers weekly from June-Sept. 35 posts.

Nail, W. and V. Bomba-Lewandoski. *The Connecticut Agricultural Experiment Station Viticulture Information Page.* Website posts information on resources, events, for regional cold-climate grape growers. Updated as needed, audience of 70.

Schloemann, S. G. *UMass New England Wine Grape Grower's Resource Center.* Comprehensive website with production, pest management, and industry resources for cold climate wine-grape growers in New England. Post meeting announcements and other calendar events and archive UMass Grape Notes Newsletters.

Schloemann, S. G. *UMass New England Grape Notes.* Periodic electronic newsletter published during the growing season with approximately 10 issues annually, distributed throughout New England. Each issue contains seasonally relevant information on grape production, insect and disease management, harvest parameters, upcoming meetings, and related topics.

Northern Grapes Project Thanks Our Partnering Industry Associations

Connecticut Vineyard and Winery Association
Illinois Grape Growers and Vintners Association
Iowa Wine Growers Association
Lake Champlain Wines
Massachusetts Farm Wineries and Growers Association
Michigan Grape and Wine Industry Council
Minnesota Grape Growers Association
Nebraska Winery and Grape Growers Association
New Hampshire Winery Association
New York Wine and Grape Foundation
North Dakota Grape Growers Association
Northern Illinois Wine Growers
Northern New York Wine Grape Growers
Scenic Rivers Grape and Wine Association (Iowa & Illinois)
South Dakota Specialty Producers Association
Upper Hudson Valley Wine and Grape Association
Vermont Grape and Wine Council
Western Iowa Grape Growers Association
Wisconsin Grape Growers Association

Visit us on-line at
www.northerngrapesproject.org

The Northern Grapes Project is funded by the USDA's Specialty Crops Research Initiative Program of the National Institute for Food and Agriculture, Project #2011-51181-30850

Visit our sister site

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

Cornell University