

University of Nebraska Viticulture Program Progress Report to the Nebraska Grape and Wine Board, May 30, 2018, York Nebraska

Groundcovers in the Vineyard

Field data for this 4-year project were collected in the winter, spring and summer of 2017 and data were analyzed in the winter of 2017/2018 prior to incorporating into Ben Loseke's PhD dissertation (May, 2018). Pruning weights were collected from the grapevines to measure how the groundcovers affected the growth during the previous growing seasons. The vines that were grown under chemically controlled groundcover conditions (control) had the highest pruning weights when compared to the four groundcover treatments. The groundcover treatments had reduced pruning weights ranging from 20% to 193%. These results were the most compelling data collected showing the detrimental effects planting groundcovers has on newly planted vines.

Grapevine leaf water potential (LWP) was collected throughout the summer in 2017 and was used to determine the amount of water stress imposed on the grapevines by adjacent groundcovers. These data will provide solid recommendations on how to educate growers in regards to planting groundcovers in their vineyard.

Soil samples were collected in 2015, 2016 and 2017 to determine the nutrient content of the soil for the four groundcover treatments and the control. Results indicated minor differences between the four groundcover treatments and the control. This may indicate that the reduced vine vigor seen in some of the groundcover plots was caused by water stress and not competition for nutrients.

Yield and berry analysis were collected in the late summer of 2017 and compared to similar data from 2016. In 2016, the total cluster number per plant was higher in the control than all of the groundcover treatments. However, in 2017 there was little difference between all of the treatments and the control. In 2017, all of the groundcover treatments with the exception of the native grass groundcover treatment had similar yields. The native grass groundcover produced the lowest yields among all treatments. Results showed that there were little to no differences in berry quality in both 2016 and 2017. These results corroborate that the conventional wisdom of maintaining a weed-free zone in new plantings is desirable, but ground covers on older plantings have merit.

Eric Nelson has chosen one of the more successful groundcover treatments we used in his vineyard and decided to plant the entire vineyard with this groundcover. He noted that the vines growing alongside the groundcover mix containing Kentucky bluegrass, white clover, red fescue, hard fescue, Chewings's fescue and perennial ryegrass appeared healthier than other vines. In addition, they appeared to rebound much more quickly from a herbicide drift incident than the

other treatments, including the control. This decision is exciting because it clearly shows that growers are enthusiastic about trying new and innovative ways to manage the below vine area of their vineyards.

An ancillary study conducted by the UNL Department of Entomology determined that the insect population makeup, including beneficials, was higher in the various groundcover treatments than the control. There were seven main insect orders present in the vineyard planted with groundcovers, including Orthoptera, Diptera, Hymenoptera, Coleoptera, Mantodea, Lepidoptera and Hemiptera.

See also Abstracts (attached) presented at professional meetings based on this research.

Grape Ripening Based on Growing Degree Days

Probably the most important and challenging viticultural decision a grower/wine maker is faced with is assessing grape maturity, predicting potential wine quality and harvesting at the most optimal time. Decisions such as whether to delay harvest until the desired quality parameters are reached or take chances on weather, shatter, wildlife or insect infestation or diseases such as fruit rot need to be assessed before a harvest timing plan is made. Overall ripeness evaluation involves much more than an analysis of °Brix, titratable acidity and pH; and many winemakers use flavor/aroma assessment in addition to the routine measureable standards. In order to reach these ideal goals one should be aware of environmental conditions. The one that we are focusing on is Growing Degree Days (GDD). While it would never be recommended that this would be a grower's only harvest guide, it can be a very helpful in gauging the approximate range of dates for harvest. Looking back on several years of GDD data combined with an ideal list of key parameters by cultivars and desired wine style provide insights into prediction of harvest timing. Information such as this can be helpful in evaluating when to start testing samples and deciding how long is acceptable to let fruit hang. It can also be helpful in planning in advance based on extended weather forecasts as to when you could expect to harvest and schedule accordingly. One example follows for Marquette grapes harvested in 2017. Data are also available for LaCrescent, Brianna, Petite Pearl, Frontenac, Frontenac Gris, Maréchal Foch, Edelweiss, Prairie Star, Lacrosse and other cultivars, and for several previous years.

| Marquette | Date | Brix | pH | GDD |
|-----------|-----------|-------|------|------|
| | 8/9/2017 | 20.25 | 2.6 | 2212 |
| | 8/14/2017 | 19.7 | 2.75 | 2297 |
| | 8/18/2017 | 22 | 3.4 | 2376 |
| | 8/22/2017 | 24 | 3.25 | 2462 |
| | 8/26/2017 | 24.25 | 3.35 | 2543 |
| Harvest | 8/29/2017 | 26 | 3.46 | 2554 |

See also the Abstract (attached) for the American Society for Horticultural Science conference.

Regional Tailgates

This year we decided to try the idea of regional tailgates as an alternative to more conventional all-day traditional field days. This is an approach that the Viticulture professionals in New York's Finger Lakes region have used to great success. One of the advantages of tailgates is that because they are held late in the day, it usually means an escape from blistering summer heat. Also, by having them in different parts of the state, it is possible for local growers and grape and wine enthusiasts to attend after working at their day job. Tailgates also work well for winery personnel, since having the tailgates during the week avoids conflicting with weekend winery events that usually are an important part of winery cash-flow. We held four tailgates this last summer in different parts of the state. The first tailgate was at Ron Heskett's vineyard south of Brownville, the second one was at Henry Prokop's vineyard north of Wilber, the third one was at Nick Ryan's (Prairie Creek Vineyard), Central City, and the fourth was at Steve Gibson's vineyard in Paxton. We will use this approach to educational events again in 2018, again scheduling in different regions of the state. We have already held two first sessions of "Serial Tailgates" at pruning time, which will be followed by tailgates at flowering/fruit-set, veraison and possibly harvest, employing the same vines as those treated at pruning time so participants can see how the vines have progressed over the growing season..

Table Grape Production in High Tunnels and Controlling Climate Variability:

Growing table grapes in a high tunnel is being investigated to lengthen the growing season and improve visual quality and flavor appeal of the fruit. In addition, a high tunnel provides protection from late spring frost, excess precipitation, hail, birds and insects.

The first year of this project focused mainly on the construction of the high tunnel, trellis system installation and the planting of the grapevines. The high tunnel was built in the UNL East Campus Horticulture garden in Lincoln, Nebraska. In the late winter and spring of 2017 the high tunnel construction began and continued all summer and into the fall. In the midst of construction the vines were planted in the late spring and construction of the trellis followed soon after. The grapes chosen for this project were 'Canadice', 'Somerset Seedless', 'Marquis', 'Thomcord' and 'Mars'. These specific cultivars were chosen based upon their anticipated ability to grow in the Nebraska climate, popularity amongst growers and consumers, and their disease and insect tolerance.

Trellis trials for Cold-Hardy Grapes:

Our research has evaluated several cultivars to determine optimum trellis systems for important cold hardy grapes grown in Nebraska. 'Frontenac', 'La Crescent', 'Saint Croix' and 'Marquette' have been demonstrated to produce the highest yields, without sacrificing quality, on either a

High-wire Bilateral Cordon system or a Geneva Double Curtain (GDC) system, when compared with a Vertical Shoot Positioning (VSP) system.

Mulches for weed suppression:

Use of conventional and non-conventional mulches has produced mixed results. Although crushed glass was an effective weed suppressor, its longevity and cost have led to disposal problems and availability, respectively. Another non-conventional mulch, Distillers Dried Grains, also provided good weed suppression, but its cost varies with the costs of feed value materials for livestock enterprises, which makes its use less competitive. Landscape fabrics have been effective, but they may be cost-prohibitive for large-scale vineyards. Wood chips and prairie hay are also effective, but again, the relative value of hay in some seasons may make it less competitive. Wood chips tend to wash out in heavy rainstorms, especially if the vines are on sloping land. Consensus? Prairie hay or similar baled materials can last for up to three years and if prices are reasonable, may be the best choice.

Cultivar Evaluation:

Evaluation of cultivars and breeders advanced selections has been one of the most valuable parts of the University of Nebraska Viticulture Program. Perhaps it is often more helpful to growers and prospective growers to be able to tell them what **not** to try to grow, thus helping them avoid costly mistakes. The UNVP has evaluated nearly 100 cultivars and selections, primarily to determine adaptation to Nebraska geophysical and climatic conditions, including disease tolerance, cold hardiness, timing of bud break, trellising systems and of course fruit yield and quality. Some examples of cultivars and selections tested by our program are noted in our web site <http://viticulture.unl.edu>

Hail Damage Prevention:

This project has just begun with the purchase of special hail netting for installation on select vineyard sites. We are exploring the possibility of use of a special hail-producing machine being tested in the Department of Biological Systems Engineering. More will be reported following the 2018 growing season.

Collaboration – Internal (within UNL):

- Department of Food Science and Technology (FST)/Food Science Center - Drs. Changmu Xu and Xiaoqing Xie – Research on a new fertilizer containing Lithium (Li) and Selenium (Se) obtained from an Italian entrepreneurial firm has shown that there are elevated levels of Li and Se in juice from treated vines and that this appears to carry over into wines made

from the juice. This research is still very experimental, but may offer valuable ways to enhance the nutritional characteristics of wine from vines treated with the experimental fertilizer.

- FST personnel (Drs. Xu and Xie) have found similarities in the mutants of Frontenac (Frontenac Gris and Frontenac Blanc) to those published for the well-known mutants of Pinot Noir (Pinot Gris, Pinot Meunier, etc.). This research is in its early stages, but offers the opportunity for greater fidelity of planting stock of Frontenac and its mutants, which should be very helpful to suppliers of planting stock.
- FST personnel (Drs. Xu and Xie) are working with our programs to evaluate potential alternative uses for pomace, potentially creating a value-added product.
- Agronomy and Horticulture – Paul Read provided the leadership for a collaborative Hatch (Federal) project involving four other A&H professionals (Adams, Dweikat, Paparozzi and Wortman) entitled “Diversifying Farm Income through Alternative and Horticultural Specialty Crops Research” (Paul E. Read, PI and Project Leader).
- Departments of Entomology and Plant Pathology – advising on insect and disease management, respectively.

External Collaboration:

- Northern Grapes Project - “Viticulture, Enology and Marketing for Cold-hardy Grapes. This cooperative research program involves viticulturists and enologists from 13 Midwest and Northeastern states. It has resulted in a series of webinars that many growers and winery people have taken advantage of, including many from Nebraska. The project is being considered for an extension of four years and is being led by Dr. Paolo Sabbatini from Michigan State University. Research results have shown that the best trellis systems for Frontenac, Marquette, St. Croix and La Crescent are high wire systems such as high wire bilateral cordon and Geneva Double Curtain.
- NE-1020 (now NE – 1720) – This is a regional project that involves viticulturists and enologists from nearly 20 states (primarily northern states) and has focused on cultivar evaluation under an agreed-upon set of parameters so that cultivar performance can be compared across states and regions. Terry Bradley is the PI and Paul Read is a collaborator/Co-PI.

Annual Conference: The 20th Annual Winery and Grape Growers Forum and Trade Show took place March 2-4, 2017 at the Omaha Marriott Hotel, Omaha, Nebraska. This conference was the final time for the University of Nebraska Viticulture Program to plan and organize this educational event and represented a “transition” to hand off this program to the Nebraska Winery and Grape Growers Association (NWGGA). This transition is timely and is a measure of the growth and maturation of Nebraska’s grape and wine industry. Conducting such conferences in

most other states with substantial grape and wine industries is handled by the professional associations affiliated with those industries, so this transition is a natural indication of the success of Nebraska's grape and wine industry and the professional growth of the NWGGA.

Extension Publications:

G2279 – Grape Growing for the Home Garden (NebGuide)

G2289 – Growing Commercial Wine Grapes in Nebraska (NebGuide)

Nebraska VineLines - a periodic email newsletter sent to over 300 recipients – average of six issues per year.

Research Publications:

Loseke, Benjamin A. 2018. Replacing Herbicides with Groundcovers for Nebraska Vineyards. University of Nebraska PhD Dissertation May, 2018.

Read, Paul E. and Benjamin A. Loseke. 2017. Creativity in Micropropagation: An overview of the AEMP/PEMP story and thoughts on what the future will bring? *Acta Horticulturae* (Invited, reviewed and accepted research manuscript).

Bavougian, Christina and Paul E. Read. 2017. Mulch and ground cover effects on soil temperature and moisture, surface reflectance, grapevine water potential, and vineyard weed management. *Biological Agriculture & Horticulture* – Manuscript ID TBAH-2017-0336

Paparozzi, Ellen T., George E. Meyer, Vicki Schlegel, Erin E. Blankenship, Stacy A Adams, M. Elizabeth Conley, Ben Loseke and Paul E. Read. Strawberry cultivars vary in productivity, sugars and phytonutrient content when grown in a greenhouse during the winter. *Scientia Horticulturae* 227:1-9.

Morrison, Donna, Erin Blankenship, Paul E. Read and Ellen T. Paparozzi. 2017. Stolon Development and Cultural Production Practices of Winter-grown Strawberries. *Intl J. Fruit Science* (Reviewed, Conditionally Accepted pending minor revisions).

Team Hatch Project, Paul E. Read Director. 2017. Project Title: Diversifying Farm Income through Alternative and Horticultural Specialty Crops Research. Approved through the University of Nebraska's Agricultural Research Division and USDA-NIFA, August 15, 2017 as NEB-22-391.

Teaching:

HORT/HRTM/NUTR 471/871 – Vines, Wines and You, 3 credits - Spring Semester, two sections, total 75 students; Fall Semester – one section, 47 students

HORT 352 - Physiology of Horticultural Crops (2 credits, team-taught with Dr. E. T. Paparozzi), Fall Semester – 12 students

HORT 353 - Vegetable Crops Laboratory (2 Credits), Fall Semester – 12 students

HORT 354 – Fruit Crops Laboratory (2 credits) – 14 students

Further Notes:

University of Nebraska Viticulture research has continued to focus on topics of concern to grape growers, including canopy management, disease and pest identification and prevention, optimizing trellis systems, weed management, herbicide drift problems and their prevention/management, cultivar and new genotype evaluation* and vineyard floor management. The latter topic is addressed in the next page by a report of a four-year study of ground covers and cover crops on a commercial cooperator's vineyard near Raymond, Nebraska.

*Newly identified selections from grape breeding programs and from private breeders are continually being tested, with additional new genotypes to be planted in University of Nebraska Viticulture Program research vineyards in 2018. Recent examples, include 'Itasca', a dry white wine type from the University of Minnesota breeding program that will be in its third growing season in 2018 and should produce a modest crop that can be tested for quality parameters such as degrees Brix, pH and titratable acidity. Likewise, TP 1-1-12 from private breeder Tom Plocher will also be in its third growing season and can be tested in a similar fashion if enough crop is produced. A new as-yet un-named table grape from the Cornell University breeding program has been added this year to the High Tunnel project.

Attachments include Abstracts presented or to be presented at professional meeting based upon research led by the University of Nebraska Viticulture Program.