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Does Minnesota have what it takes to become the next grape growing haven?

As European regions have been leaders in the grape and wine industry, what does Minnesota have in common with these regions? Do they have what it takes to compete?



Christopher Long

Minnesota State University, Mankato

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In the last 20 years, Minnesota has seen rapid development in the grape growing industry; both in scientific development of cold-hardy grape hybrids and in the number of growers and wine producers. As the industry in Minnesota continues to exponentially take off, there are concerns that grape exportation may be problematic as a means for industry expansion. As emphasis has been placed on creating cold-hardy grape hybrids, less focus has been on the ideal characteristics relevant to the taste of the finished wine.

As critics in the profession continue to raise questions, to this point Minnesota has found an answer. Some viewed Minnesota as being unable to support grape vineyards due to cold and sometimes volatile weather conditions. This has now been possible due to scientific advances, and Minnesota has begun to establish itself in the grape growing industry. Research and development in new grape hybrids are the foundation on which the grape growing industry in Minnesota plans to continue expansion. Outside of winter climate conditions, the geography and topography in Minnesota makes it a fine candidate for grape growing with warm summers, ideal soil, and numerous lakes and rivers surrounded by hilly terrain. As there are concerns as to whether Minnesota can establish itself as well in the export market, with more of an effort in brand marketing of the wine and differentiation of Minnesota grape attributes, this is entirely feasible. In order to fully understand what opportunities as well as limitations Minnesota may have, this paper will begin by explaining the different steps and phases of the wine making process and provide an overview of the grape growing process.

I have been studying the development of the grape growing and wine industry, specifically in Minnesota, because I want to understand the current standing of the industry and the potential direction it may be heading. This paper will take an in-depth look at the industry in Minnesota, including what new research has been done to improve the genetics of grape varieties to make them well-suited for the cold Minnesota winters. As European regions have been leaders in the grape growing and wine industry on an international level, comparisons to European regions such as those found in Austria are also relevant to the direction both wine producers and marketers should take to maximize the Minnesota market. This paper will also elaborate on different marketing techniques used to sell the finished wine, and how the techniques vary depending on the grape growing region.

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Overview of the Wine Making Process

Grape Crushing

At the end of a warm summer growing season fully mature grapes are ready for harvesting by grape growers. Throughout the growing season wine producers (wineries) maintain constant contact with their contracted growers to ensure they receive a strong, marketable product. Wineries are eager at this point to receive the season's harvest to continue processing into various wines for the consumer.

Upon the finishing of grape harvest, the grapes are ready for the crushing and pressing machines to extract the juice and make wine. As the grapes are emptied into the hopper of the crusher a set of paddles separates the stems from the grape and serrated rollers break the skin so juice can flow. The crushed grapes are called the "must", and the must is pumped directly from the crusher to the press. The "must" for both red and white wines is at this point is white; the skin has most of the pigment that will give color to the wine. The grapes are then pressed multiple times, and the squeezed juice resulting from each press has different characteristics.

Each part of the grape possesses different compounds and qualities that combine to make a good wine. The interior pulp is, of course, almost pure liquid. As already mentioned, the skin has much of the pigment that will color wine, as well as tannins, acids and compounds that become aroma and taste. While a delicate white wine would be overpowered by too much of these compounds, a red wine derives its body and flavor from the use of these elements, so the pressing is effective in two stages. The first press is called the free run, and comes from the middle of the pulp. It is the clearest, most easily pressed liquid, and is gotten with very little pressure. After first press, a heavier pressure is exerted to get the juice from within the skin. The operator determines the amount of pressure in the second pressing and has to be careful; if too much force is applied the grape seeds may break which can add bitterness to the wine.

After pressing, the resulting juice is now ready for fermentation.

Fermentation

Fermentation is the chemical change in which yeast converts the natural grape sugars into alcohol.

The fermentation process begins with the addition of yeast to the juice. Yeast consumes sugar which then converts into alcohol and carbon dioxide. There are a couple popular methods of adding the yeast to the mixture. The first approach to be mentioned is most popular in United States, and is done by winemaker inoculation. The most common type of juice inoculation is by using an active dried yeast culture. The yeast is freeze dried and stored in vacuum packed tins by supply companies ready for use. The winemaker then rehydrates the yeast in warm water in order to bring it out of their suspended state. The hydrated yeast is then added to the juice. There are many different strains of yeast the winemaker can choose, and using the inoculation

technique allows the winemaker to manipulate the aromas the wine will exhibit. Also, some strains ferment better at different temperatures, and since winemaker has control of these variables he/she can choose the strain that will help maximize the chance of a clean and complete fermentation.

The second method, commonly used in Europe, is a less interventionist approach which lets nature take its course. This method is referred to as spontaneous fermentation. The grapes contain active cells of *saccharomyces cerevisiae* (yeast), and when the juice is left alone to let nature take its course, the yeast cells start to convert the sugars to alcohol. An advantage to this method, though not scientifically proven, is that the wine exhibits better “mouth feel” and is thought to be softer and creamier. It is believed that this desired body is a product of the natural yeast. Also, this method costs nothing to initiate. Disadvantages to spontaneous fermentation include the extra time required during fermentation, and a potentially higher rate of spoilage.

When all of the fruit’s sugars are converted to alcohol, or the alcohol is tested and found to be the desired percentage, this means the first stage of fermentation is complete and all the natural yeast, as well as the added yeast nutrients, has been destroyed. Although many red wines and some white will then undergo a second fermentation by bacteria, called malolactic fermentation, which lowers the acid content.

In order to find out if the sugar has been absorbed, the winemaker uses a hydrometer. When the sugar converts to alcohol, the wine mixture thins out, and this tool measures the density of the fluid it is testing. If the hydrometer reads the tested wine is at the appropriate level, the wine is ready to continue fermentation in storage, generally in oaked barrels or stainless steel vats.

For red wines, once in the barrel the wine is kept in barrel aging rooms with controlled humidity, heat and light settings. While red wines are fermenting, they generally do best when they are being stored in an area where the temperature is 65-85 °F (18-30 °C). Anything warmer will result in the wine essentially being destroyed. The contents inside will cook: the cork will dry out, the protection for the wine will be gone, and the contents inside will be affected.



Red Wine Stored in Oaked Barrels

While large wineries will often ferment their red wine in oaken kegs, white wines are usually fermented in large stainless steel vats. The steel tanks provide stable temperatures needed to produce crisp, clean white wines. The winemaker usually lets the wine ferment 4-6 weeks, at around 60 °F (15 °C).

Winemakers will often add more nitrogen and micro nutrients during this phase of the fermentation process to prevent any production of hydrogen sulfide gas. If this gas gets into the grapes, it creates a rotten egg smell thus stinking up the wine mixture. Considerable effort is

taken to avoid this chemical reaction, although even the most experienced winemakers can have this reaction occur.

Upon the completion of fermentation, the winemaker has the option of fining the wine. This is the process of clearing the product of any solid particles of yeast or grape. As the wine is gently decanted from the barrel, it leaves sediments behind. The wine may then be fined, a process in which a substance is added that draw particles to it. The wine may also be filtered, though filtering not only removes every last particle, but some of the flavor of the wine. As a result many wines are left unfiltered to retain a full flavor. The wine is then bottled and siphoned into an airtight container and the wine making process is complete. (virtualwine.com.au, 2005)

The fermentation process is really a science. There are a seemingly endless amount of factors to consider during fermentation, and there are even more implications to choices made and techniques used. As a result, this section is simply meant to provide a basic understanding of wine fermentation through a summary of general practices.

Understanding the Grape Growing Process

There are actually more than 5,000 different varieties of wine grapes; however, there are only two broad families. They are *Vitis Labrusca* and *Vitis Vinifera*. *Vitis vinifera* is a European type of grape vine that has the ability to produce wines such as Merlot, Cabernet Sauvignon, Chardonnay and Riesling. *Vitis Labrusca* produces American grapes such as Concord, Catawba, Delaware and Niagara. Each vine has shown high levels of adaptability and will mutate according to its new environment after introduction. Because of this, they can be found on every continent except Antarctica.

The process of growing grapes is known as viticulture. Factors such as soil, chemicals, geology, topography and climate are all important to the process and are carefully observed and managed by the viticulturists.

Viticulturists, or growers, have an important role in the growing process and influence the characteristics of the end grape the winery starts their winemaking process with. Because of this, they are often highly involved with the winery. Other responsibilities of the grower include monitoring and controlling pests and diseases, fertilizing, irrigation, canopy management, monitoring fruit development and characteristics, deciding when to harvest and also prune during the winter months.

In most cases, grapes begin to bud during the spring and then grow and develop fruit during the summer, a stage called fruit set. Following fruit set growers then have the option of performing “green harvest”, a technique later described.

The phase during which grapes begin to change color is known as *veraison*. This is an especially important phase for red or black grapes. Regardless of what color they will eventually become, all grapes begin as dark green and hard. It is only during the ripening phase in the sun that they

begin to take on their true color. It is during this time that white varieties of grapes will begin to achieve their golden hue and red varieties of grapes will begin to take on their deep purple hue.

By early fall the grapes are ready for harvesting. The exact time at which grapes need to be harvested can depend somewhat on the local climate as well as personal judgment. The natural sugar content as well as the ripeness of grapes is an indicator of the appropriate time for harvesting. When grapes are typically ready to harvest, the leaves on the grapevines of white varieties will begin to turn yellow while the leaves of red varieties will take on a red hue.

Ideal Growing Conditions

The presence of large bodies of water and mountains or hills has a positive effect on the climate and vines. Nearby bodies of water can serve as protection for large temperature drops at night by releasing heat it stored during the day to create a more temperate environment for the vines. Areas with hillsides and slopes are preferred over flatter terrain for multiple reasons. As evenings bring with them cooling temperatures, areas with hilly terrain receive welcomed cool air flow down the slopes into the valleys, although too much cool air will deprive the vine of heat needed for photosynthesis. Also, when the vines are on an angled slope, they will receive greater intensity from the sun rays as the sunshine falls on a perpendicular angle to the slope. An additional benefit is the natural drainage the slope induces so the vine does not sit with too much moisture in the soil. With flatter terrain, the strength of the sunlight is diluted as it is spread out across a wider surface area. In cooler climate regions of the northern hemisphere, south facing slopes receive more hours of sunlight, and in warmer climates, north facing slopes are preferred for the increased amount of sun exposure. (In the southern hemisphere the orientations are reversed.) The vine needs approximately 1300-1500 hours of sunshine during the growing season, and around 27 inches of rainfall during the year in order to produce adequate grapes for winemaking. Ideally, rain is most desired during the spring and winter months. Rain during harvest time increases the threat of diseases and grape splitting. The majority of wine producing regions are situated between the 30 – 50 degree latitudes in both hemispheres. In these areas the average yearly temperatures are between 50-68 °F (10-20 °C). Ideal weather for a growing season is a long, warm summer which allows the grapes to fully ripen and develop a desired balance between the acid and sugar levels.

Soil Types

Grape vines thrive in well-drained soils with somewhat sandy surface layers over moderately permeable clay subsoil. How well a particular soil retains heat is important. The amount of soil-available water directly affects grape vine water balance. The water balance is considered to be the most important factor in the choice of soil for a grape vine.

As mentioned earlier, good drainage is important. The fertility of the soil, so important in other crops, is less important for grapes.

Grapes will grow adequately in a wide variety of soils, but those involved with viniculture are always seeking a way to create a better grape, which has led to increased emphasis on soil type. For example, Chardonnay and Pinot Noir vines thrive in limestone soil. The great vineyards of

Champagne, Burgundy, the Loire River, and Bordeaux all have quality limestone soil. Cabernet Sauvignon likes gravelly soil. Riesling likes slatey soil. Generally speaking, European growers have put more emphasis on soil type. This may be largely contributed to the maturity of the industry and marketing techniques used to sell the finished wine, later explained.

In the middle ages there was the introduction to the research of different varieties, to see which vines were more suitable for a particular area. Around this time early concept of terroir emerged as wines from particular places began to develop a reputation for uniqueness. Terroir is a group of vineyards from the same region that share the same type of soil, weather conditions, grapes and wine making styles which contribute to the personality of the wine. In wineries operating under Roman wine law, such as Italy, France and Spain, the land is considered paramount, and is sacred in the growing process. They are areas that label the wine based on terroir, and their wines are associated with where the grapes are grown, rather than the grape type.

Also related to terroir is the idea of cru vineyards, which is a label able to be put on a wine implying the vintages of the wine are grown at the same vineyard each year and are consistent. Cru vineyards are used solely for one type of wine, and this ensures a consistently flavored grape. Cru vineyards used for unique and high quality wines, and signifies the highest designation for a vineyard.

Trellis Systems

Trellis systems are simply a framework that supports grape vines as they grow, training them upward rather than letting them grow outward along the ground. Trellising not only keeps the vines off the ground but exposes both the canopy and grape clusters to more sunlight and provides better air circulation.

In the most basic terms, a trellising system consists of a row of posts or stakes anchored in the ground at various intervals and typically connected by taut wires on which the vines can be trained. The Romans were the first to use stakes as a trellis system to keep the vine off the ground as an alternative to training the vine to grow up along trees trunks.



Three Wire Trellis System

Today trellising is customized according to the vineyard site and grape variety. Trellis styles include: Single stakes (no wires-the vines are simply trained vertically); one-wire trellis, the vines trained on one horizontal wire strung between posts (used primarily for table grapes); two-wire trellis (with the wires about a foot apart), and the most common system used for grape vines; three-wire trellis (a foot apart), which offers more support points for the canopy.

Green Harvest

Green harvest is essentially the removal of immature grape bunches, for the purpose of reducing total crop yield and increasing the quality of the grapes to be harvested.

It is a relatively modern practice used most often to increase the quality of the wine. During the process tiny, immature grapes are removed from the vine. While these grapes may still be green, they induce the vine to put considerable energy into developing the remaining grapes. This theory advocates that the result will end in more ripened grapes that have better developed and mature flavor compounds. Without green harvest, a healthy, vigorous vine can produce dilute, unripe grapes. Many regions do not use this method, due to natural conditions that suppress the total yield of the vine. In these regions, the vine is prevented from producing too many grapes without human intervention. In contrast, regions with fertile soil, abundant sunlight, and irrigation, the vine can generate large quantities of characterless grapes.

After fruit set, when the flower develops into seed and berry, the grower has an opportunity to estimate the end total yield of the crop. Often the grower has a target yield in mind, and the grower may cut off bunches to leave an amount close to the target yield. In Europe, there are regulations that restrict the yield permitted from a given area, creating incentive to perform green harvesting when dealing with excess crop. Without green harvesting, the excess crop may have to be sold for a dismal amount, and then used for industrial alcohol production. This trend has only increased in recent years.

Hazards in the Vineyard

The grape growing process is touchy, and the vine can be susceptible to many hazards and diseases that can affect the wine produced from the grapes or kill the vine itself. In the flowering stage the vine is especially susceptible to weather hazards such as strong winds and hail. Cold temperatures at this time can produce clusters with no seeds and varying sizes. Too much heat can have the opposite effect and cause clusters to drop to the ground or not fully develop.

One of the most common threats to a grape vine's health is frost, and this presents an especially large threat to vineyards in northern territories such as Minnesota. Frost is formed on the vine when the temperature drops below the freezing point of their cell contents. Certain bacteria can actually increase or decrease the hazard of frost by raising or lowering the cell temperatures of the plant. During the budding stage of the vine, frost damage can occur at temperatures as high as 26 °F (3.5 °C). This is a more common hazard in Minnesota where volatile temperature drop occur at night. Even in the spring months frost may leave the vines damaged if proper methods are not observed.

There are two types of frosts, radiation and advective frosts.

Radiation frosts are caused by cool air inversions and occur on clear nights when radiation from the ground to the sky is not impeded by cloud cover. Radiation frosts occur as land air temperatures increase during the day, but decrease with elevation. At night the heat from the

land is lost as the hot air rises and the cool air sinks, and if this air is too cold the vine freezes. Radiation frosts tend to occur near dawn.

A cloudy day followed by a cloudless night produces the greatest frost risk. The cloudy day reduces the sun's ability to heat the soil surface and when followed by a clear night what little heat is stored quickly dissipates. Only a small amount of cloud at night is required to prevent a frost from developing.

Advection frosts are also known as freeze or wind frosts. This type of frost is caused by wind chill. Simply if the wind is too cold the vine freezes.

There are many different techniques that can be used to prevent frost damage. Airflow is essential in frost prevention, and there are simple measures that can be taken to ensure proper airflow. This includes laying out vineyard rows parallel to the direction of the cold air drift and pruning unnecessary branches and leaves that would restrict the free flow of air.



**Overhead Sprinkler Systems in
New Zealand Vineyard**

Other prevention methods include frost fans, wind machines and sprinkler systems.

A more elaborate and expensive means of frost prevention has been demonstrated in the vineyards of New Zealand. When the temperatures drop at night they run helicopters over the field, dragging down warmer air from the inversion layers that prevent the stagnant collection of cold air on the ground.

Other diseases include powdery mildews that infect green tissue on the grapevine, including leaves and young berries. Mildews are serious disease in terms of expense and must be treated immediately. Mildews can be treated with sulfur or fungicides, but if gone untreated it will cause crop loss and possibly poor wine quality.

Without proper measures taken to avoid these hazards the results can be devastating. In the late 1800s vineyards began deteriorating in European regions, particularly in France. Later to be called the “phylloxera plague”, the disease in France alone caused a drop in wine production from 85 million hectoliters to 24 million hectoliters. This led to immediate extensive research in prevention of this disease among others.

There are many individual hazards that show potential risk to the well-being of the crop. With the utilization of proper hazard prevention methods these risks can largely be avoided, ensuring healthy, plentiful crop come end of season. Section Work Cited: (Wikipedia, 2009) (Fortune, 2009) (Academic Dictionaries and Encyclopedias, 2009)

Evolution of Grape Growing: New Cold-Hardy Hybrids Lead Minnesota into Industry

Industry Potential

While there has been considerable progress in cold hardy grape varieties, several Universities in the United States plan to release new cold-hardy grape hybrids that are expected to spur growth in Minnesota's already rapidly growing wine industry.

A limiting factor in Minnesota grape growing had been the cold weather climate that excluded the growth of many grape varieties and had created a need to take intensive measures to protect the vines from frost damage. This has been a significant economic disadvantage compared to other parts of the country. In order to develop the industry here, cold-hardy grapes that would make quality wines and survive reliably in winter have been needed.

The University of Minnesota leads the way in research and development of new strains of vines. Within the last decade a number of cold-hardy hybrids have been released and has provided Minnesota with potential to expand its industry into the national market.

"The new cold-hardy grapes should encourage agricultural diversification," says Lisa Gjersvik, manager at Agricultural Utilization Research Institute. "It's an opportunity for growers to get into an alternative crop with less up-front investment. Grape growing operations require less start-up capital than traditional farming, and grapes will grow on marginal land." (Morrison, 1998)

"Furthermore, grapes are a high-value crop. Gross revenues can run up to \$4,000 per acre," says Peter Hemstad, U of M research viticulturist. "And processing grapes into wine can increase their value as much as tenfold. There aren't many other crops you can grow with such a high gross return. The sandy soils of the Minnesota and Mississippi river valleys are good for grapes. And there's strong interest in viticulture here, with more than 750 members in the Minnesota Grape Growers Association. Ours is one of the largest grape growers' associations in the country." The Minnesota Legislature has also recognized the need for grape research. Last year, lawmakers provided funds for a professional winemaker and research winery at the U of M. *"That will be a big boost to our industry."* (Morrison, 1998)

Ray Winter, a commercial vineyard and farm owner in Minnesota is licensed to grow vines the University releases, which currently accounts for 90% of his vine stock. As a farmer who also grows 650 acres of corn and soybeans, Ray sees grapes as a good business venture - an in-demand, high-value crop that diversifies his crop portfolio.

"I make between \$4,000 and \$5,000 (net profit) per acre of grapes. When I have 10 to 12 acres of fully producing grapes, I'll make as much from them as I do from the 650 acres of corn and beans," he says. "Of course," he adds, "you can't grow grapes from a tractor."

Much of the work, pruning and harvesting must be done by hand.” To be a licensed winery in Minnesota, at least 51 percent of the juice must come from Minnesota-grown grapes. “Now several of my neighbors are growing grapes. The wineries can't get enough. I think it will be a long time before there are too many grapes in Minnesota.” (Barker, 2006)

In such a young industry that has developed ten-fold in recent years due to new cold-hardy grape varieties, the sky is the limit, and Ray Winter is an example of the increased grape growing trend in Minnesota.

Geography and Climate Conditions

Central Minnesota lies at the same latitude as the Bordeaux wine region of France (45 degrees North), and only a couple degrees farther south than the prominent Wachau region of Austria. The Wachau wine region is an ideal candidate for grape growing, it stretches along the Danube river valley surrounded by rolling hills and offers a very temperate year-round climate. As in these regions, the summers in south-central Minnesota are well-suited for grape vines - sunny, warm, and with ample rainfall. A main feature of summer weather in Minnesota is the weakening of the jet stream, leading to slower movement of air masses, a general increase in the stability of temperatures, and less wind, similar to the mild summers found in the Wachau region. Likewise, Minnesota too has an abundance of good vineyard sites, with rolling hills and bluffs along a plentiful number of rivers and lakes.

But because of its geographic location in the center of North America, Minnesota is subject to some of the widest temperature ranges in the United States. Temperatures in Minnesota range from an average of 13.1 °F (–10 °C) in January to 73.2 °F (23 °C) in July. Being 1,000 miles (1,609 km) from any large body of water (with the exception of Lake Superior), temperatures and precipitation in Minnesota can vary widely. With no natural barriers to block cold air from pouring south from Canada, Minnesota is subjected to many arctic air masses throughout the winter months. These arctic air masses bring with them very cold temperatures and sometimes strong wind.



Along with the wine growing regions in Minnesota, frost damage is also a common hazard in Europe. Unlike Europe, Minnesota has an increased threat of winterkill during the winter months. Freeze injury, or winter kill, is when very low temperatures permanently damage vine tissue. This can lead to poor quality crops with less yield or even split vine trunks. During the winter months the vines become dormant, which increases their resistance to frost damage. Even so, the most commonly used grape family (European *Vitis Vinifera*) can experience winterkill in temperatures 0° to -15° F (-17 to -26° C). Only through the releases of cold-hardy grape hybrids has Minnesota been able to grow and sustain grape vines through the winter months.

New Research and Releases of Cold-Hardy Varieties

As mentioned earlier, Minnesota shares some of the same characteristics as great European vineyard sites such as those found in Austria. But unlike Europe, Minnesota has a continental climate that brings surges of frigid temperatures. Early autumn frosts have often cut the growing seasons short and severe winter weather has damaged even the hardiest of grape vines. The challenge to Minnesota grape growers has been to find grape varieties that can be grown within the limits imposed by the climate. That search has taken three directions.

1) Breeding Improved Varieties

For over 35 years the University of Minnesota has worked at breeding new and improved grape varieties specially adapted to the rigors of the climate. Seven of these varieties have been patented and released to cold-climate grape growers. Numerous wineries have won national awards for wines made from these grapes. The University of Minnesota has had a grape-breeding program since 1983. Its first major release was a red wine variety named Frontenac, which was made commercially in 1996. The Marquette variety, released in 2006, quickly found a niche in the Minnesotan market, and accounts for almost 30% of vines planted in the last 4 years.

2) The French-American Hybrids

The French-American Hybrids were developed many years ago in France by crossing premium wine grape varieties like Chardonnay and Gamay Beaujolais with native American wild species. These hybrids combine the quality of fine wine grapes with the disease resistance and early ripening of native wild grapes. The French Hybrids themselves lack winter hardiness in Minnesota, but this hybrid among some others can be grown successfully if they are protected from the winter cold. Late in the fall, the grapevines can be cut down from their trellis supports, pinned flat on the ground and covered with soil or straw. In the spring, as soon as the snow melts, the vines can be uncovered and tied back up on the trellis for another growing season. This process is time-consuming and costly, but it does allow growers to produce a broader spectrum wines in Minnesota.

3) European Varieties

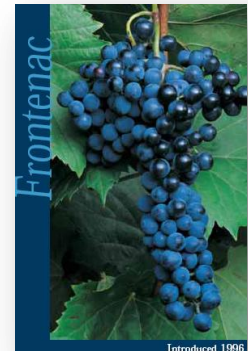
Some of the classic high-quality European wine varieties will ripen in Minnesota given good growing conditions and meticulous care, though seldom grown due to the cost and risk involved.

Supported by a state-of-the-art enology lab and winery, the University of Minnesota's cold-hardy hybrids have potential to revolutionize the grape growing market. They are recognized as one of the top wine grape programs in the United States, and have been able to develop high

quality, cold-hardy, and disease resistant grape varieties. Hobby and commercial growers alike have the ability to purchase vines and their licenses from the University. The following mentions a few popular varieties and characteristics that have been developed:

Frontenac:

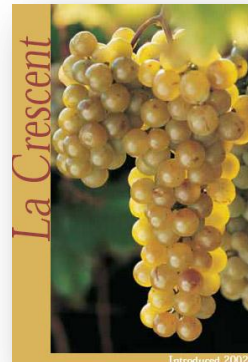
The Frontenac variety reflects the characteristics of its parents, European Vitis Riparia and French hybrid Landot. Suitable for short growing seasons in Minnesota, Frontenac ripens in late mid-season. Cold-hardy, this vine has produced a full crop after temperatures as low as -33 °F (-36 °C). It is very disease resistant, with near-immunity to downy mildew. This versatile grape can be made into a variety of wine styles, including Rosé, Red, and Port. Frontenac is now being widely planted throughout the Midwest, New England, and Quebec.



La Crescent:

La Crescent combines a selection from Vitis Riparia and Muscat Hamburg. With this hardy heritage, trunks have survived an amazing -36 °F (-38 °C). Moderately disease resistant, vine leaves sometimes exhibit downy mildew, which can be controlled with a standard spray program. Proper conditions and care result in very productive harvests.

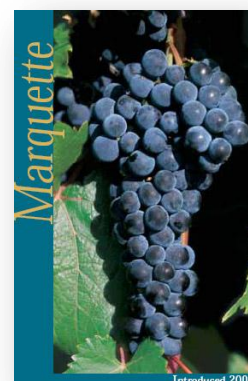
Similar to Germanic style wine such as Vignoles or Riesling, La Crescent lends itself to superior quality off-dry or sweet white wines. The grape's high acidity also provides good structure for excellent dessert or late-harvest style wines.



Marquette:

A recent and widely popular release, Marquette is a complex hybrid of Vitis Riparia, Vitis Vinifera, and other Vitis species. Viticulturally, Marquette is outstanding. This hybrid exhibits high resistance to downy mildew, powdery mildew, and black rot, and its open, orderly growth habit makes vine canopy management efficient.

High sugar levels and moderate acidity make it very manageable in the winery. As a red wine, Marquette is seen as representing a new standard in cold-hardy varieties.



Officially introduced in 2006, Marquette vines are in high demand and short supply. Those wishing to make a new order are placed on a waiting list currently around two years out. (University of Minnesota, 2008)

In-Depth Look at the Minnesota Grape and Wine Industry

Industry Study

The grape growing industry in Minnesota is experiencing substantial change. There are an increasing number of individuals expressing interest in growing grapes, and more wineries are being approached by growers interested in selling their grapes. The potential for this industry hinges on the continuing research and development of cold-hardy grapes through research institutions such as the University of Minnesota. While a large percentage of cold-hardy research is being conducted through the University of Minnesota, other research institutions include: University of Wisconsin Madison, Michigan State, Ohio State, Cornell University and the University of Indiana.

In an effort to quantify the standing of the industry in Minnesota and the direction in which it is heading, the following will attempt to summarize and reflect on an industry study conducted in 2007. (Minnesota Grape Growers Association, 2009)

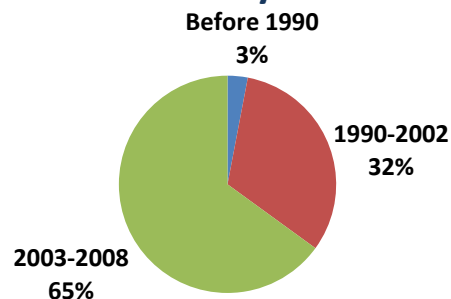
The study was completed by the Department of Applied Economics at the University of Minnesota. The participants include 609 grape growers of 752 currently in contact with the Minnesota Grape Growers Association. Of the 609 grape growers, 84% indicated that they are currently growing grapes in Minnesota. Through research of their own, they have estimated that there are currently 632 active grape growers in the state.

The results of this survey indicate rapid growth in the number of vineyards, vineyard acreage, and the number of vines. As a result of increasing cold-hardy research there are new varietals being planted each year in large quantities, with a majority of this growth happening in the last 5 years. Further, the survey indicates that this growth will continue, at least in the short term.

Vineyards:

There are a total of 632 vineyards in Minnesota. Chart 1 shows the age of these vineyards. Of those, only 3% were established prior to 1990. Another one-third of the vineyards were started between 1990 and 2002. Almost two-thirds of vineyards in the state were planted within the last 5 years, meaning the industry has almost doubled in a 5 year period. This is tremendous growth for any industry.

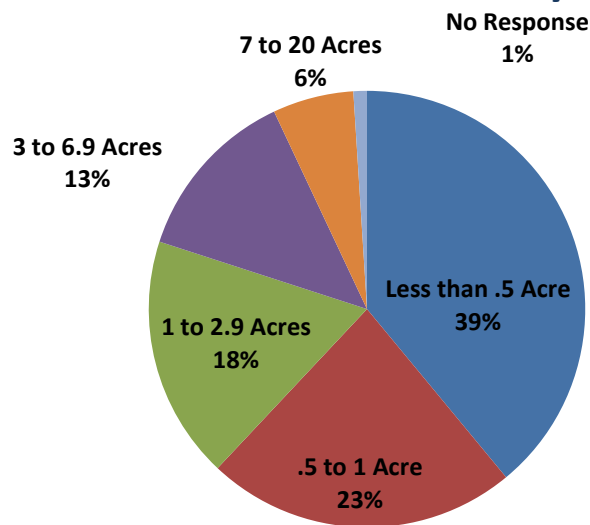
Chart 1: Year of Vineyard Establishment



Acreage:

Relative to other wine growing regions, Minnesota acreage per grower is rather low. The average is a mere 1.67 acres, and through statistical estimation the total number of vineyard acres in Minnesota is 1,056. The following chart illustrates the number of growers by acreage, and as indicated over half the growers have one acre or fewer of planted grapes. Of these, 39% are growing on less than half an acre and are most likely growing for non-commercial purposes. As a result, it can be determined that about 60% of the grape growers are commercial.

Chart 2: Number of Growers by Acreage

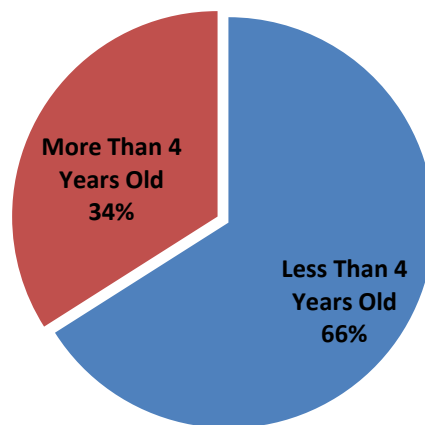


Vines:

The total acreage of a vineyard is one method for measuring the size of a grape growing operation, and measuring the number of planted vines is another such method. In such a young Minnesotan industry new releases of varieties appear to be an important factor in industry growth. Therefore, in addition to the total number of vines, the type of vines being grown is of interest to the grape industry.

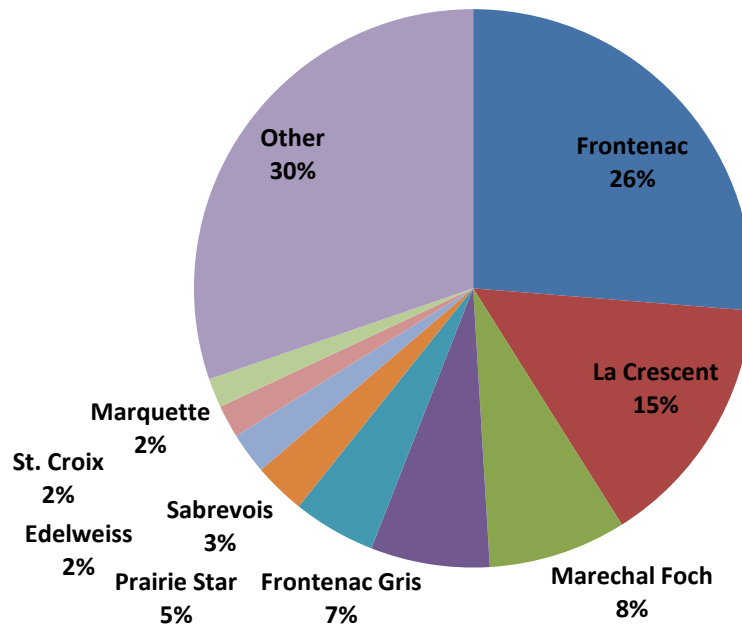
As mentioned earlier, the number of vineyards has doubled in the last 5 years and the number of vines planted seems to be keeping pace. Firstly, this validates earlier evidence of industry growth. Secondly, it raises concerns about the utilization of the grapes each vineyard produces. The age of the vine has implications to the growth of the industry; vines that are less than 4 years of age are not yet fully mature in size and at full cropping potential.

Chart 3: Age of Vines

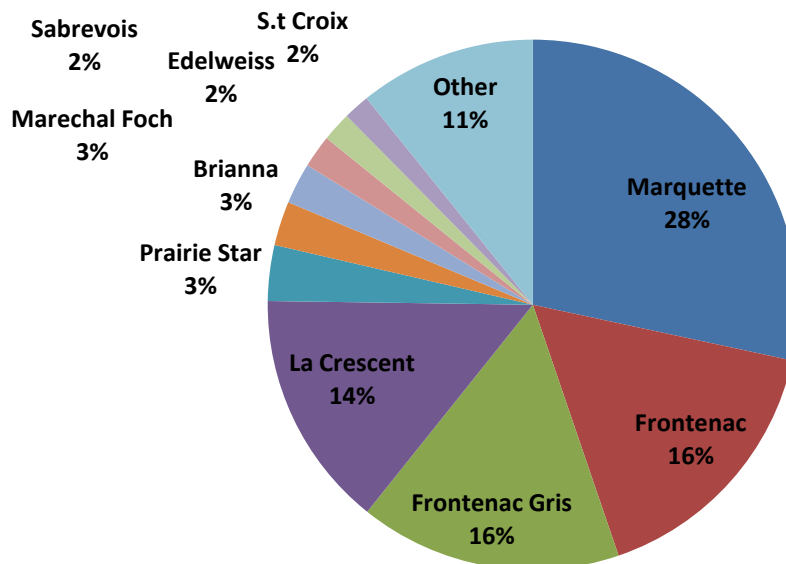


In addition to the age of the vines being planted, it is important to look at the trends of different varieties being planted compared to the age of the vine. As the next two charts show, there have been substantial changes in the types of vines being planted. Chart 4 shows the vines by type that are more than 4 years old. Chart 5 shows the variety of vines that are less than 4 years old. For viewing ease, the numbers of varieties included in the graph have been condensed, and the charts take into account the highest percentage of varieties used in Minnesotan vineyards. As shown, the Marquette grape, a relatively new release from the University of Minnesota, has become popular among grape growers. Over 25% of planting in the last 4 years have been of the Marquette variety, and is thought to be an excellent grape for wine production. This can be attributed to its excellent winter hardiness, disease resistance, orderly growth habit and canopy, high sugar levels and moderate acidity, all which make it very manageable for the winery.

Vines by Type: More Than 4 Years Old



Vines by Type: Less Than 4 Years Old



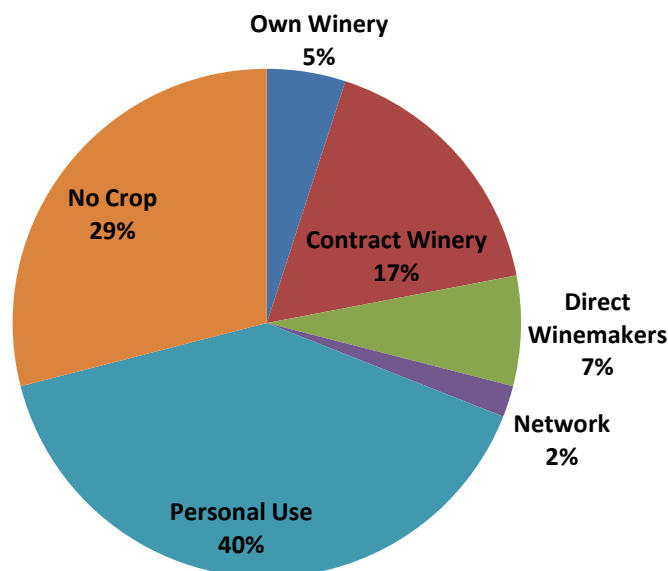
Use of Grapes:

The future destination of grapes grown in Minnesota is an important issue. New grapes coming into the market must have a final destination or else there will be a surplus in the market. In the survey by the Department of Applied Economics the growers were asked how they marketed their grapes in 2007. The question format was multiple choice with the following choices: used in own winery, sold through contracted winery, sold through network connections, sold directly to individual winemakers, used by themselves, or there was no production in 2007.

As the following chart will show, there are a large percentage of growers that use their grapes for their own purposes. They may grow for their own winemaking or for jellies/jams or just for the enjoyment of a few vines. This is consistent with the earlier conclusion that those growing on less than half are non-commercial and account for approximately 40% of all grape growers in Minnesota.

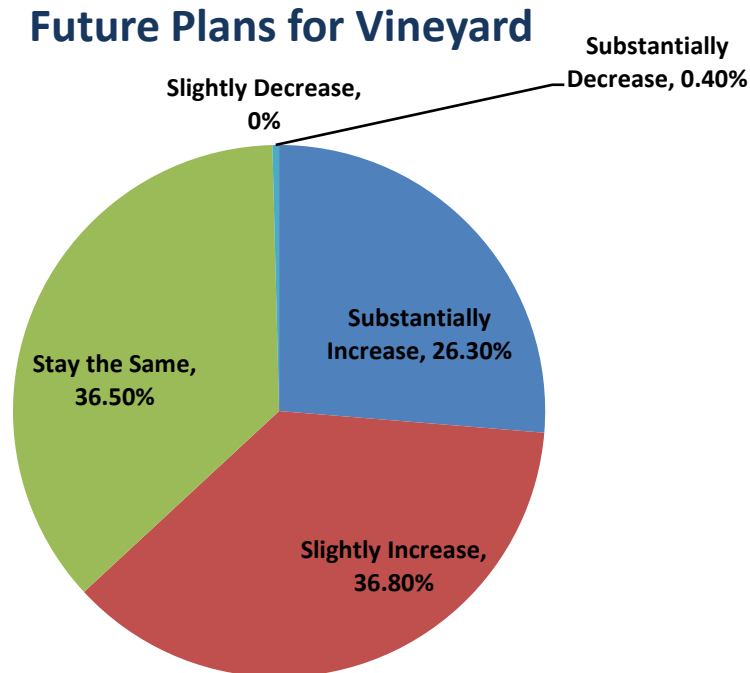
Almost 30% of respondents indicated that they did not produce a crop in 2007. This was due to a variety of factors described by the growers. Reasons included immature vines, crop damage due to weather, and crop damage by animals, birds or insects. Of those who reported no crop, 65% reported this was due to immature vines.

Method for Marketing Grapes



Future Plans:

The final question of the survey asked the respondents to indicate their future plans for their vineyard. They were asked if, in the next two years, they planned to substantially increase, slightly increase, stay the same, slightly decrease or substantially decrease. At this point, research has shown that the grape growing industry is in a high growth period. This question is an attempt to quantify the intended direction of the industry, and address whether or not growth is expected to continue.



It appears as though the industry intends to continue to grow. A vast majority intends to increase in the next two years, and just over one-third intend to keep their vineyards the same size. Practically no grower intends to decrease the size of their vineyard.

The intended growth in the industry raises concerns regarding the oversupply of grapes in the market. A question on marketing strategy was added to the survey to help understand the situation more fully. Of growers that plan on substantially increasing in the next 2 years, about 35% had no crop for sale in 2007. It is possible that their marketing effort has been non-existent while the grape vines mature, and that the growers expect to have to increase their marketing efforts to move a future crop.

There are a number of "personal use" grape growers identified in the study. A majority of growers planning to slightly increase their marketing efforts used grapes for their own purposes. This may indicate a desire to move some of their grapes onto the market should crops yield more than the owner needs for their intended use. Most of the remaining personal use growers plan on continuing their current marketing efforts.

The winery owners, who own or control the vineyards, seem to be more cautious in their marketing plans with a majority planning to increase slightly.

This survey suggests the industry will continue to grow in the near future. However, the results from the survey only account for growth that will come from current growers in 2007. Therefore, more growth could come from new growers and the few not part of the sample population.

Economic Impact

Minnesota grape growers and wineries are also an economic engine in the state of Minnesota. Production of grapes, production of wine, operation of a winery, and tourism related to the wineries, all create economic activity.

In an effort to quantify the total economic impact the wine and grape industry has had in Minnesota, I referred to the Minnesota Grape Growers Association. They conducted a study on just this topic, total economic contribution.

Evaluated were 3 components that contribute to the Minnesota economy: production of grapes, operation and production of wineries, and winery-related tourism.

Production of grapes yielded \$13.6 million in economic output, and contributed \$4.4 million in labor income while creating 101 jobs. The operation and production of wineries yielded \$8.5 million in economic output, and contributed \$2.9 million in labor income while creating 68 jobs. Lastly, the winery-related tourism sector generated \$14.1 million, and contributed \$3.5 million in labor income over 155 jobs. The following chart quantifies the total economic impact the grape and wine industry has had on Minnesota. This is a considerable amount and shows a potential for this industry to help stabilize the Minnesota economy, currently in the midst of a recession.

Economic Impact of the Grape and Wine Industry (2007)

	Direct	Indirect	Total Contribution
Output	\$21.5 Million	\$14.6 Million	\$36.1 Million
Employment	209	115	324
Labor Income	\$6.3 Million	\$4.5 Million	\$10.8 Million

(Minnesota Grape Growers Association, 2009)

Where is the Industry Heading?

There has been significant increase in the number of vineyards, planted acreage, and planted vines. In addition, the types of vines being planted have shifted as new varieties have been released.

Obviously, there is an interest in grape growing in Minnesota, and the young state industry is one of potential. As the industry continues to grow, it must address certain pressing issues. One concern is the utilization of the grapes grown. The study indicates that the market supply may increase significantly, and the supply will need to be absorbed by the market to prevent an oversupply that may occur in the short run especially as more newly planted vines begin to mature.

It is also apparent that Minnesota growers intend to increase their marketing efforts. Currently there are few that rely on contracts or networks, and if supply continues to rise, vineyards without solid marketing plans may have trouble selling their grapes. Given the projected growth, it is most likely in the best interest of the growers to establish contracts sooner rather than later.

Capital needed to start up a vineyard is substantially lower than the capital needed to establish a running winery from an investment perspective. If the short run yields an oversupply of grapes in the market there may be a demand for wineries to make larger purchases. Due to the investment cost of a start-up winery it may be difficult to absorb an oversupply of grapes in new wineries, making it a necessity for existing wineries to increase demand.

There has been a significant shift in the types of vines being planted, thanks in large part to the continuing research and development of new grape varieties. Due to the unique weather in the Minnesota region, the development of these new varieties has been focused mainly on cold-hardiness, and less emphasis has been placed on quality or other unique properties of the grape that leads to an ideal finished wine. Export markets outside the state may be problematic as production in many other states continues to rise. For exporting to be the path for future growth of the Minnesotan grape and wine industry, this can only be done through differentiation of desired attributes found in Minnesotan grapes. This indicates that more effort needs to be directed at brand marketing, not for growing, but for final consumption.

Price Point and Marketing

Many factors, some a little surprising, impact the price of wine. Obvious factors include the wine's scarcity, the labor costs to produce the grapes and the wine, and the cost of the vineyards themselves. Other less obvious factors that can impact the price of wine include where the grapes are grown, consumer perception about the cost of a quality wine, the costs of oak barrels used to age the wine, and the cost of label design and packaging.

Price points for each variety of wine not only takes into consideration the profit of the distributor, retailer, and the winery itself, but also what the consumer is willing to pay. Numerous studies have found that consumers who are presented with two drinks from the same bottle of wine, but told they were different with disparate prices, perceived the more expensive wine to taste better.

An important factor that influences the price of wine is where the grapes are grown. Typically, grapes for less expensive bottles of wine can be grown in many areas, but the highest quality of grapes can only be grown in a few places; thus, making those grapes scarce. Also, a wine's appellation, or affiliation with where the grapes are grown, has a considerable impact on the price of wine.

Marketing the Finished Wine

On an international level there are laws that regulate how a winery markets their wine. In Europe, for example, a distinction is made between Roman and German law. While German law (Austria, Germany) concentrates on grape variety, the Roman wine law (Italy, France and Spain) defines and characterizes the wine according to its regional origin. If you ask an Austrian who is acquainted with German wine law, "which wine did you have yesterday?", and he will

probably name a grape variety. Ask a consumer from a Roman country the same question and he will name the origin of the wine.



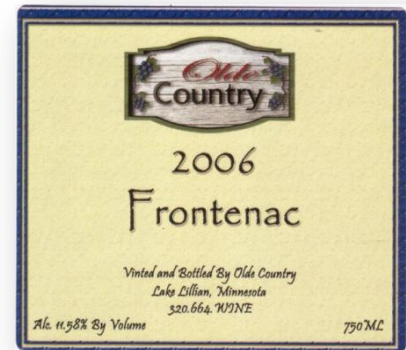
Left: Vintage 2005 Bordeaux. **Above:** Vintage 2005 Red Chianti. Notice, no mention to the grape variety is made.

While Roman classification corresponds more or less to a broadened wine description, Roman law does have its advantages.

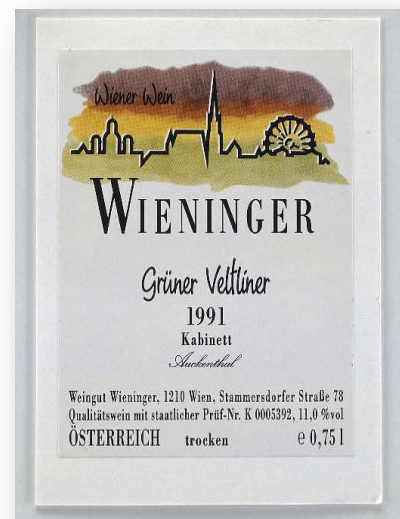
Wines which are named and defined according to their origin are not exchangeable. The fact that Chianti or Bordeaux have to taste like Chianti or Bordeaux every year necessitates an accurate definition of the wine (grape variety, production measures, maturation). All these details are defined by persons involved in the wine business within the given region, and it is a great advantage that the responsible professional groups are obliged to focus intensively on the wine and the region to create non-exchangeable and unmistakable wines.

This method of branding may be a profitable direction to take the marketing of Minnesotan wine. Cold-hardy grapes, while unique and still producing quality wines, have had a hard time selling in the export market. In an interview with New York grape grower Rob McDowell, he says cold-hardy grapes actually offer a marketing advantage to the newly developing wine industries. "The key point about wines from cold-hardy grapes is that because they don't have the years of suffocating tradition that dictate marketable wine styles and flavors, the winemaker is free to create wines that are expressive of the inherent flavors of the grapes and the local mélange of soil, sun, and climate."

Currently both Minnesota and Austria market and label their wines according to the grape variety and vintage. It is also possible for the label to mention the origin or region it is grown, but less emphasis is placed on this. While labeling according to variety and vintage may be more descriptive of the type of wine you are buying it leaves room for a varying level of quality for the consumer to interpret. In the last few years European laws have been slowly been changing to reduce the confusion to consumers. This last year Roman law began allowing the indication of grape variety and vintage on the label of table wines, and one may assume that more adaptation will come in the future. (Austrian Wine, 2007)



Minnesotan Wine Label: Vintage 2006 Frontenax Variety



Austrian Wine Label: Vintage 1991Grüner Veltliner Variety

Conclusion

Research has shown the Minnesota grape and wine industry is relatively young and is likely to face continuing rapid change and future challenges. Change is coming from both outside and inside the industry. The demand among Americans for wine is on the rise, and as American interest in wine continues to increase, so does the number of American wineries and grape growers. While wine production remains a staple of western states, particularly in California, production in states not traditionally associated with wine has continued to increase. Grape growing has also become more appealing as new cold-hardy varieties are being released. With this rapid increase in demand and production comes growing pains for the grape and wine industry. This growth is good for the industry but could also be problematic if demand does not increase equally as quickly. The number of wineries has almost quadrupled from 1995 to 2009, and many wineries have indicated that they plan on increasing wine production. Still, the amount of grapes Minnesota has been producing has increased by at least this rate, and many grape vines that have been planted within the last few years have yet to produce matured crop ready for wineries. As many new growers start to see ample harvests wineries inside Minnesota must compensate to meet demand, or grape exporting may become a necessity sooner rather than later.

The European grape and wine industry has continued to flourish and provide economic stability. As it is a very mature industry, Minnesota may look at what they have done to become such a grape growing haven. As exporting in Minnesota begins marketers may take a look at what has or has not worked in Europe in grape growing, wine production and marketing.

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