Evaluation of Potential Alternative Wine Grape Varieties for SW Michigan

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Eleven wine grape varieties were harvested and vinified separately in small lots for the purpose of evaluating each cultivar's potential to produce quality wine in southwest Michigan. Yields of each variety varied significantly. The 2016 and 2017 harvest data, as well as the wines made from each variety, offer valuable insight into each cultivar's ability to produce quality wine grapes.

Goals and Objectives:

The goals and objectives of this study were originally outlined by Dr. Tom Zabadal, in his 2016 report "Things a Grower Wants to Know About a New Variety." (Please see attached.) This report asked the following questions:

1. Do the vines survive in our climate?
2. Does the variety break bud early?
3. When does the fruit ripen?
4. Does the variety produce quality juice (or better yet, wine)?

To answer these questions, data on vine survival, bud viability, the timing of bud break, the timing of harvest, as well as basic juice chemistry numbers were gathered from the 2016 vintage, and were presented in the same report referenced above.

For this project, during the 2017 vintage, grapes from 10 different varieties were made into wine. In this report, data consisting of harvest dates, yields, and basic juice and wine chemistry are presented.

The wines made from both the 2016 and 2017 vintage have been presented at the SW Michigan Hort Days show for two consecutive years. A final objective of this study is to present the wines at other important industry seminars and conferences, such as the Michigan Grape and Wine Conference.

Materials and Methods:

24 vines of each variety grown at Michigan State University's Southwest Michigan Research and Extension Center (SWMREC) were harvested and made into wine. Each variety was harvested after the sugar concentration of a vineyard sample was measured to be greater than 21^{o} Brix. These measurements of sugar concentration were measured by refractometer by SWMREC personnel.

Each variety was hand-picked into farm picking lugs and transported to Lake Michigan College for weighing and processing. Clusters that were deemed after visual inspection to be overly compromised by *Botrytis* or other disease were dropped on the ground and not gathered.

Added to this project at the last minute were two white varieties of commercial interest that were bred at the University of Minnesota as part of the Northern Grapes Project: Itasca, and Minnesota 1272. The grapes from 24 plants of each of these two varieties were donated by local grower Jon Hinkelman, and were processed in the same manner as the SWMREC grapes.

Between 2016 and 2017, 12 varieties have been evaluated in this project. These varieties are listed in the following table. It should be noted that the varieties selected for this study have been those which have best survived the back-to-back polar vortices of 2014 and 2015:

Table 1: Varieties evaluated, their origins, and a summary of past observations

White Varieties	Origins	Past Observations	Other Names?
Itasca	Minnesota hybrid. Experimental planting. Replacement for Thompson Seedless?	Incredibly vigorous and fruitful. Early ripening.	
1272 Minn	Minnesota hybrid. Experimental planting. Replacement for Thompson Seedless?	Not quite as early as Itasca, but still very productive	???
GM 311	Geisenheim cross between Riesling and Chancellor	Earlier ripening	
GM 318	Geisenheim cross between Riesling and Chancellor	Sensitive to *Botrytis*	Geisenheim, GM-318-57
Muscat Blanc	Muscat family of wine grapes. Used to make *vin doux naturel* in S. France		Muscat Blanc *à petit grains, Muscat Canelli*
Sauvignon Gris	Clonal mutation of Sauvignon Blanc. Some plantings in Bordeaux, Burgundy, and Chile.	Earlier ripening	
Sauvignon Blanc Musqué	Also a clonal mutation of SB. Widely planted in California.	Earlier ripening, more open cluster	Savagnin musqué
Sauvignon Vert	Regioin of Friuli in NE Italy	Late budbreak and early ripening, but highly sensitive to *Botrytis*	Tocai Friulano. Tocai is no longer allowed by the EU.

Red Varieties	Origins	Past Observations	Other Names?
Tempranillo	Base for red wines from the Rioja in northern Central Spain. Cultivated since 1100 BC	Early ripening,	Tinto Fino, Tinto Roriz, Ull de Llebre
Teroldego	Trentino-Alto-Adige or Südtirol in NE Italy	Early budbreak, later ripening	
Lagrein	Also from Alto-Adige or Südtirol in NE Italy, descendant of Teroldego	Late budbreak, mid to late ripening	
Barbera	Major grape of Piedmont in NW Italy, some plantings in California, used for blending	Later ripening, vigorous and fruitful, generous acids	

For the 2017 vintage, both the GM 318 and the Muscat Blanc varieties were abandoned because of an acceptably small crop coupled with a high degree of rot. At the teaching winery, each variety was weighed and run through an EnoItalia ENO 15 de-stemmer-crusher. An addition of 75ppm sulfite was added to each lot. Winemaking protocol and analytical methods are as follows:

White Wine Processing: After de-stemming and crushing, the white must was directed into a 90 liter Speidel Hydropress for separation of the juice. Juice was collected in a 110 liter variable capacity (floating lid) stainless steel tank. Juice was settled for 24 hours, and then racked to a second clean 110 liter variable capacity tank. A commercial strain of *Saccharomyces cerevisiae*, Lalvin DV 10, was added to each of the white juices at a rate of 0.25 grams per liter. GoFerm was added at a rate of 30g/hL, and di-ammonium phosphate at a rate of 4 lbs/1000 gallons. All white wines were allowed to ferment to dryness, as verified by enzymatic/spectrophotometric measurements of residual glucose/fructose. At dryness, each white wine received an additional 75ppm sulfite to discourage malo-lactic fermentation. Wines were settled, and racked off of the gross lees. Sulfite content was adjusted to 0.5 molecular SO_2 and bottled in early February of 2018.

One variation of note: the sugar concentration of the Itasca at harvest was 25.6^{o}Brix. If left uncorrected, the finished wine alcohol, if it finished, would have been in excess of 15%. For this reason, to the Itasca variety was added 4.25 gallons of water to lower the potential alcohol to 13%.

Red Wine Processing: The must for the red varieties was collected in 225 liter used oak barrels for fermentation. A commercial strain of *Saccharomyces cerevisiae*, Lalvin DV 10 supplied by Scott Labs, was added to each of the red musts at a rate of 0.25 grams per liter (of juice). GoFerm was added at a rate of 30g/hL, and di-ammonium phosphate at a rate of 4 lbs/1000 gallons. Each red lot was kept on the skins for a total of 21 days before pressing. A 90 liter Speidel Hydropress was used for separation of the red wine. Each red wine was collected in a 110 liter variable capacity (floating lid) stainless steel tank. Wine was settled for 24 hours, and then racked to a second clean 110 liter variable capacity tank. All red wines were allowed to ferment to dryness, as verified by enzymatic/spectrophotometric measurements of residual glucose/fructose. A commercial strain of *Oenococcus oeni*, Lallemand's O-Mega, was added to each lot to initiate the malo-lactic fermentation. At the completion of the malo-lactic fermentation, as determined by depleted malic acid by enzymatic/spectrophotometric methods, each red wine received and additional 75ppm sulfite. Wines were settled, and racked off of the gross lees. Sulfite content was adjusted to 0.5 molecular SO_2 and bottled in early February of 2018.

Wine Analyses: Harvest brix numbers were determined by and Atago refractometer. The pH values were determined with a Hanna Instruments HI2222 pH meter. Titratable acidity values were determined by titration with 0.10N sodium hydroxide as described in *Methods for Analysis of Musts and Wines* by Ough and Amerine. Residual sugar and malic acid measurements were determined using Megazyme glucose-fructose assay kits and a Thermo Scientific Genesys 10S UV-Vis spectrophotometer. Wine alcohols were determined by IR spectroscopy using an Anton-Paar Alex 500.

Results and Discussion:

Harvest Data: The harvest yield data are presented in the table below. It should be noted that all yields for all varieties are from 24 plants. Both of the new Minnesota hybrids, Itasca and Minn 1272 are substantially more productive and earlier ripening than the other varieties. Part of the difference might be attributed to rootstock, as the Minnesota varieties are own rooted while the varieties at the SWMREC station are planted to rootstock. Part may be attributed to differences in site. Nonetheless, both of the Minnesota hybrids are significantly more productive than the other varieties in this study.

The grapes also ripen earlier in the growing season. This could be advantageous for growers hoping to avoid late season rains and freezes.

Table 2: 2017 Harvest date, yield, and initial juice sugar, pH and titratable acidity

Variety	Date	Pounds	Brix	pH	TA
Itasca	14-Sep	556	25.6	3.56	10.1
1272 Minn	22-Sep	695	22.0	3.34	
GM 311	4-Oct	122	22.5	3.24	8.5
GM 318	NA	NA	NA	NA	NA
Muscat Blanc	NA	NA	NA	NA	NA
Sauvignon Gris	4-Oct	168	23.0	3.36	7.1
Sauvignon Blanc Musqué	4-Oct	144	23.0	3.30	7.6
Sauvignon Vert	4-Oct	62	22.2	3.30	7.6
Tempranillo	4-Oct	99	21.0	3.44	8.0
Teroldego	9-Oct	140	21.0	3.52	7.7
Lagrein	9-Oct	122	21.3	3.52	8.1
Barbera	19-Oct	132	21.0	3.21	13.2

If one were to extrapolate yield data, it becomes evident that the Sauvignon Vert and the Tempranillo in this study are low yielding. 100 lbs from 24 plants at 800 plants per acre would translate into about 3300 lbs per acre. The GM 318 and the Muscat Blanc were not harvested in 2017 because of rot.

One should be careful not to jump to conclusions too quickly from one study. However, the Muscat Blanc did not perform well in either 2016 or 2017. Excessive mildew pressure necessitated early

harvesting of this variety in 2016, while the same issues forced the variety to be abandoned completely in 2017. Also, it should be noted that this variety has been traditionally grown in warmer, drier climates of the Mediterranean.

Neither did the GM 318 and the Sauvignon Vert perform well in 2017, also because of rot. The performance of the Tempranillo has been marginal in both 2016 and 2017 in terms of yield, for the same reason.

Table 3: 2016 Harvest date, yield, and initial juice sugar, pH and titratable acidity

Variety	Date	Pounds	Brix	pH	TA
Itasca	NA	NA	NA	NA	NA
1272 Minn	NA	NA	NA	NA	NA
GM 311	3-Oct	205	21.2	3.15	6.6
GM 318	30-Sep	172	21.2	3.36	4.4
Muscat Blanc	27-Sep	171	18.0	3.25	5.6
Sauvignon Gris	30-Sep	144	21.0	3.46	4.5
Sauvignon Blanc Musqué	30-Sep	135	23.0	3.35	5.0
Sauvignon Vert	30-Sep	180	21.0	3.60	3.8
Tempranillo	18-Oct	77	21.0	3.38	6.3
Teroldego	24-Oct	186	22.2	3.47	6.5
Lagrein	18-Oct	156	21.4	3.31	7.8
Barbera	18-Oct	287	21.5	3.12	13.7

While a more diligent fungicide spray program might have allowed for larger yields of these poorly performing cultivars in 2017, the results are nonetheless insightful. Southwest Michigan can experience high relative humidity and ample rainfall during the growing season. It has a shorter growing season and lower heat accumulation than other regions. Varieties which more susceptible to powdery mildew require more fungicide applications. These sprays of course add to the costs of farming the grapes, not to mention potential drift and environmental concerns. Varieties which require late season harvests in order to reach grape maturity are more risky to grow, as late October weather can be either wet and rainy, or below freezing.

Wines: Ten wines were produced from the 2016 vintage, and nine from the 2017 vintage. (The 2017 Sauvignon Vert was discarded as there was very little of it and the quality was poor.) All wines have been bottled and are available for further analysis. To date, wines have been poured in an informal setting for growers and other wine industry members at both the 2017 and 2018 SW Michigan Hort Days conference. All wines produced are commercially viable in terms of basic chemistry: ethanol content, pH, and titratable acidity (data not shown.)

A formal blind tasting of these wines is needed. However, some observations should be noted:

1. The Itasca and the Minnesota 1272 hybrids are promising in terms of their aroma and flavor profiles. In this study, it has been observed that both lack the atypical wine aromas of some of the hybrid varieties.

2. For white varieties, both Sauvignon Gris and Sauvignon Blanc Musqué have both made high quality wines in both 2016 and 2017.

3. For the red cultivars, Barbera, Teroldego, and Lagrein all show promise for southwest Michigan in terms of wine quality.

Again, it should be noted that the varieties used in this trial were those which had already demonstrated a high degree of cold hardiness in the vineyard. All of the varieties planted at SWMREC had survived the harsh winters of 2014 and 2015. Cold hardiness, reasonable disease resistance, as well as high wine quality are essential characteristics of alternative wine grape varieties.

Communication of Findings:

This work has been presented at both the 2017 and 2018 SW Michigan Hort Days Conference. The work will also be presented at the 2018 Michigan Grape and Wine Conference. It is hoped that next year's Grape and Wine Conference will also allow for a blind evaluation of at least some of the wines that were made during this project.