Sensory characterization of Frontenac and Marquette wine grape cultivars by descriptive analysis

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Introduction

Interest in producing wine grapes that will grow in more northern and inland climates such as South Dakota and Minnesota has existed since the early 1900s, however, breeding work in the last thirty years has been especially productive, and has resulted in the development of a number of cold-hardy wine grape cultivars. Frontenac and Marquette red wine grapes are two such cold-hardy varietals released by the University of Minnesota in 2006 and 1997 respectively, comprise almost 75% of the cold-hardy vines planted in Minnesota. Maturity of wine grapes at harvest is an important factor in the quality of the resulting wine.

The purpose of this study was to explore the changes to the aroma, flavor, and astringency that occur during the ripening of Marquette and Frontenac wine grapes and the resulting changes in their respective wines. Paired with information about the chemical maturity of the grapes, this knowledge may improve determination of the optimal maturity of wine grapes and help improve the overall quality of these wines.

Hypotheses

As Frontenac and Marquette grapes ripen:

- Sweetness would increase
- Sourness would decrease
- Astringency would decrease
- Aroma and flavor intensity would increase

Panelists and Samples

Panelists

Fourteen panelists, 9 females and 5 males, (ages 21-60) with previous training and experience in descriptive analysis panels participated in training and testing in February 2013 and 2014. Panelists were selected based on their age (being of legal age to consume alcohol), their tasting ability (previously shown to be PROP tasters) previous training (on citric acid taste and butanol aroma scales), having no medical reason to not consume alcohol, and their availability. Panelists were compensated. All recruiting and experimental procedures were approved by the University of Minnesota's Institutional Review Board.

Grape Samples

Marquette and Frontenac grapes were grown in the 4 locations in South Dakota State University vineyard. The brix of each sample was sorted into a new variable called Sugar Level with the categories low, medium, and high. For Frontenac 'low' sugar level consisted of grape growing reps with Brix <22^0, 'medium' sugar level of grape location with Brix of 22^0 to 24^0, and 'high' sugar level of grape growing reps with Brix >24^0. For Marquette 'low' sugar level consists of grape growing reps with Brix <23^0, 'medium' sugar level of grape growing reps with Brix of 23^0 to 24.1^0, and 'high' sugar level of grape growing reps with Brix >24.8^0.

Training

During group training panelists reviewed butanol and citric acid intensity scales, generated attributes and developed lexicons for both grape varieties, refined tasting methodology for grape berries, and practiced rating. Grape skin and pulp were evaluated separately. I evaluated panelist ratings for the ability to discriminate and ability to replicate. Follow-up group training sessions provided feedback to panelists and discussion of challenging attributes.

Testing

Panelists participated in two testing sessions in which they tasted all 12 Frontenac grape samples twice and rated the intensity of the grape berry aroma attributes and the intensity of the taste, flavor, and aftertaste attributes for both pulp and skin. Panelists evaluated each sample by rating the intensity of the attributes on 12-cm line scales with 20 markings from '0' at the left end and '20' at the right.

Grape Lexicon

Attribute	Reference Standard
	Aroma and Flavor
Overall Intensity	
Fresh Fruit	Two pieces of each diced apple, pear, strawberry, plum, halved blueberry and raspberry **intensity=10**
Dried Fruit	Raisins (Sun-Maid, Kingsburg, California)
Citrus Fruit	Lemon peel, lime peel, orange peel
Fermented Fruit	1-4 day old "Fresh Fruit" stored in the refrigerator
Jammy	Black currant preserves (Duerr's, Manchester, England)
Fresh Green	Green strawberry tops, whole, no fruit attached
Green Wood	Green grape stems, cut into 1 inch segments
Earthy/Musty	Potting soil, 1 T, **intensity=6** (Miracle-Gro, Scotts Miracle-Gro Company, Marysville, Ohio)
Hay	Hay
Floral	Crushed violet candy, ½ teaspoon (Chowards, Bellport New York
Metallic	0.005% Ferrous Sulfate, 7-Hydrate (0.025g/500ml) (Mallinckrodt Baker, Dublin, Ireland)
Artificial Grape	Grape candy (Jolly Ranchers, Hershey Company, Hershey Pennsylvania)
	Taste and Mouthfeel
Sweetness	5.0% sucrose in distilled water (25g/500ml) (C&H Sugar, Contra Costa County, California)
Sourness	0.075% citric acid in distilled water (0.375g/500ml)
Bitterness	0.014% caffeine in distilled water (.071g/500ml) **intensity=2** (Sigma Aldrich, St. Louis, Missouri)
	0.057% caffeine in distilled water (.285g/500ml) **intensity=6**
Astringency	0.062% alum in distilled water (0.31g /500mL); **intensity=2**
	0.25% alum in distilled water (1.25g /500mL); **intensity=12**
	Aftertastes
Overall aftertaste	
Sweetness aftertaste	5.0% sucrose in distilled water (25g/500ml)
Sourness aftertaste	0.075% citric acid in distilled water (0.375g/500ml)
Bitterness aftertaste	0.057% caffeine in distilled water (.285g/500ml)

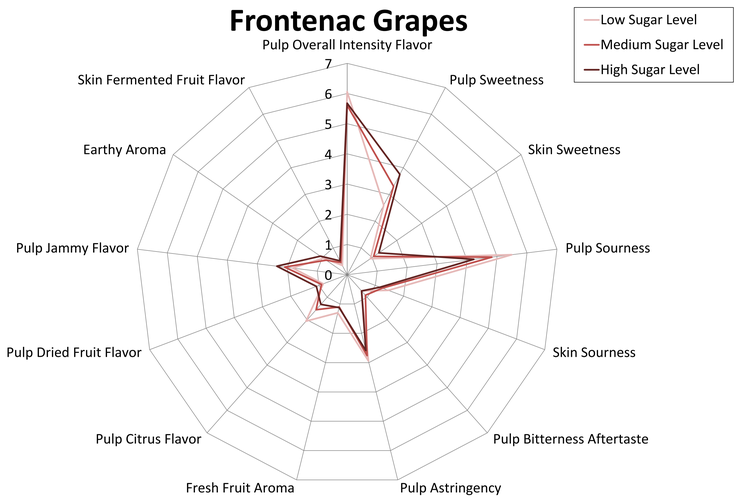
Data Analysis

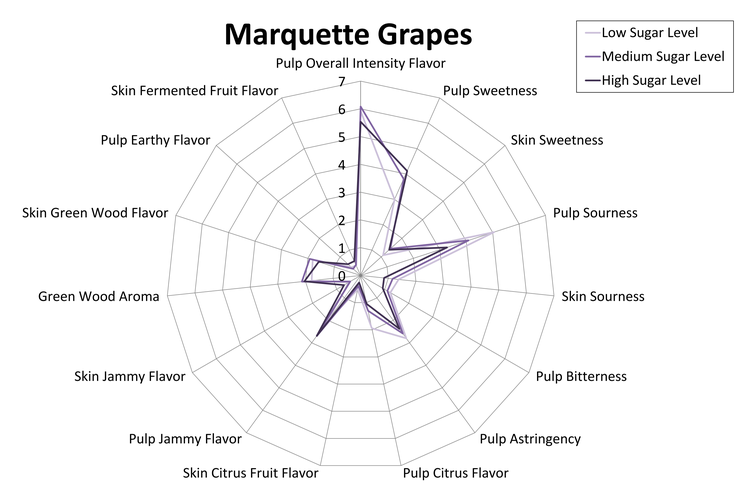
Analyses of variance with Student–Newman–Keuls multiple comparisons tests were used to determine if the three sugar levels of grapes differed in each attribute.

Results

- Sweetness increased as the grapes ripened
- Sourness and astringency decreased as the grapes ripened
- Overall intensity of flavor, as well as the fresh fruit aroma, citrus flavor, and fermented fruit flavor decreased.

Results





Conclusion

When the sugar levels of the grapes increased from low to medium to high, panelists rated the sweetness of the grapes higher, the sourness lower, and the astringency and bitterness lower. Panelists also tended to rate the jammy and dried fruit attributes higher as the sweetness of the grapes increased, though this may be due to confusion with the sweetness..

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