

Manipulating Soil Moisture and Nitrogen Availability to Improve Fermentation Behavior and Wine Quality

Part III: Effects on Wine Aroma and Flavor

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Introduction:

The sensory evaluation of the 2000 vintage Pinot noir wines from the Oregon State University viticulture trials at Benton Lane Vineyard was conducted by a panel of 11 semi-trained panelists using a modified version of free-choice profiling. 36 wines were made from 3 replications of the 12 field treatments. For a discussion of winemaking protocol, see Watson et al.(2000). One wine lot was lost to breakage in the winery. Wines were evaluated for differences in aroma and flavor.

Materials and Methods:

11 panelists participated in this study including students and faculty from the Food Science and Horticulture departments at Oregon State University as well as three members of the professional sensory evaluation panel from the Sensory Science Laboratory. All panelists had experience with formal sensory evaluation techniques. Each wine (n=35) was seen twice by each panelist in a randomized block design. Panelists were required to evaluate the wines for 15 pre-determined descriptors and were also allowed to generate their own additional descriptors. Table 1 lists the pre-determined descriptors as well as the additional descriptors and their frequency of use.

Training consisted of three one-hour periods. Panelists were introduced to the wines, the 16-point evaluation scale and the ballot of pre-determined descriptors. Testing occurred in six two-hour sessions over a two-week period. Data were entered into a spreadsheet and sorted using Excel. Statistics were performed using SPSS and SAS, and Generalized Procrustes Analysis was performed using Sensetool.

Results & Discussion

The fifteen pre-determined attributes rated by all panelists were analyzed using ANOVA and MANOVA with panelist treated as a random effect. Significant differences among samples were discerned using a Tukey HSD post-hoc test ($p < 0.05$). A rich model was fit including all two and three way interactions of the main effects. No main effects were significant outside of interaction effects. Significant treatments by fieldrep interactions (Fieldrep*Irrigation*Tillage*Fertilization) were seen for four of the fifteen pre-determined descriptors: *Acidity*, *Vegetative Flavor*, *Astringency* and *Body*. These differences arise from the heterogeneity of the vineyard.

Significant differences between the 12 field treatments were found for three flavor attributes. For *Spicy flavor*, the I N T S N treatment was significantly higher than the I T S N (4.24 versus 3.29, $p < 0.05$). The D T S N treatment was significantly less *Acidic* than the I N T F N treatment (6.57 versus 7.27, $p < 0.05$). The I T F N treatment was significantly higher in *Bitterness* than the D T S N treatment (3.18 versus 2.43, $p < 0.05$). Table 2 shows means for all pre-determined descriptors across the main effects.

Table 1: Descriptors for 2000 Vintage BLPN Panel		
Pre-Determined Descriptors	Additional Descriptors	Frequency*
<u>Aroma Attributes</u>	cherry	8
Overall Intensity	strawberry	4
Overall Fruitiness	black pepper	4
Overall Floral	resinous/cedar	3
Overall Spiciness	pepper	3
Overall Vegetative	raisin	3
Earthy/Musty	blackberry	2
	canned green bean	2
<u>Flavor Attributes:</u>	mint	2
Overall Intensity	berry	2
Overall Fruitiness	dusty	2
Overall Floral	grape	2
Overall Spiciness	rose	2
Overall Vegetative	mushroom	2
Acidity	chemical	1
Bitterness	meaty	1
Astringency	plum	1
Body	red berry	1
	cinnamon	1
	cooked cabbage	1
	dried fruit	1
	ethyl acetate	1
	licorice	1
	leather	1
	phenolic	1
	white pepper	1
	*Out of 11 total panelists	

Generalized Procrustes Analysis was used to create spatial maps of the samples from the free-choice profiling data, using both the 15 pre-determined descriptors and each panelist's unique descriptors (Figures 1 and 2). Dimension 1 explains 18% of the total variation. Fruitiness, Cherry and Berry characterize samples on the positive end of dimension 1 while samples on the negative end are characterized by *Vegetative*, *Spiciness*, *Pepper*, *Floral* and *Body*. Dimension 1 shows a trend where wines receiving the Dry treatment tend to be higher in *Fruitiness*, *Cherry* and *Berry* while Irrigated wines tend toward the *Vegetative*, *Spiciness*, *Pepper*, *Floral* and *Body* end of the axis.

Dimension 3 shows a trend where tilled treatments tend to be higher in *Vegetative* character while not tilled treatments are higher in *Fruitiness* and *Spiciness*.

Analysis of this vintage will continue and results will be presented in the Master's thesis of Heather Hjorth.

References:

Watson, Barney, Mina McDaniel, Anna Specht, Kate Wall and Hsaio-Ping Chen. 2000. Manipulating Soil Moisture and Nitrogen Availability to Improve Fermentation Behavior and Wine Quality; Part 1: Effect of Nitrogen, Irrigation and Soil Management on Yeast Assimilable Nitrogen, Juice Composition at Harvest, Fermentation Behavior, and Wine Composition and Quality. In OSU Winegrape Research Wine Advisory Board Progress Report, Oregon State University, Oregon.

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Table 2: 2000 Vintage BLPN Means

AROMA MEANS

		<u>Aroma OI</u>	<u>Fruity Ar</u>	<u>Floral Ar</u>	<u>Spicy Ar</u>	<u>Veg Ar</u>	<u>Earthy/Musty</u>
<u>Irrigation</u>	Dry	9.68	7.46	2.73	3.63	2.95	3.46
	Irrigated	9.77	7.21	2.71	3.67	3.40	3.72
		<u>Aroma OI</u>	<u>Fruity Ar</u>	<u>Floral Ar</u>	<u>Spicy Ar</u>	<u>Veg Ar</u>	<u>Earthy/Musty</u>
<u>Nitrogen</u>	None	9.68	7.49	2.88	3.58	2.99	3.55
	Foliar	9.78	7.24	2.56	3.64	3.22	3.66
	Soil	9.71	7.27	2.71	3.73	3.32	3.54
		<u>Aroma OI</u>	<u>Fruity Ar</u>	<u>Floral Ar</u>	<u>Spicy Ar</u>	<u>Veg Ar</u>	<u>Earthy/Musty</u>
<u>Tillage</u>	No Till	9.68	7.35	2.75	3.75	3.06	3.49
	Till	9.77	7.31	2.68	3.56	3.29	3.68

FLAVOR MEANS

		<u>Flavor OI</u>	<u>Fruit FI</u>	<u>Floral FI</u>	<u>Spicy FI</u>	<u>Veg FI</u>	<u>Acidity</u>	<u>Bitterness</u>	<u>Astringency</u>	<u>Body</u>
<u>Irrigation</u>	Dry	9.44	7.06	2.94	3.74	2.66	6.87	2.79	6.52	4.64
	Irrigated	9.60	7.13	2.97	3.85	2.87	7.05	2.84	6.47	4.78
		<u>Flavor OI</u>	<u>Fruit FI</u>	<u>Floral FI</u>	<u>Spicy FI</u>	<u>Veg FI</u>	<u>Acidity</u>	<u>Bitterness</u>	<u>Astringency</u>	<u>Body</u>
<u>Nitrogen</u>	None	9.56	7.26	2.95	3.96	2.59	7.00	2.74	6.56	4.72
	Foliar	9.50	7.02	3.00	3.75	2.90	7.04	2.99	6.57	4.74
	Soil	9.49	7.02	2.92	3.69	2.81	6.84	2.73	6.36	4.68
		<u>Flavor OI</u>	<u>Fruit FI</u>	<u>Floral FI</u>	<u>Spicy FI</u>	<u>Veg FI</u>	<u>Acidity</u>	<u>Bitterness</u>	<u>Astringency</u>	<u>Body</u>
<u>Tillage</u>	No Till	9.52	7.07	2.94	3.89	2.75	7.01	2.82	6.56	4.76
	Till	9.51	7.12	2.97	3.70	2.78	6.91	2.81	6.44	4.67

Figure 2: Generalized Procrustes Analysis of 2000 Vintage BLPN Wines

GPA Group Average : dimension 1 versus 3

