Oregon Wine Advisory Board
Research Progress Report

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Pinot noir Fermentation Processing Effects on Wine Color and Phenolics

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Oregon Pinot noir wines differ greatly in their color and phenolic profiles and this variability is due to both vineyard and to fermentation management practices. We have observed that Pinot noir fruit composition can vary significantly with vintage, with degree of maturity, with yields, with trellis systems, and with the relative degree of light exposure on the fruit during ripening (see phenolic compounds in grapes and wines). Most of the potential character of a red wine is determined by both the fruit composition at harvest and by the fermentation practices used.

Several commercial fermentation practices were studied during the 1992 and 1993 vintages for their effects on the extraction of anthocyanin pigments and other phenolic compounds and on the color stability of Pinot noir. Treatments included the additionof S02 (50 mg/L) vs no S02at crushing, and pre-fermentation vs post-fermentation maceration on the skins. In 1993 the control wines were fermented on the skins for 10 days at 25-30'C prior to pressing. Both the pre and post maceration treatments were on the skins for 15 days. The pre-fermentation maceration treatments were held at YC for 5 days prior to fermentation and the postfermentation treatments were held on the skins for 5 days at 18'C after fermentation prior to pressing. Replicated wine lots were monitored during fermentation, processing, and aging for anthocyanin and phenolic content, color intensity, and for specific phenolic fractions using high pressure liquid chromatography (HPLQ).

Anthocyanin pigments were extracted rapidly following crushing in all the treatments and maximum concentrations were reached within about three days of skin contact at ambient temperatures. Pre-fermentation maceration delayed color extraction but produced new wines at one month of age with greater anthocyanin content and color intensity than the other treatments (Fig. 1). The controls and the post-fermentation maceration treatments were similar in pigment content and color intensity, and the No S02 treatments had the lowest levels of each (Table 1). Within the first three months of age the anthocyanin content and the color intensity decreased significantly in all the treatments. By eight months of age the control wines had the greatest color intensity even though the pre-fermentation maceration wines had a slightly higher anthocyanin content.

Polymeric pigment was not detectable in grapes at crushing but increased to lou., and similar concentrations in all the treatments by one month of age. The polymeric pigment content was at similar levels in the wines from both vintages even though the 1993 wines contained about twice the pigment content of the 1992 wines. The polymeric pigment represented only about 2% of the total potential color in the 1993 wines compared to closer to 20,rl', In the 1992 wines.

The total phenolics increased steadily during fermentation in all the treatments reaching maximum levels at the time of pressing and then decreasing slowly during processing and aging. The total phenolic

content was highest in the post-fermentation maceration wines apparently due to the increased extraction of catechin and gallic acid from the seeds (Table 1). The polymeric phenolic content (tannin) was also highest for the post-fermentation maceration treatments. The 1992 wines contained about one and a half times more total phenols and about five times greater polymeric phenols than the 1993 wines. Catechin from the seeds was also about five fold higher in concentration in the 1992 wines and may be related to the increased levels of polymeric phenols in wines from that vintage.

Other readily extractable phenolic compounds included quercetin glycosides and caffeoyl tartaric acid (caftaric acid). These phenols were extracted rapidly once the grapes were crushed and like the anthocyanins reached maximum concentration in about three days at ambient temperatures. In all treatments the caftaric acid content decreased to very low levels by the end of fermentation. Caftaric acid is one of the major oxidation substrates in grape juice and is easily oxidized during processing. At one month of age the treatments had similar low levels of caftaric: acid present in the new wines but by four months of age the NoS02 treatments contained the lowest levels.

Quercetin glycosides were detectable in fermenting wines within four days of crushing but at the time of pressing the concentration had decreased significantly. Within thirty days at the first racking the concentrations had decreased even further and significant levels of quercitin aglycones (hydrolysis product of the glycosides) were detectable. Quercetin levels have been shown to increase greatly in the skins of Pinot noir and in wines produced from fruit with greater light exposure in the canopy during the growing season. Quercetin may have significant sensory impact on astringency and or bitterness and is currently being studied in the Sensory Laboratory in the Department of Food Science and Technology. Quercetin may also be involved with co-pigmentation (enhancing apparent color) with anthocyanins as well as polymerization reactions with pigments to more stable forms.

Phenolic profiles of grapes and wines were shown to vary considerably with vintage and the dynamics of color and phenolic extraction varied with different fermentation practices. Significant changes in color and phenolic profile occur rapidly during fermentation and during the first few months of a wines life. Afterwards, during processing and aging, the changes slow considerably. Because the fruit phenolic composition can vary greatly with vintage, fruit maturity, and with vinyard management practices specific fermentation practices can give different results in different vintages and with different lots of fruit in a given vintage. A closer understanding of the factors affecting color and phenolic development in the fruit and of the subsequent effects of processing on new wine composition is critical to more controllable and predictable wine making.

During the 1994 vintage we will further investigate the effects of processing on color and phenolic profiles. Processing variables will includeSo2vs no SO2, pre-fermentation maceration, post-fermentation maceration, whole berry fermentation, fermentation with stems, and fermentation with different yeast strains and several commercial enzyme preparations.

Table 1

1993 PINOT NOIR PROCESSING TRIAL

		Control (RC 212)	Pre Ferm Maceration (5°C)	Post Ferm Maceration (18°C)	No SO_2
Color Intensity[1]	1 mo.	6.61	7.71	6.57	6.40
	3 mo.	4.32	4.71	4.13	4.27
Anthocyanin mg/L	1 mo.	357	419	370	339
	3 mo.	275	312	284	253
Total Phenols mg/L	1 mo.	1339	1429	1498	1347
	3 mo.	1217	1363	1582	1307

[1]Absorbance 520 + 420 nm

Fig. 1