# Oregon Wine Advisory Board
# Research Progress Report

## 1996 - 1997

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## Fermentation Processing Effects on Anthocyanin and Phenolic Composition of Pinot noir Wines

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### Introduction

During the 1994, 1995, and 1996 vintages we designed a series of trials to evaluate the effects of commercial Pinot noir fermentation practices in Oregon on wine composition and quality. Differences have been observed in anthocyanin content, color intensity, polymeric pigment content, phenolic content, and in aroma, flavor, body, and mouthfeel characteristics in experimental wines produced from these trials. A better understanding of the relationship of fermentation practices to color and phenolic extraction and to wine composition will help winemakers to optimize Pinot noir wine quality.

Fermentation practices monitored in the 1994 vintage: Wines were produced from the following processing treatments: crushing and desternming followed by 4, 8, 14, and 20 days of maceration on the skins prior to pressing; crushing and desternming with a 6 day cold maceration prior to fermentation; and fermentation of whole berries and whole clusters.

Fermentation practices monitored in the 1995 vintage: Fourteen yeast strains used commercially for red wine production were evaluated for their effects on color, phenolic extraction, and color stability during aging.

Fermentation practices monitored in 1996 vintage: Wines were produced with the addition of color extracting enzymes, the addition of tannin preparations recommended for color stabilization, with selected yeast strains, and by fermentation with 0, 25, 50, and 100% stems present.

### Current Progress and Discussion

**1994 Processing Trials:**
In the spring of 1996, Pinot noir wines from 1994 fermentation trials were analyzed after one year of bottle age for anthocyanin content, color intensity, phenolic content. The wines also underwent sensory evaluation with a winemaker industry panel (see Descriptive Analysis: Winemaker Evaluation of Experimental Wines, McDaniel, Young, and Watson).

Pinot noir wines fermented with 8 days of skin contact time (SCT) prior to pressing had the highest anthocyanin pigment content, followed by wines produced by whole cluster fermentation for 8 days (WCl), post-fermentation maceration for 6 days prior to pressing (14 days total SCT), and whole berry fermentation for 8 days (WBr). Wines produced by fermenting whole clusters had the highest red color

intensity at wine pH (520+420 nm) as well as the highest polymeric pigment content. Extraction of stem phenolics appears to have stabilized red wine color by increasing polymerization of anthocyanin pigments.

Wines with the lowest color intensity were produced by early pressing at about half-way through fermentation (4 days total SCT) as well as by extended maceration for 12 days after completion of fermentation prior to pressing (20 days total SCT). Early press wines contained the lowest level of both total phenols and polymeric pigment. Significant color loss was observed in the extended post-fermentation maceration wines, apparently due to polymerization followed by precipitation and/or oxidative breakdown of pigments (Figures I and 2). Extended maceration significantly increased the extraction of seed phenolics including gallic acid and catechin due to solubilization with alcohol. Polymeric phenols also increased due to extraction from the seeds and/or from formation by extracted phenolic precursors. Pre-fermentation maceration for 6 days (14 days SCT) produced wines with lower total phenols than the control wines (8 day SCT). Whole berry fermentations also produced wines with lower total phenols while whole cluster fermentation produced wines with the highest total phenolic content due to the additional extraction of phenolic fractions including catechin from the stems (Figure 3).

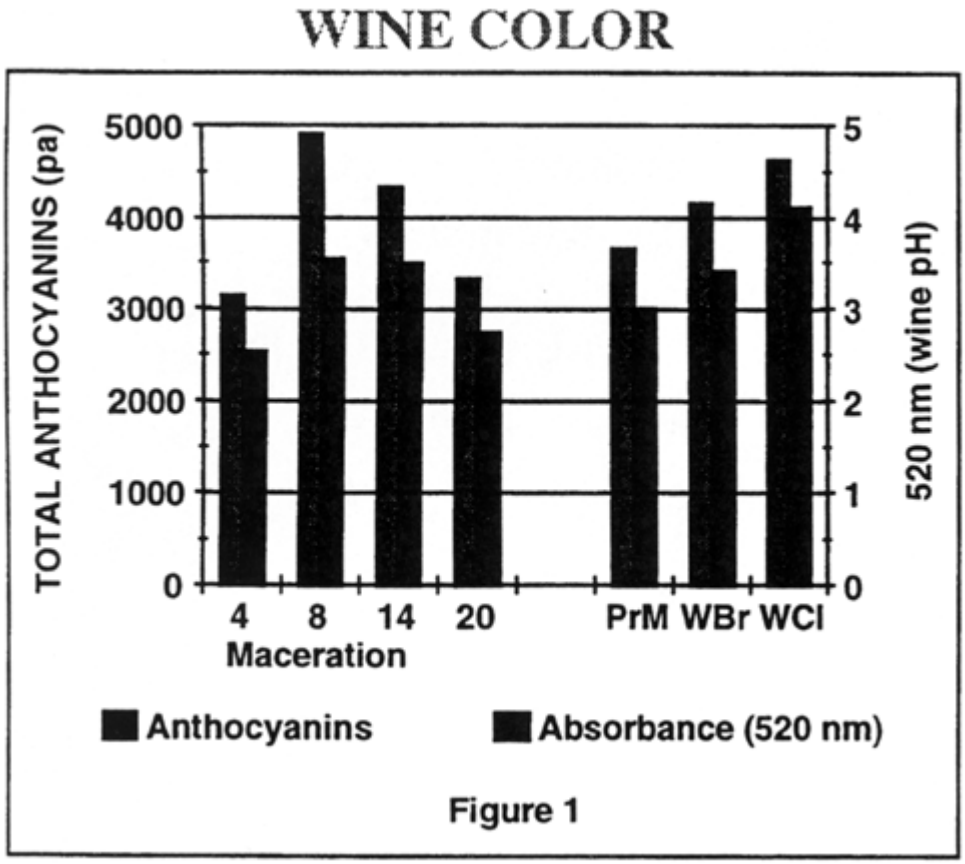


Figure 1

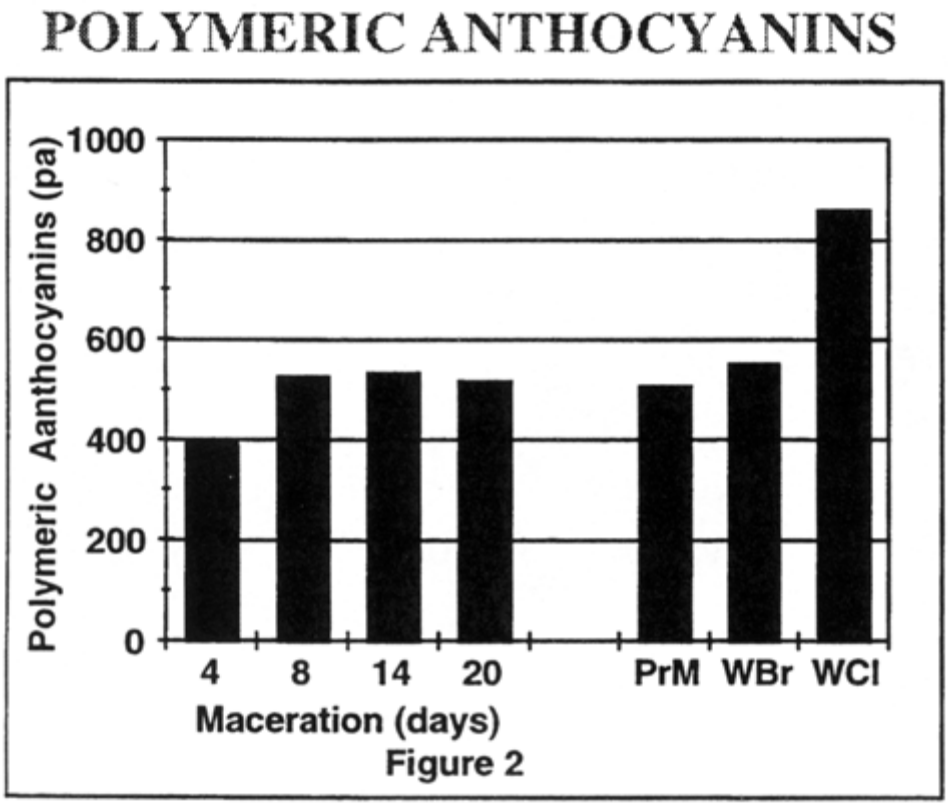

Figure 2

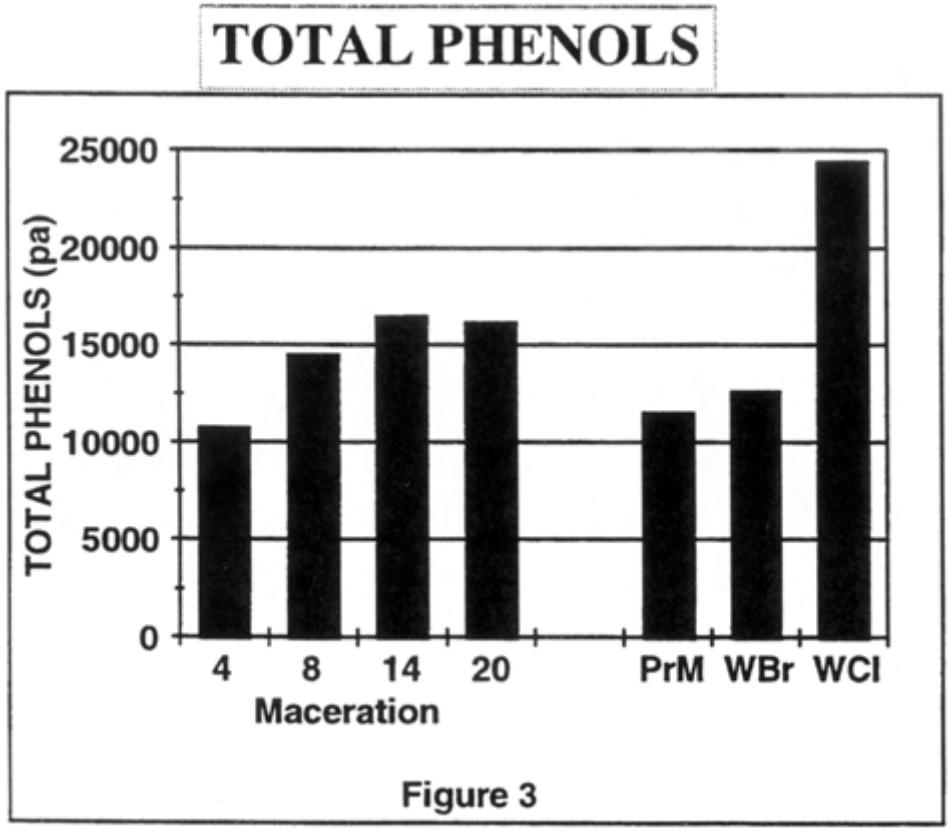

Figure 3

The wines underwent sensory evaluation at 14 months of age by an industry winemaker panel using free-choice profiling. This technique allows each panelist to use his/her own descriptive terms to rate intensity of aroma and flavor attributes perceived. The wines produced from early pressing and whole berry fermentation differed significantly from the other fermentation treatments in aroma characteristics. The early press wines were more pronounced in cherry, berry, floral, and plum character while the whole berry wines were more pronounced in vegetal, earthy/musty, floral, spicy/herbal character. All other treatments did not differ significantly in aroma characteristics.

Significant differences in flavor and mouthfeel characteristics were observed among the treatments. Wines produced by pre-fermentation maceration, both post-fermentation extended maceration treatments and by whole berry fermentation were described as having more vegetal, musty/mushroom, and cherry character as well as more body and mouthfeel characteristics than the other treatments. The control wines and whole cluster fermented wines were described as having more floral, cherry/berry, prune/raison character and to have more pronounced bitterness and astringency characteristics.

**1995 Processing Trials:**
Wines fermented with fourteen commercial dry yeast strains used for red wine production were analyzed for anthocyanin content, color intensity (520 + 420 nm at wine pH), and for phenolic content at the end of fermentation and after 14 months of aging (January1997). Total anthocyanin content and color intensity in newly fermented wines varied with the different yeast strains. Total anthocyanin content of the new wines ranged from 179 to 328 mg/Iand color intensity from 3.42 to 4.53 (520+420 nm at wine pH). The differences in pigment content in new wines may be due to differences in anthocyanin extraction and/or to losses in color after extraction. Recent research has shown that yeast cells can act as fining agents to combine and precipitate anthocyanin pigments and reduce color in wines. After 14 months of age the anthocyanin content had decreased significantly in all the wines, presumably due to polymerization, precipitation, and degradative reactions. Color intensity at wine pH also decreased significantly in all wines except those fermented by a few yeast strains. The hue of the wines, or relative ratio of brown to red color as expressed by the ratio of 420/520 nm, was higher for all the wines at 14 months of age. Several wines with greater color intensity at 14 months of age had the highest ratio of brown to red color (Figure 6).

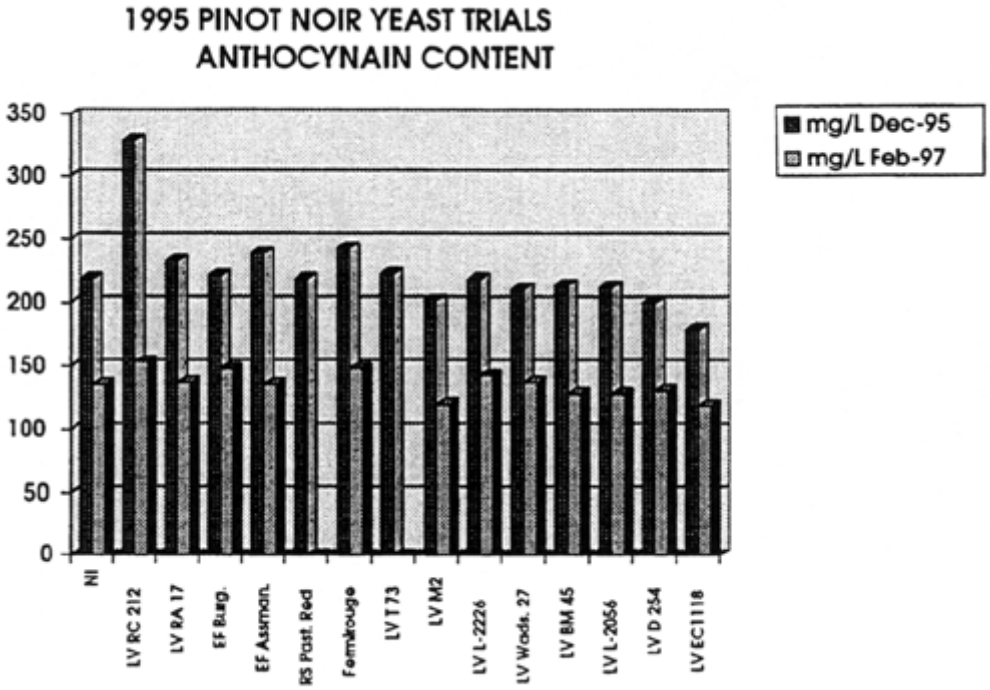


Figure 4

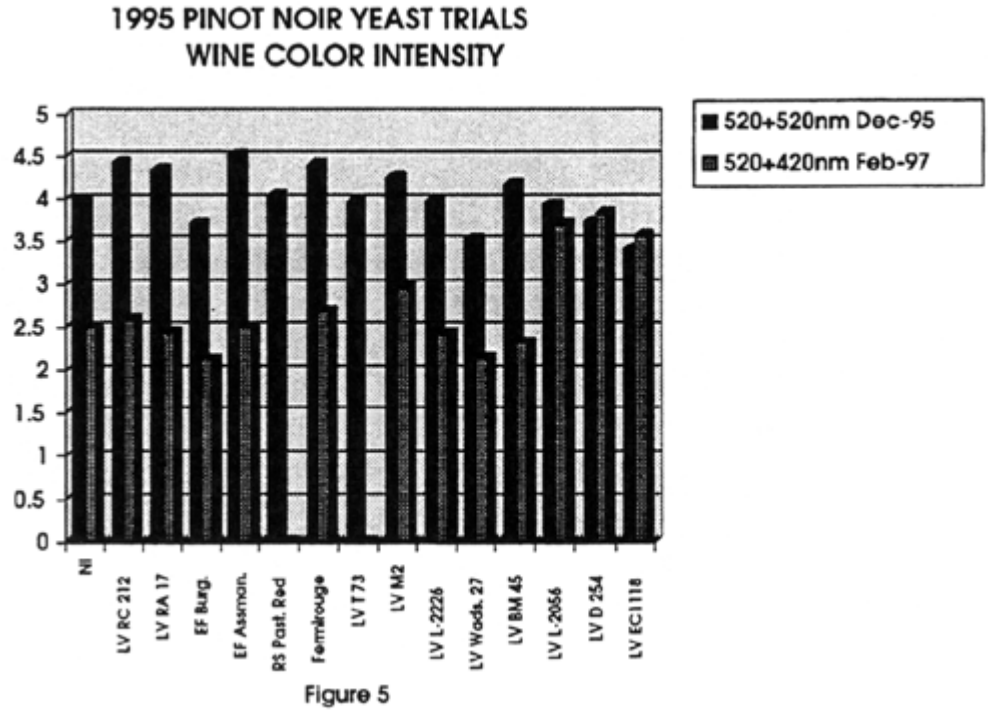


Figure 5

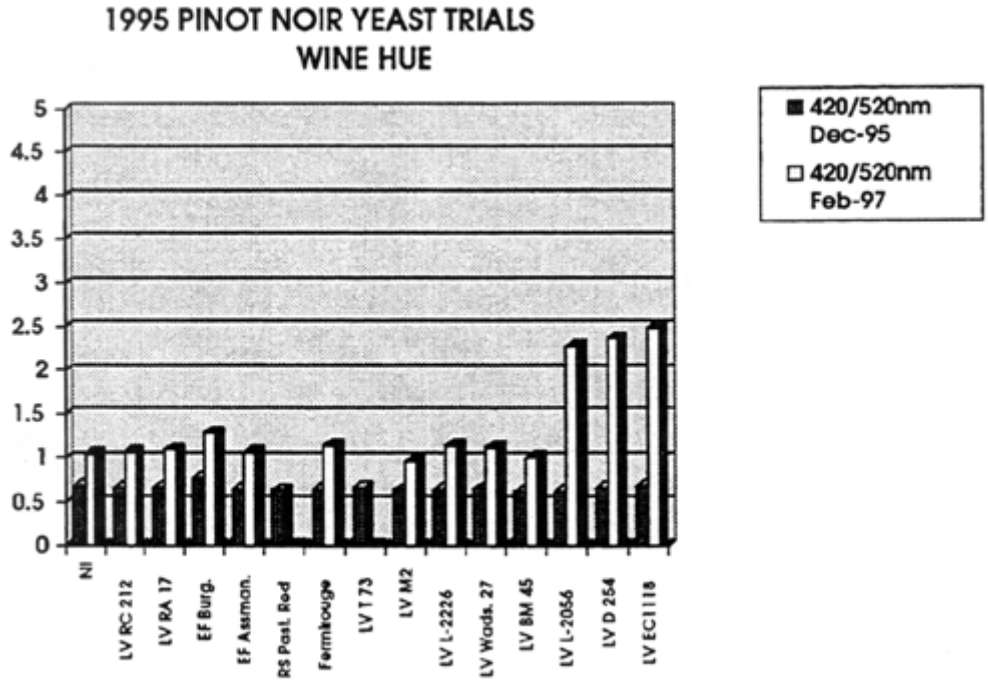

Figure 6

**1996 Processing Trials:**
Fermentation treatments included the addition of two commercial enzyme preparations (Scottzyme Color Pro and Scottzyme Color X) and three commercial tannin preparations (Tanin VR Supra, Quertanin and Oenotan) recommended for increasing color and color stability in red wines, five commercial yeast strains (Bourgorouge RC 212, Assmanhausen, EC 1118, Wads 27, and Zymoflore F 10), and fermentation with 0, 25, 50, and 100% stems present.

The addition of Scottzyme Color Pro and Scottzyme Color X at a level equivalent to I 00ml/ton produced new wines with slightly greater color intensity but with much higher total phenolic content than control wines with no enzymes added. Addition of 140g/ton (25 g/hL) VRS Tanin (Scott Labs) and I I 5g/ton (20 g/hL) Quertanin (Scott Labs) produced wines with color intensity similar to the control wines but also increased total phenolic content. Addition of 40g/ton (7g/hL) of Oenotan (Oenotan Selections) appeared to decrease color intensity slightly while also increasing the total phenolic content of the new wine (Figure 7 and 8).

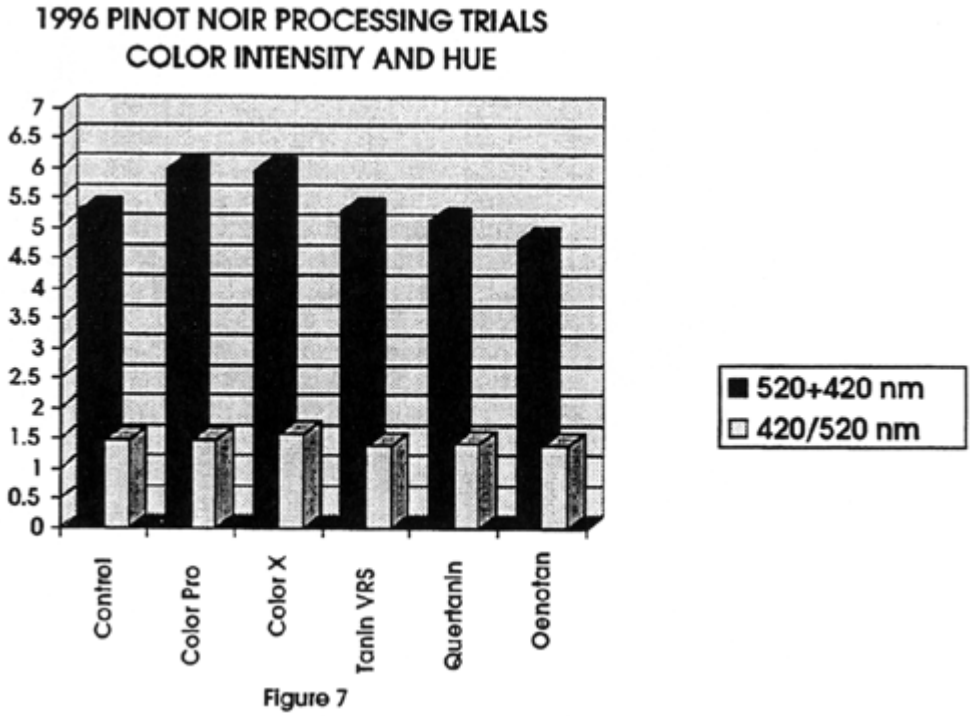


Figure 7

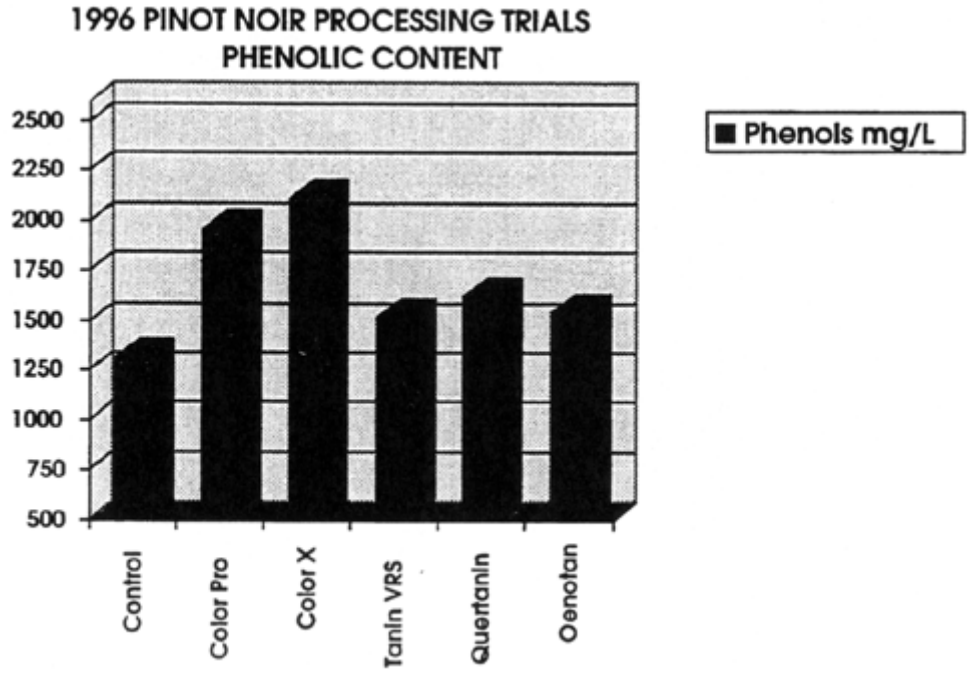


Figure 8

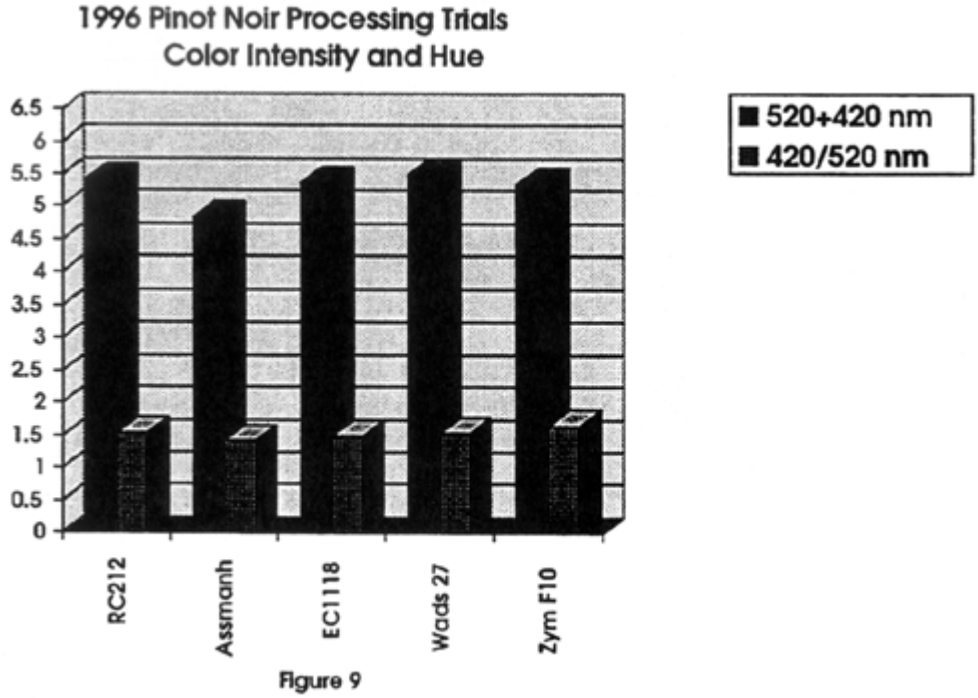


Figure 9

The color intensity in new wines fermented by five different yeast strains was very similar in the 1996 yeast trials (Figure 9) compared to the differences observed in new wines in the 1995 yeast trials. The color intensity of the 1996 wines was much greater than in the 1995 wines in our trials. It may be that in lighter colored wines any effects yeast may have on color intensity in newly fermented wines may be more obvious than in darker colored wines. Some modest differences were observed in phenolic content in new wines fermented with different yeast strains in 1996 suggesting some differences in overall extraction during fermentation occurred (Figure 10).

Fermentation of whole clusters (100% of the stems present) produced new wines with greater color intensity than control wines with 0% stems present (Figure 11). Similar results were obtained with the 1994 processing trials. The presence of 25% and 50% stems during fermentation did not have as pronounced effect as fermentation with 100% stems. There was, however, a linear increase in total phenolic extraction during fermentation with increasing amounts of stems. Fermentation with 100% stems produced wines with 78% higher total phenolic content than the control wines (Figure 12).

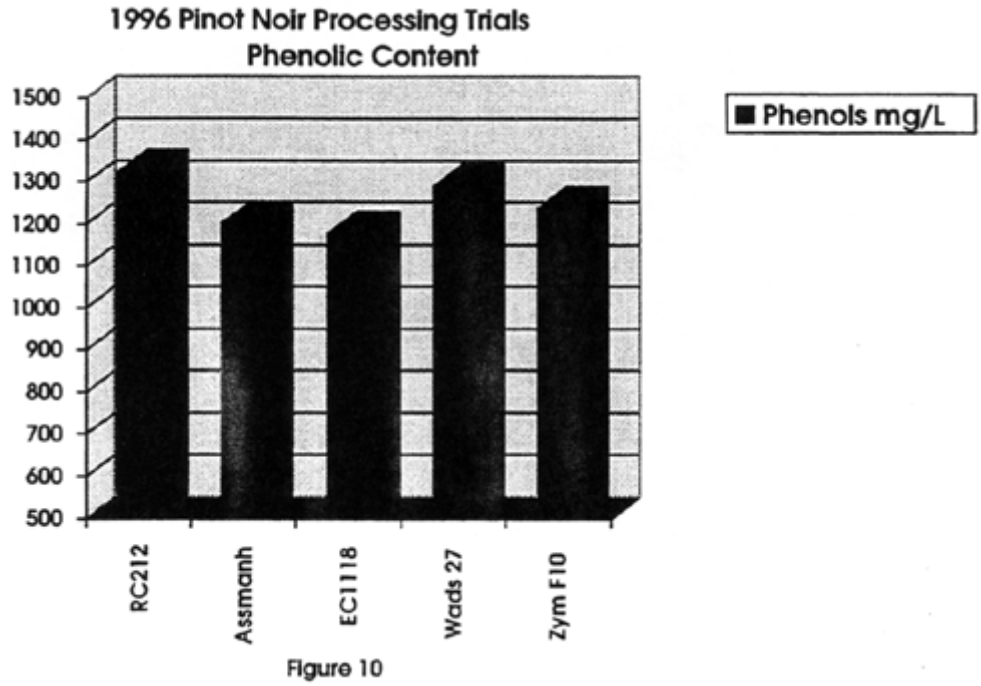


Figure 10

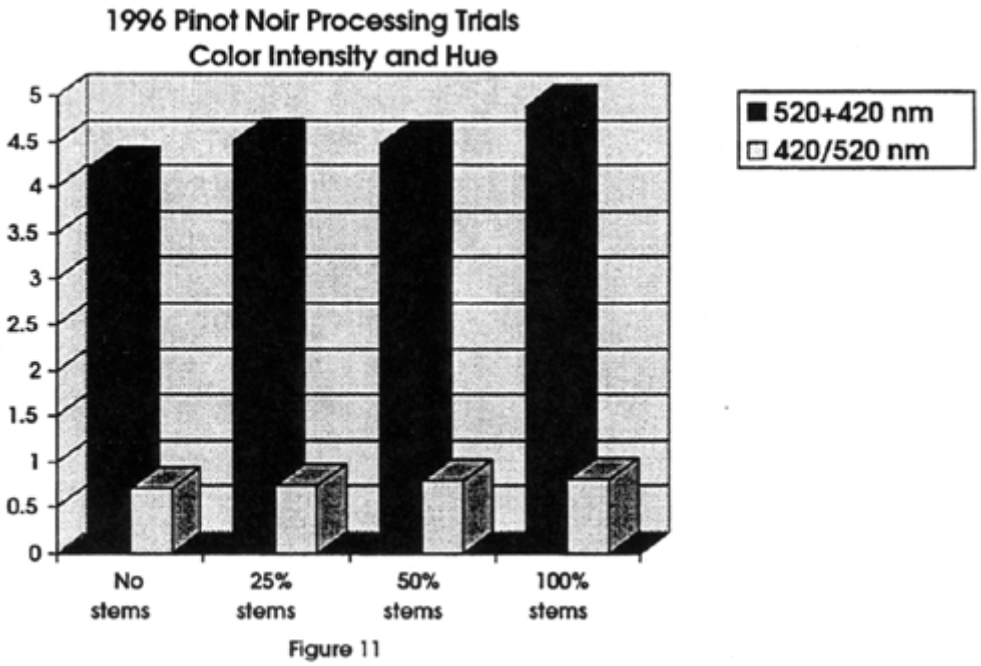


Figure 11

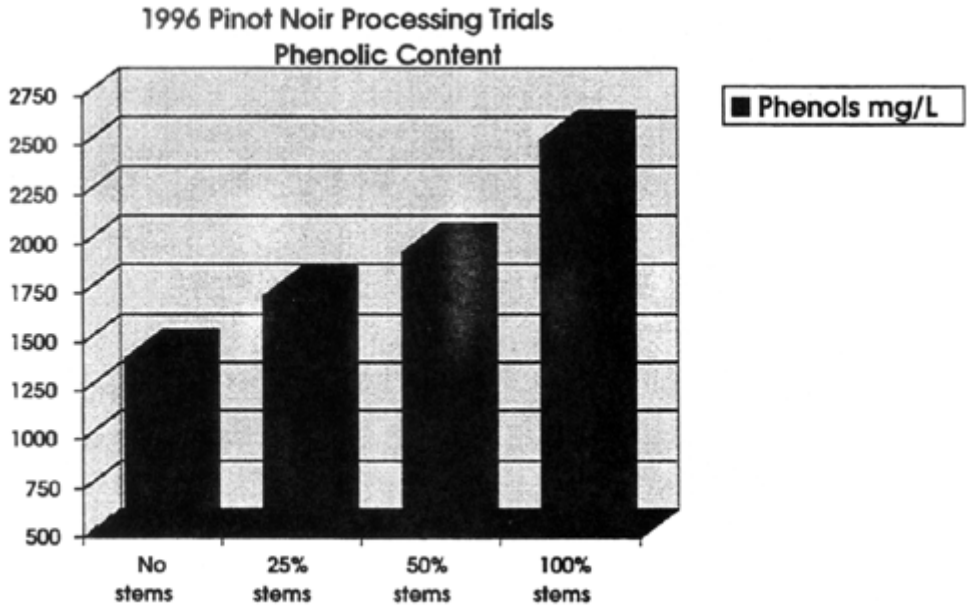


Figure 12

The wines from these trials will also be analyzed after completion of malolactic fermentation and at bottling for anthocyanin content, phenolic content, and color intensity. In early summer our industry winemaker tasting panel will begin sensory evaluation of the wines using free-choice profiling in the Sensory Sciences laboratory in the Department of Food Science and Technology.