

**EFFECTS OF MACERATING PECTINASE ENZYMES ON COLOR, PHENOLIC PROFILE, AND  
SENSORY CHARACTER OF PINOT NOIR WINES**

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**Introduction and Methods**

Several macerating pectinase enzyme preparations are currently being used by Oregon wineries to enhance color, color stability and phenolic extraction of red wines. Previous research on the use of commercial pectinase enzymes in Oregon Pinot noir and Cabernet Sauvignon wines showed that some enzyme preparations were capable of reducing red wine color through pigment modification and subsequent degradation (Wightman, J.D. et al. 1997). During the 1996 and 1997 vintages, commercial 'color' extracting enzymes were evaluated for their effects on Pinot noir wine composition and sensory character.

In 1996, the trials included the addition of two enzymes, Scottzyme Color Pro and Color X (Scott Laboratories) at a rate of 100ml/ton (the highest dosage

recommended by the supplier). In 1997, the trials included the addition of several enzymes at both a low and a high dosage rate. Scottzyme Color Pro and Scottzyme Color X were added at the rate of 60 and 100 mL/ton, Lallzyme EX (Lallemand) at 15 and 30 g/ton, Rapidase EX Color (Gist Brocades) at 15 and 30 g/ton, and Vinozyme G (Cellulo) at 25 and 50 g/ton. Pinot noir was harvested from Woodhall Vineyards, in Alpine, Oregon and all treatments were made in triplicate lots from 16 kg of fruit. Enzymes were added after crushing and destemming, addition of 50 mg/L sulfur dioxide, and inoculation with 250 mg/L of rehydrated Lalvin RC 212 yeast. The wines were pressed off the skins after 12 days of skin contact at dryness. The new wines were inoculated with OSU malolactic bacteria (Lalvin) and cold stabilized at 4°C after completion of malolactic fermentation (MLF). The wines were bottled unfiltered with addition of 25 mg/L of sulfur dioxide at 6 months of age.

The new wines were analyzed at bottling for total anthocyanin content, color intensity, total phenolic content and for specific phenolic fractions by high performance liquid chromatography (HPLC). HPLC analysis was provided by ETS Laboratories, St. Helena, CA. The wines underwent sensory evaluation at 9 months of age by a winemaker industry panel in the Sensory Sciences Laboratory of the Department of Food Science and Technology using the technique of free-choice profiling. Data was analyzed through Generalized Procrustes Analysis and Analysis of Variance.

## Results and Discussion

Differences in color intensity, total phenols, and specific phenolic fractions as measured by HPLC were observed in wines with enzyme treatments compared to untreated control wines. Wines produced by enzyme treatments were higher in polymeric anthocyanins, polymeric phenols, and catechin, but not in monomeric anthocyanin content compared to control wines, as shown in Table 1. As an example of the effect of enzyme treatment on overall phenolic profile, a spider graph of HPLC analysis of 1996 Pinot noir produced with addition of Scottzyme Color X (100mL/ton) is shown in Figure 1 compared to the untreated control (concentrations of the phenolic fractions in control wines were normalized to 100%).

In the 1997 trials, all five of the enzymes produced new wines with greater total phenolic content than untreated controls (expressed as gallic acid equivalents, GAE). Scottzyme Color Pro at the high dose rate produced wine with the highest total phenolic content at pressing, however, by the end of MLF a decrease in total phenols was observed, presumably due to polymerization reactions and precipitation. Similar decreases were observed in the control wines and in wines produced with the addition of Scottzyme Color X (Fig. 2).

The total anthocyanin content (as measured by absorbance 520 nm, pH<1) of the 1997 wines at the time of pressing (dryness) and at the end of malolactic fermentation (MLF) is shown in Fig. 3. At pressing, the anthocyanin content of wines produced by enzyme treatment was similar to or in a few cases higher than the untreated controls. By the end of MLF, however, a loss in anthocyanin content was observed in all the treatments. Only the Scottzyme Color Pro wine at the low dosage rate was higher in total anthocyanin content

than control wines. Several of the enzyme treatments did, however, produce new wines with greater color intensity than untreated controls. Color intensity of wines at the end of MLF (absorbance at 420 + 520 nm at wine pH) is shown in Fig. 4. Addition of Scottzyme Color Pro, Scottzyme Color X, and Vinozyme G produced new wines with greater color intensity than controls at both the low and the high recommended dosage rates. The low dosage rate of Lallzyme EX Color appeared to be more effective in increasing color intensity than the high dose rate. The low dose of Rapidase EX Color did not increase color intensity while the high dose showed a slight increase. The increase in wine color intensity by the enzyme treatments may be due to increases in polymeric anthocyanin content and/or due to co-pigmentation effects due to the enhanced extraction of other phenolic fractions.

Table 1.

**Phenolic profile\* through HPLC (high performance liquid chromatography) on 1997 Oregon Pinot noir wines**

Sample	Monomeric Anthocyanins mg/l	Polymeric Anthocyanins mg/l	Polymeric Phenols mg/l	Catechin mg/l
<b>Control</b>	<b>81.0</b>	<b>8.0</b>	<b>195.0</b>	<b>120.0</b>
Scottzyme Color Pro				
(low)	72.0	11.0	258.0	152.0
(high)	73.0	11.0	268.0	163.0
Scottzyme Color X				
(low)	71.0	12.0	277.0	144.0
(high)	73.0	11.0	274.0	164.0
Lallzyme EX				
(low)	78.0	11.0	276.0	156.0
(high)	79.0	10.0	271.0	158.0
GB Rapidase EX Color				
(low)	78.0	10.0	250.0	158.0
(high)	78.0	10.0	264.0	154.0
Vinozyme G				
(low)	74.0	11.0	273.0	155.0
(high)	83.0	11.0	283.0	163.0

\*Measurements taken at the end of malolactic fermentation (90 days after crush)

\*n=1, pooled sample of 3 wine batches

Fig. 1

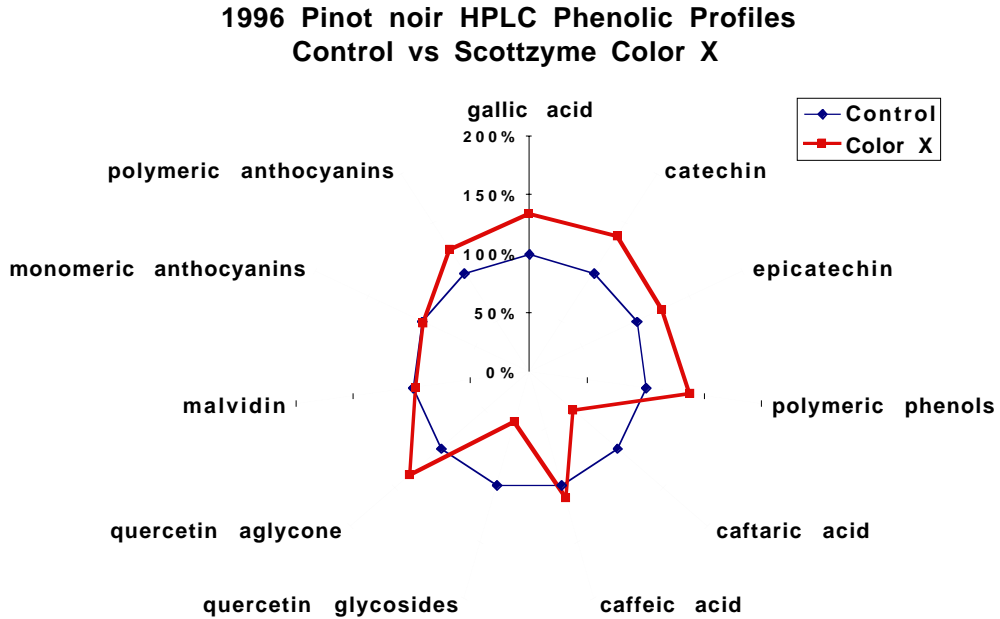


Fig. 2.

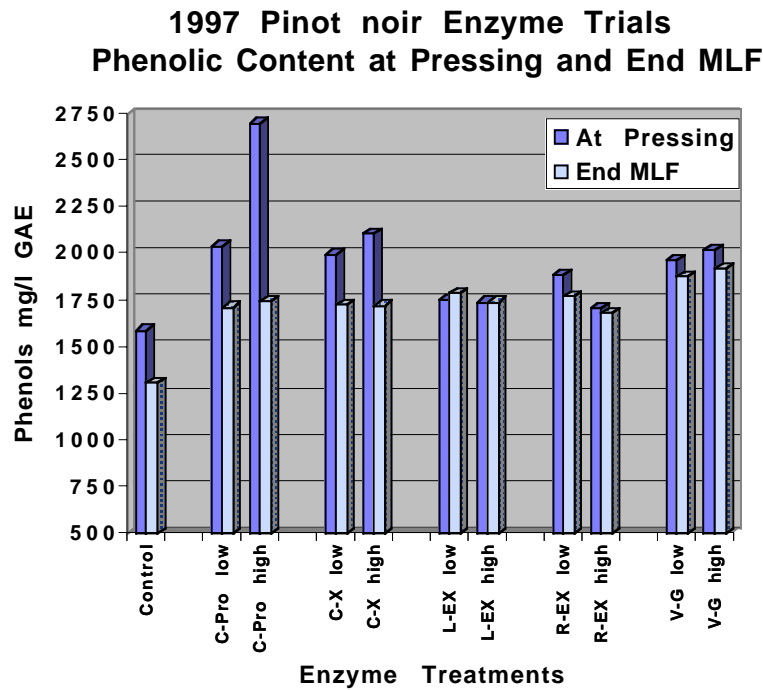


Fig. 3.

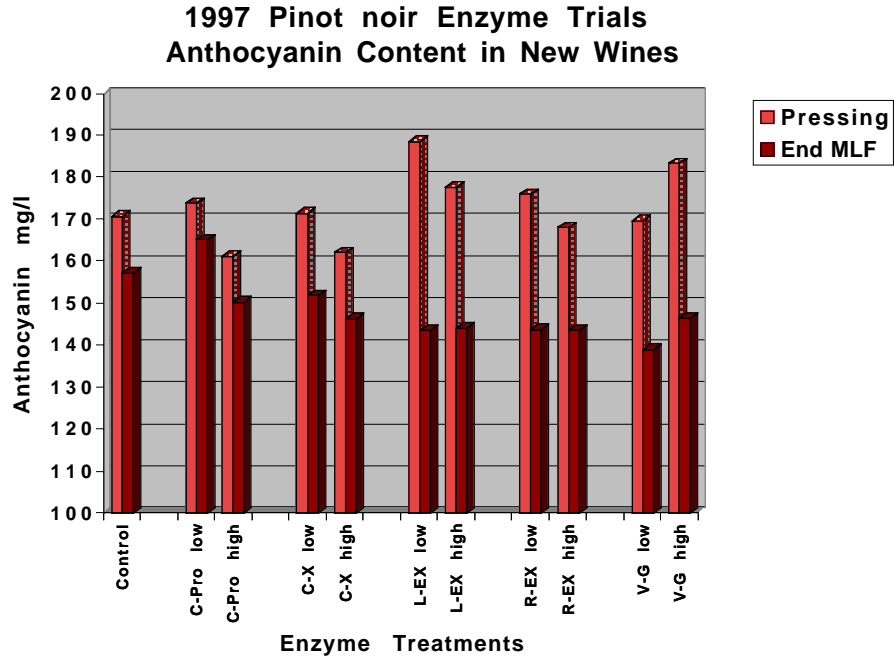
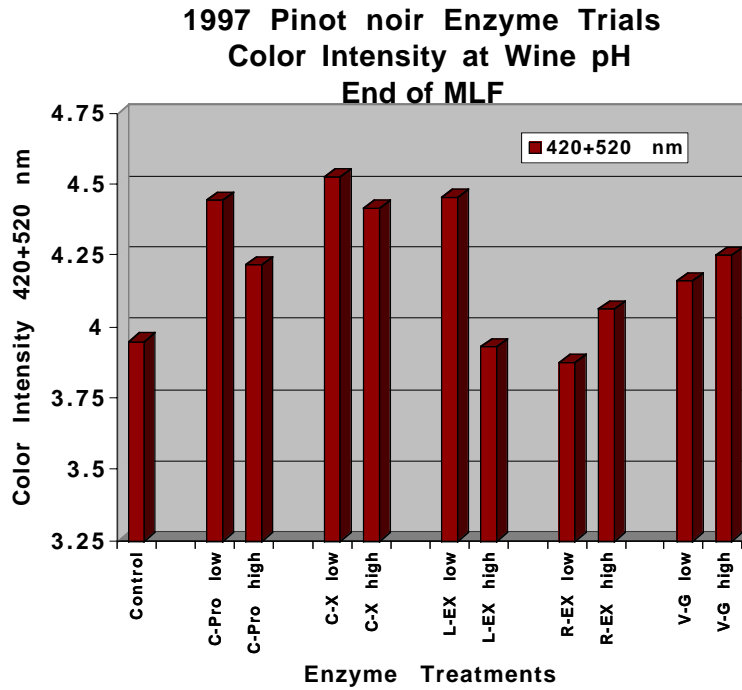


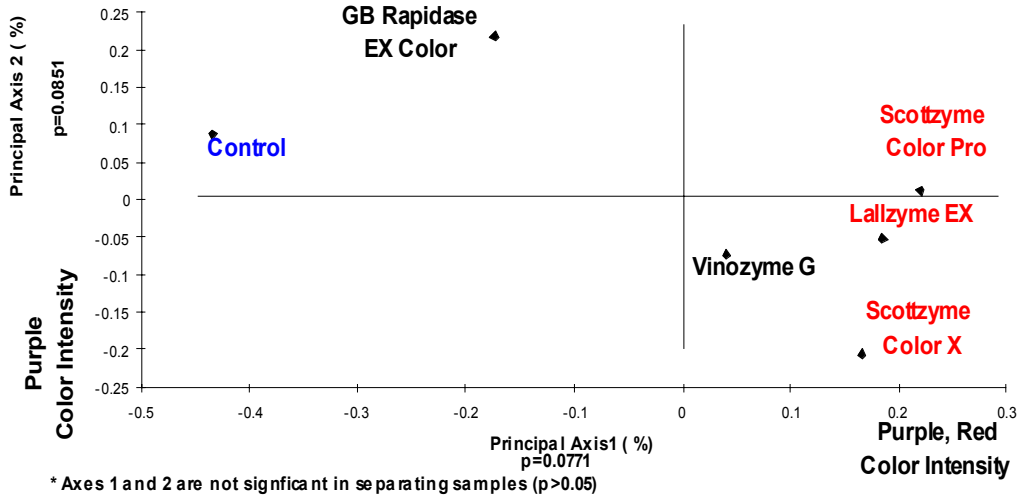
Fig. 4.



Significant differences were observed in color intensity, aroma, flavor, body, and mouthfeel characteristics in wines produced using some of the enzyme treatments compared to untreated control wines. Using the technique of free-choice profiling the winemaker panel was able to differentiate the wines produced by the lower enzyme treatments more clearly from the control wines than the those produced by the higher enzyme treatments in color, aroma, and flavor characteristics. Overall, Pinot noir wines produced with the addition of the lower dosages of the enzymes tended to produce wines with greater purple, red descriptors, increased color intensity, and enhanced fruity, floral, spicy, vegetative, earthy, and body characteristics (Figs. 5, 6 & 7). At the higher treatment levels (data not shown) the trends in color, appearance, and aroma characteristics were similar to the lower enzyme treatments, however, in flavor the wines were described as generally having enhanced acidity, bitterness, and astringency characteristics.

Fig. 5.

Color & appearance profile map\* of low dosage enzyme treated 1997 Pinot noir wines from a winemaker panel



Fi. 6.

Aroma profile map\* of low dosage enzyme treated 1997 Pinot noir wine from a winemaker panel

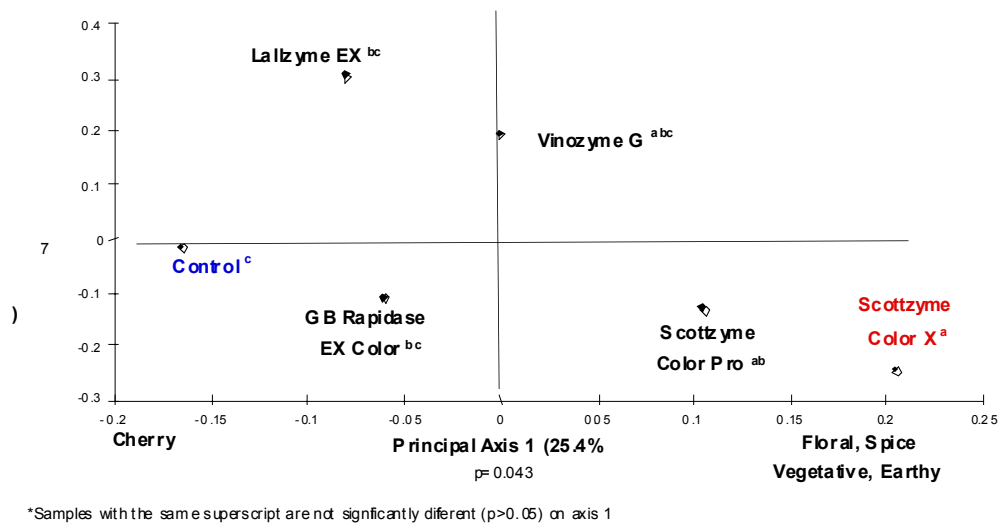
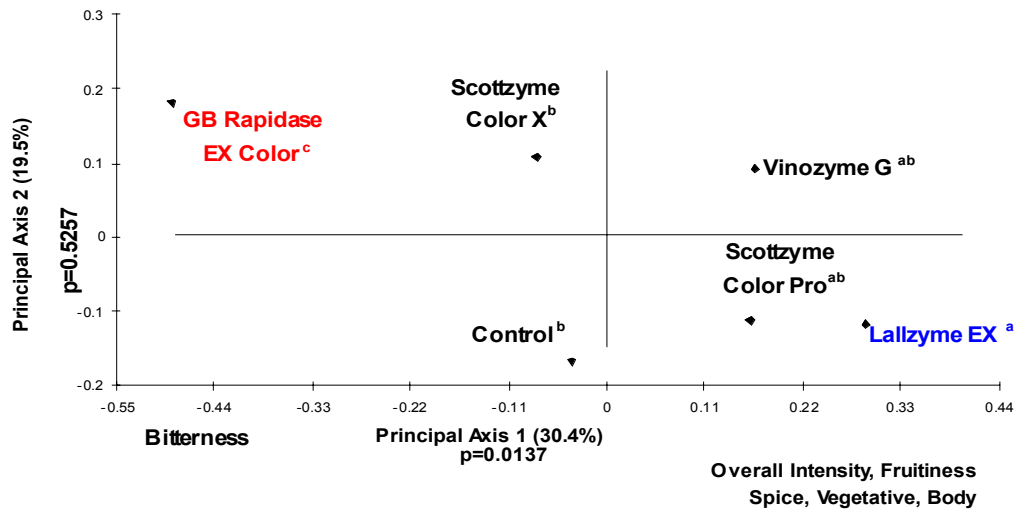




Fig. 7.

**Flavor profile map\* of low dosage enzyme treated 1997 Pinot noir wine from a winemaker panel**



\*Samples with the same superscript are not significantly different ( $p > 0.05$ ) on axis 1

References:

1. Wightman, J.D., Price, S.F., Watson, B.T., and R.E. Wrolstad. 1997. Some effects of processing enzymes on anthocyanins and phenolics in Pinot noir and Cabernet Sauvignon wines. *Am. J. Enol. Vitic.*, Vol. 48, No.1, pp39-47.
2. McDaniel, M., Young, S, and B.T. Watson. Descriptive Analysis: winemaker evaluation of experimental wines. Proc. of the Fourth International Symposium on Cool Climate Viticulture and Enology. VII-1-8. Rochester, New York, USA. July 16-20, 1996.