A producer-focused summary of *The unique ripening kinetics and grape chemistry of Petit Manseng*

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Introduction

Over the past 20 years, Petit Manseng has gained popularity in Virginia vineyards. Although traditionally used for off-dry or dessert style wines[1], some Virginia winemakers produce dry table wines from this variety. However, Petit Manseng's naturally high sugar and acid levels pose significant challenges to producing a balanced dry style wine. This study characterized the ripening kinetics of Petit Manseng to inform harvest timing and winemaking decisions for production of dry Petit Manseng. Chardonnay was used as a reference variety because it is the most widely planted white grape in Virginia[2], providing a familiar benchmark for ripening kinetics among growers and winemakers.

Methods

The study included systematic sampling of Chardonnay and Petit Manseng from five vineyard sites across Virginia: 2 in Northern Virginia, 2 in Central Virginia, and 1 in the Shenandoah Valley. Each site grew both varieties in the same vineyard and utilized farming operations considered standard to Virginia. Sampling was conducted weekly from veraison until harvest (for a total of 74 samples). Each sample was analyzed for: berry weight, total soluble solids (TSS)(Brix), pH, titratable acidity (TA), glucose, fructose, malic acid and yeast assimilable nitrogen (YAN). Statistical analyses included use of boosted tree models, broken line linear regression, and linear discriminant analysis.

Results

Figure 1 show broken line regressions for eight metrics measured in this study. There were several statistically significant differences between Chardonnay and Petit Manseng identified in this study.

Sugar

- Brix, glucose and fructose increased 33-45% faster in Petit Manseng than to Chardonnay.
- The slope flattened at a maximum of 23.5° Brix in Petit Manseng vs.19.5° Brix in Chardonnay.
- In many cases, Chardonnay was harvested near the day of sugar plateau (with an average harvest 2 days post sugar plateau) while Petit Manseng was often harvested long after the sugar leveled off (averaging 21 days).

pH

- pH in Chardonnay increased almost twice as fast (1.8 times) as pH in Petit Manseng.
- The maximum pH in Petit Manseng averaged 3.15 vs. 3.44 in Chardonnay.
- pH reached a maximum within 3 days of sugar maximum in Chardonnay, but 15 days after sugar maximum in Petit Manseng.

Titratable Acidity

- TA decreased at nearly the same rate in both varieties.
- TA plateaued sooner, at a value of 10.8 g/L in Petit Manseng vs. 7.13 g/L in Chardonnay.

Malic Acid

- Malic acid plateaued at the same value in Chardonnay and Petit Manseng. However, it decreased slower in Petit Manseng than Chardonnay.
- Chardonnay malic acid reached its minimum 15 days before sugar maximum while Petit Manseng malic acid reached its minimum the same day as sugar maximum.

Applications

For winemakers seeking to produce dry Petit Manseng, several insights from ripening kinetics can inform vineyard sampling, harvest timing, processing, and fermentation management. Applying these insights can help balance acidity and alcohol while also supporting fermentations that finish to dryness.

Before harvest:

- Sample fruit weekly after veraison and compare sample values over time.
    - Because Petit Manseng accumulates sugar quickly, samples may need to be taken more frequently, especially close to harvest time.
    - Keeping track of progress over time will help you know when you have reached physiological maturity, and what pace acidity is dropping and Brix are accumulating at your site, in the current vintage.
- Include titratable acidity in your fruit chemistry measurements. Even if the pH is >3.0, the TA may still be prohibitively high. The WRE website has resources on how to measure TA if you need them.

Harvest Decisions

- Pick as early as the pH and TA will allow.
    - Due to rapid increase in Brix, even a few days earlier can make a difference for potential alcohol and yeast stress during fermentation.

- Picking later into physiological ripeness shifts to an unfavorable glucose:fructose ratio and probably leads to more intense tropical aromas.

- Ideally, fruit should be harvested at <24 °Brix, TA <10 g/L, and pH >3.0. In practice, however, these metrics may not align, and winemaking interventions may be required to both encourage a healthy fermentation and achieve balanced acidity.

Processing

- Consider pre-fermentation skin contact. Even a couple of hours of skin contact after de-stemming will release potassium that can remove tartaric acid. This may shift the TA into a more acceptable range. However, be careful to avoid oxidation during contact time.
- This is one time not to be too gentle with the press pressure if you want to maximize potassium found in grape skins. But be careful, as phenolics may also be extracted (and tip the balance again).

Fermentation Conditions

Stress is cumulative. Several aspects of Petit Manseng physiology lead to the potential for difficult fermentation. Higher overall sugar accumulation leads to high potential alcohol. Long hang times lead to high fructose relative to glucose. pH <3.0 leads to yeast stress. Wherever possible, do what you can to moderate these and other stressors to help the yeast succeed.

Recommendations

- Choose your yeast strain carefully. Ideally your yeast would be
  - Fructophilic: A fructophilic yeast strain will help finish a fermentation with glucose:fructose < 1.0. Even if this is not your primary yeast, have a restart yeast on hand for a second inoculation if the fermentation slows well before completion.
  - Tolerant to high alcohol and low pH. Each of these conditions can be stressful on its own. Taken together, they need a powerhouse yeast strain.
- Careful nutrient management including complex nitrogen additions at 2-3□Brix depletion increases the number of fermenting cells. Addition at 1/3 Brix depletion helps cells replenish sugar transporting proteins.
- Maintain fermentation temperature within the tolerance limit of the yeast strain.
- If the fermentation slows with several Brix remaining, consider using a restart yeast with specialized transport proteins for fructose.

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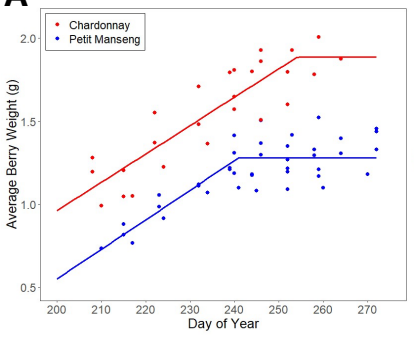
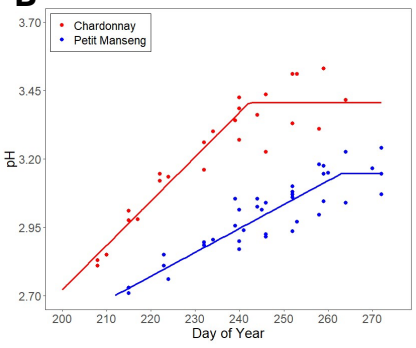
Figure 1: Ripening kinetics of Chardonnay and Petit Manseng grapes. Linear plateau models (a type of linear regression) were fit to the chemistry variables to characterize the change per day prior to ripeness, the plateau for each variable, and the timepoint at which each plateau occurred.

A



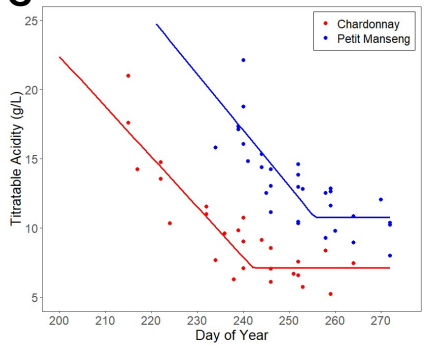
	Chardonnay	Petit Manseng	*p*-value
Plateau (g)	1.89 ± 0.088	1.28 ± 0.023	<0.0001
Change per day	0.02 ± 0.002	0.02 ± 0.002	0.8873
Plateau day of year	254 ± 6.2 (Sept 11)	241 ± 2.9 (Aug 29)	0.0825

B



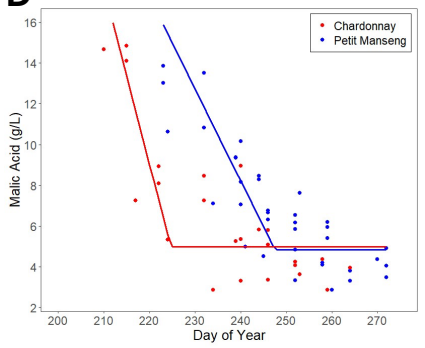
	Chardonnay	Petit Manseng	*p*-value
Plateau	3.44 ± 0.02	3.15 ± 0.03	<0.0001
Change per day	0.016 ± 0.001	0.009 ± 0.001	<0.0001
Plateau day of year	244 ± 2.3 (Sept 1)	263 ± 3.8 (Sept 19)	0.0002

C



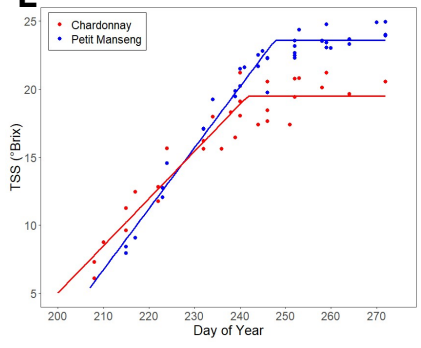
	Chardonnay	Petit Manseng	*p*-value
Plateau (g/L)	7.13 ± 0.53	10.76 ± 0.63	<0.0001
Change per day	-0.362 ± 0.049	-0.404 ± 0.036	0.867
Plateau day of year	242 ± 2.6 (Aug 30)	256 ± 2.4 (Sept 12)	0.001

D



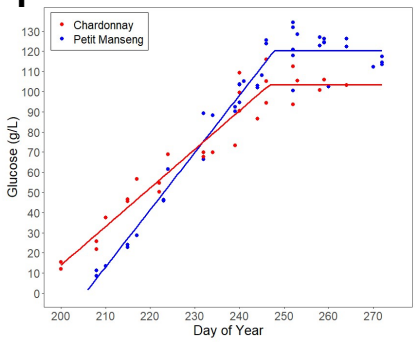
	Chardonnay	Petit Manseng	*p*-value
Plateau (g/L)	4.99 ± 0.52	4.84 ± 0.51	0.882
Change per day	-0.821 ± 0.08	-0.470 ± 0.03	0.0004
Plateau day of year	225 ± 1.6 (Aug 13)	247 ± 1.8 (Sept 4)	<0.0001

E



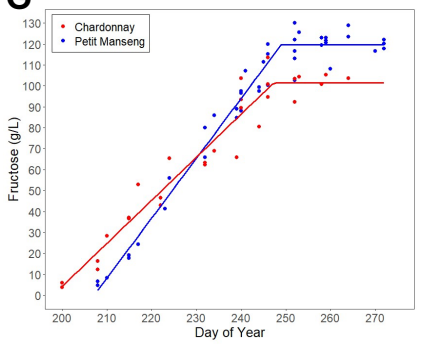
	Chardonnay	Petit Manseng	*p*-value
Plateau (°Brix)	19.49 ± 0.40	23.58 ± 0.22	<0.0001
Change per day	0.35 ± 0.03	0.45 ± 0.02	0.0037
Plateau day of year	242 ± 1.9 (Aug 29)	248 ± 0.9 (Sept 4)	0.0037

F



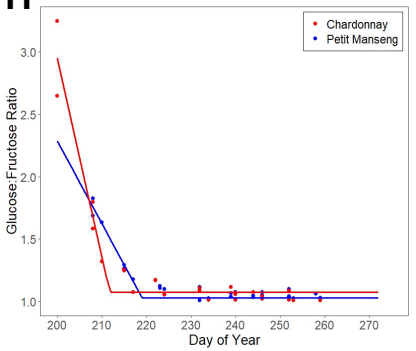
	Chardonnay	Petit Manseng	*p*-value
Plateau (g/L)	103.5 ± 3.43	120.4 ± 1.86	<0.0001
Change per day	1.92 ± 0.119	2.84 ± 0.124	<0.0001
Plateau day of year	247 ± 2.3 (Sept 4)	248 ± 1.2 (Sept 5)	0.689

G



	Chardonnay	Petit Manseng	*p*-value
Plateau (g/L)	101.6 ± 3.53	119.7 ± 1.53	<0.0001
Change per day	2.06 ± 0.122	2.86 ± 0.10	<0.0001
Plateau day of year	247 ± 2.3 (Sept 4)	249 ± 0.95 (Sept 6)	0.472

H



	Chardonnay	Petit Manseng	*p*-value
Plateau	1.07 ± 0.02	1.03 ± 0.008	0.0538
Change per day	-0.160 ± 0.012	-0.066 ± 0.006	<0.0001
Plateau day of year	212 ± 0.6 (July 31)	219 ± 0.7 (Aug 7)	<0.0001