

## Vine Nutrition Guidelines for Oregon Wine Grape Vineyards (updated May, 2019)

			Petiole		Leaf Blade (Preferred)		
Nutrient	Sample timing	Units	Deficient	Excessive	Deficient	Safe/Healthy	Excessive
<b>N</b>	bloom	%	<b>0.60 - 0.70</b>		<b>2.20</b>	<b>&gt; 2.40</b>	<b>4.25</b>
	véraison	%	<b>0.35 - 0.40</b>		<b>1.80</b>	<b>&gt; 2.00</b>	<b>2.50</b>
<b>P</b>	bloom	%	<b>0.15</b>		<b>0.17</b>	<b>&gt; 0.20</b>	
	véraison	%	<b>0.05</b>		<b>0.10</b>	<b>&gt; 0.12</b>	
<b>K</b>	bloom	%	<b>0.75 - 1.50</b>	<b>3.25</b>	<b>0.70</b>	<b>&gt; 0.80</b>	<b>1.5</b>
	véraison	%	<b>0.50 - 0.60</b>		<b>0.60</b>	<b>&gt; 0.70</b>	<b>1.25</b>
<b>Ca</b>	bloom/véraison	%	<b>0.9 - 1.0</b>		<b>0.9 - 1.0</b>	<b>&gt; 1.00</b>	
<b>Mg</b>	bloom/véraison	%	<b>0.20 - 0.50</b>		<b>0.10 - 0.20</b>	<b>&gt; 0.25</b>	
<b>Mn</b>	bloom/véraison	ppm	<b>20</b>		<b>20</b>	<b>&gt; 20</b>	
<b>Zn</b>	bloom/véraison	ppm	<b>20 - 25</b>		<b>15 - 20</b>	<b>&gt; 20</b>	
<b>B</b>	bloom/véraison	ppm	<b>20 - 25</b>	<b>125</b>	<b>15 - 20</b>	<b>&gt; 20</b>	<b>250</b>
<b>Cu</b>	bloom/véraison	ppm	<b>3 - 5</b>	<b>25 - 50</b>	<b>3 - 5</b>	<b>&gt; 5</b>	

Data shown are based on nutrition research for wine grapes in Oregon with comparison to other regions. Deficient levels for nitrogen (N), phosphorus (P), and potassium (K) are well characterized for Pinot noir. Véraison samples are more reliable than bloom samples for diagnosing most nutrients. Levels from leaf blades at véraison are more reliable than petioles for diagnosing N, P, K, and Mg. *Source: Paul Schreiner, USDA-ARS, Hort Crops Research Lab, Corvallis, OR.*

## Rationale / Considerations for Critical Nutrient Levels in Oregon Wine Grapes

- N, P, & K - derived from microplot studies based on growth, yield, fermentation & wine composition of Pinot noir. (Schreiner et. al. 2013, 2018a & b)
- Ca - based on lowest observed levels in healthy, productive Oregon vineyards. NOTE: A German standard for deficient Ca was reported as 2.0% in veraison leaf blades (Gärtel 1996), but values of 0.8% & 1.0% have been recorded in Oregon leaf blades at bloom & veraison, respectively. A French standard was defined as 0.5% in bloom leaf blades (Champagnol 1984).
- Mg - based on presence of leaf symptoms in Pinot noir & Chardonnay NOTE: Only leaf blades have been useful in diagnosing vines expressing obvious symptoms and levels have been below 0.10%. However, leaf blade values of 0.20% in routine samples prior to symptom development have later expressed Mg deficiency.
- Zn - levels reported here are fairly conservative, and require more work. Leaf blades with Zn as low as 8-10 ppm & petioles as low as 17-23 ppm have been observed in a few cases in healthy Oregon vineyards, but critical Zn levels likely vary by cultivar and Zn deficiency causes severe stunting of shoots, tiny leaves and shot berries.
- B - levels reported here are fairly conservative, and also require more work. Leaf blades as low as 12 ppm & petioles as low as 15 ppm are routinely observed in a healthy Pinot noir vineyard near Salem, but B deficiency also causes severe growth problems and poor set.
- Cu - levels based on healthy microplot and Oregon vineyards. Leaf blades & petioles with as little as 2 ppm Cu have not caused growth problems, leaf symptoms or reduced rates of photosynthesis.

### Literature Cited:

- Champagnol F. 1984. Elements de physiologie de la vigne et de viticulture generale. Saint-Gely-du-Fesc, France.
- Gärtel W. 1996. Grapes. *In*: Nutrient deficiencies and toxicities in crop plants (Ed. Bennett, W.F) APS Press, St. Paul, MN.
- Schreiner RP, Lee J and Skinkis PA. 2013. N, P, and K supply to Pinot noir grapevines: Impact on vine nutrient status, growth, physiology, and yield. *Am J Enol Vitic* 64:26-38.
- Schreiner RP, Osborne J and Skinkis PA. 2018a. Nitrogen requirements of Pinot noir based on growth parameters, must composition, and fermentation behavior. *Am J Enol Vitic* 69:45-58.
- Schreiner RP and Osborne J. 2018b. Defining phosphorus requirements for pinot noir grapevines. *Am J Enol Vitic* 69:351-359.

Quantity of Macro-Nutrients Needed by the Canopy & Actual Uptake from Soil from Budbreak until Harvest in 4 year-old & 22 year-old Pinot noir grapevines in Oregon (reported in pounds/acre)

Nutrient	Canopy Demand		Uptake from Soil	
	4-yr-old	22-yr-old	4-yr-old	22-yr-old
<b>N</b>	14	30	12	14
<b>P</b>	2.1	3.1	3.0	2.1
<b>K</b>	21	33	25	28
<b>Ca</b>	21	22	27	21
<b>Mg</b>	3.5	8.9	4.1	8.3

Citations for this work appear on the next 2 pages along with timing of uptake

When are Nutrients Taken Up from Soil  
 22 year-old own-rooted Pinot noir  
 Woodhall Research Vineyard  
 2001 & 2002 Average Values

<b>Nutrient</b>	<b>Budbreak - Bloom</b>	<b>Bloom – Veraison</b>	<b>Veraison - Harvest</b>	<b>Post Harvest</b>
<b>N</b>	53 %	30 %	5 %	12 %
<b>P</b>	45 %	46 %	1 %	4 %
<b>K</b>	26 %	53 %	21 %	0 %
<b>Ca</b>	28 %	58 %	14 %	0 %
<b>Mg</b>	21 %	55 %	24 %	0 %

Micro-Nutrients were too variable to accurately quantify uptake

From: Schreiner RP, Scagel CF and Baham J. 2006. Nutrient uptake and distribution in a mature 'Pinot noir' vineyard. *HortScience* **41**:336-345.

# When are Nutrients Taken Up from Soil 4 year-old grafted Pinot noir in Microplots 2007 & 2008 Average Values

<b>Nutrient</b>	<b>Budbreak - Bloom</b>	<b>Bloom – Veraison</b>	<b>Veraison - Harvest</b>	<b>Post Harvest</b>
<b>N</b>	58 %	25 %	1 %	16 %
<b>P</b>	35 %	42 %	19 %	4 %
<b>K</b>	21 %	66 %	13 %	0
<b>Ca</b>	14 %	52 %	34 %	0
<b>Mg</b>	16 %	60 %	24 %	0
<b>S</b>	40 %	51 %	9 %	0
<b>Mn</b>	29 %	54 %	17 %	0
<b>B</b>	45 %	45 %	10 %	0
<b>Zn</b>	16 %	57 %	27 %	0
<b>Cu</b>	26 %	43 %	31 %	0

From: Schreiner RP. 2016. Nutrient uptake and distribution in young Pinot noir grapevines over two seasons. *Am J Enol Vitic* **67**:436-448.