Vineyard nutrient management in 2004, in light of the 2003 season

- Predictions for 2004
- Strategies for 2004 season
- Observations on 2003 season
  - visual assessments
  - soil and plant tissue testing

NUTRIENTS ESSENTIAL FOR NORMAL GRAPEVINE GROWTH AND DEVELOPMENT

Obtained from air and water	**Macro-nutrients**	Micro-nutrients
Carbon (C)	**Nitrogen (N)**	Iron (Fe)
Hydrogen (H)	**Phosphorus (P)**	Manganese (Mn)
Oxygen (O)	**Potassium (K)**	Copper (Cu)
	Calcium (Ca)	Zinc (Zn)
	Magnesium (Mg)	Boron (B)
	Sulfur (S)	Molybdenum (Mo)
		Others (?)

Examples of N- and P-deficient plant tissue diagnostic results from bloom, 2003

Sample	N	P	K	Ca	Mg
1 cab s	0.79	0.08	4.46	1.52	0.47
2 merl	0.71	0.13	5.03	1.36	0.59
3 cab s	0.56	0.08	3.86	1.33	0.42
4 cab s	0.66	0.08	2.69	1.01	0.27
Normal	1.20 - 2.20	0.14 - 0.30	1.50 - 2.50	1.00 - 3.00	0.30 - 0.50

2003 plant tissue samples

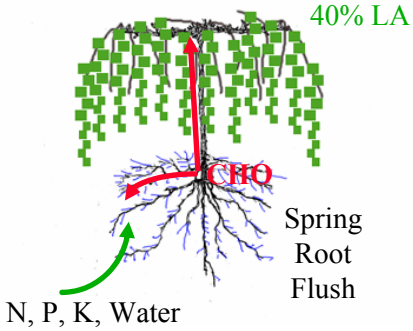
- Most plant tissue samples were within normal range for all nutrients except nitrogen.
- However…..
- About 50% of samples that I saw were low in nitrogen.

"But… Friendly Fertilizer Foundation said that my vines were suffering nutrient stress in 2003 and that that was why I was seeing symptoms such as….."

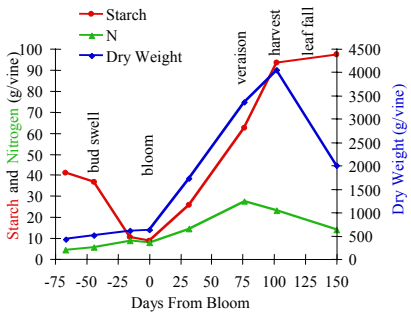
- Pale green leaves in May
- Poor fruit set (shot berries, no clusters)
- Reddening leaves
- Leaf dropping in mid-summer

"But… are their alternative explanations?"

- poor fruit set and the effects of prolonged cloudy weather
- an analogy

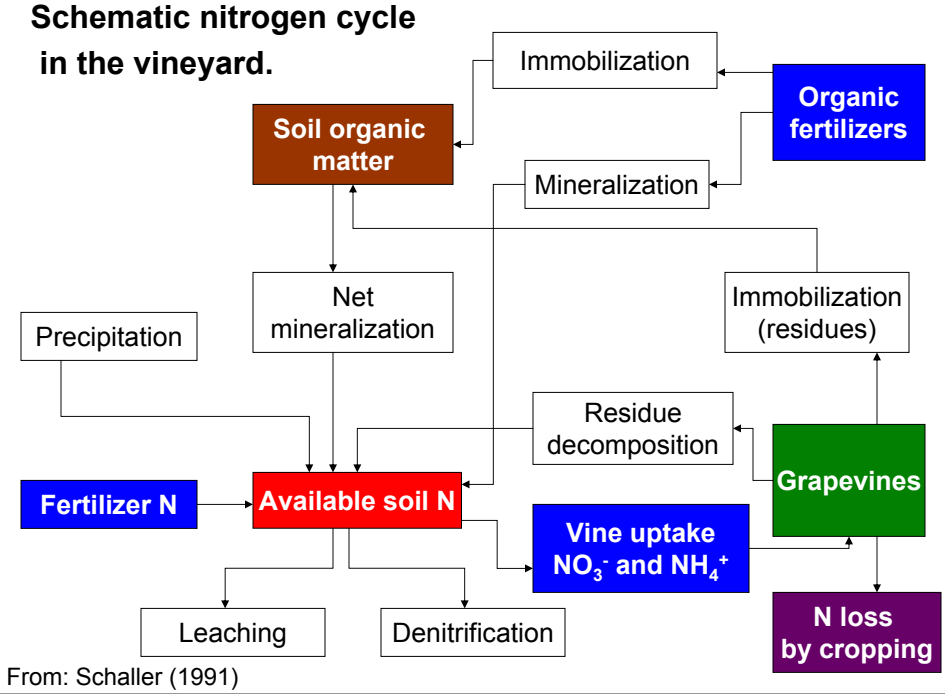


Bud Swell to Bloom



Data and illustration from Terry Bates, Cornell University

Schematic nitrogen cycle in the vineyard.



From: Schaller (1991)

Nitrogen considerations

- Increased leaching of nitrates from soil profile during extended rainy weather
- Reduced conversion of nitrates into amino acids and protein during periods of cool, cloudy weather
- Cool, wet soil limiting root function and nitrate uptake
- What is vineyard's historical N status (routine need for fertilizer N, or not?). I.e., 2003 might have been an anomaly

NITROGEN ISSUES

- Assessing need
  - Visual (vine size, leaf color, trellis fill)
  - Tissue analysis (timing, tissue, relationship to standards (total N assessed at bloom-time - sufficiency at 1.2 to 2.1% N with this timing)
  - Cane pruning weights (e.g., < 0.2 lbs/ft canopy)
  - Weed or cover crop competition

NITROGEN ISSUES

- Correction
  - Materials
    - basis of cost (urea likely least expensive)
    - compost, manure, chicken litter, other organics
    - other nitrate fertilizers (DAP, KNO_3 - expensive)
  - Timing
    - relationship to periods of root growth
    - recognition that some of benefit not observed until second year; post-harvest application --foliar or soil
    - multiple, small applications rather than single large
    - fertigation

NITROGEN ISSUES

- Most efficient source is from soil-derived N.
- Foliar N as a short-term correction
  - urea (various formulations, e.g., Coron [Helena])

Phosphorus deficiency in Riesling on low pH soil. (R.M. Pool)

Phosphorus deficiency in Pinot noir. (R.M. Pool)

PHOSPHORUS

- **Fertilizer phosphorus is not used efficiently; much of the added P is "fixed" or rendered unavailable to plants**
- **Less available at low (< 5.5) and at high (>7.5 pH). [precipitation by Al, Fe, and Mn at low pH].**
- **Soil test should be in > 5 ppm (>10 lbs/acre range).**
- **But - grapes are efficient at extracting P from soil, even with low P content**

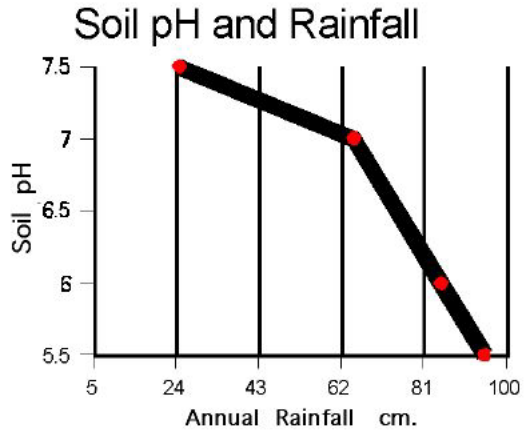
PHOSPHORUS

- **Little phosphorus is lost to leaching -- 2003 symptoms may be due to restricted root growth or soil pH problems.**

- And -- therefore -- might not be a problem in 2004 if 2004 is a "normal" season. Soil test would be good starting point.

PHOSPHORUS

- **Phosphite / phosphorous acid is not a plant nutrient. Effective for Downy Mildew control, but not for increasing vine-available phosphorus.**



40” rain (July 2003) > 100 cm.

Loss of basic cations from soil profile, increased availability of H^+ and K^+

Soil testing

- Methods in Mid-Atlantic Winegrape Grower’s Guide
- Labs: Your choice [Virginia Tech, A&L, Brookside] some provide more information than others, but….
- all will provide basic information on:
  - pH
  - Availability of macro- and micro-nutrients (lbs/acre or ppm)

PLANT TISSUE ANALYSIS

Tissue: leaf petioles from leaves opposite cluster

Timing: Bloom (unless problem diagnosing)

Number: 75-100

Labs: Multiple

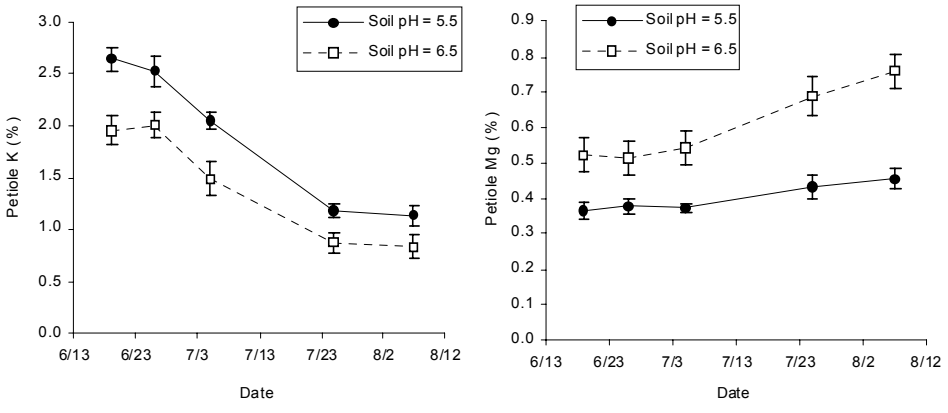
Interpretation: Diagnostic samples related to nutrient sufficiency ranges that have been generated from similar tissues.

TEMPRANILLO

Potassium deficiency symptoms

POTASSIUM

- Deficiency most apt to occur with high soil pH, under conditions of drought, and with young vines (small root system).
- Sufficiency range for bloom-sampled vines is 1.5 - 2.5%
- Concentration decreases with season - led to use of late-season (70-100 days post-bloom) sampling in NYS (Shaulis).



T. Bates, Cornell University

Correction of K deficiency

- **Pre-plant soil test: 150 to 200 lbs K/Acre (75 - 100 ppm) desired range (VT Rx)**
- **<u>Example</u> (conversion of ppm to lbs/acre of K_2O):**
  - **sample tests at 50 ppm K**
  - **Want 100 ppm**
  - **difference is 50 ppm X 2.4 = 121 lbs K_20/acre**
  - **or 202 lbs KCl (60% K_20)**
  - **or 242 lbs/acre of K_2SO_4 (50% K_20)**

Multiply ppm by 2 to obtain lbs/acre

CORRECTION OF K DEFICIENCY

- Tissue analysis test of mature vineyard:
  - Desired bloom-time values of 1.5 - 2.5%
- <u>Example</u>:
  - petiole sample shows 1.00 % K

Degree of deficiency	Pounds/acre required to correct KCl	Pounds/acre required to correct K_2SO_4
Severe	900*	1,200
Moderate	600	800
Mild	300	400

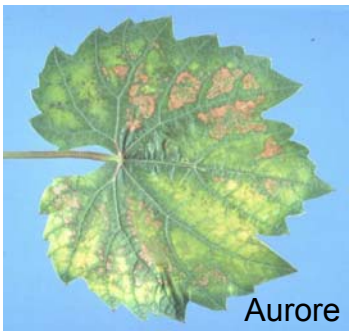
Applications in excess of 600 lb/A NOT recommended in one application due to potential for vine salt injury.

CORRECTION OF K DEFICIENCY

- Application:
  - Broadcast and incorporate in pre-plant
  - Band under trellis in established vineyard
  - Fertigation is an option

Chardonnay: 0.19% Mg in petioles, Piedmont Vineyards, 1986

EXAMPLES OF MAGNESIUM DEFICIENCY SYMPTOMS



- Symptoms typically on basal to mid-shoot leaves

- More common with low soil pH (< 5.5)

- Impact on fruit yield and quality not well quantified.

Correction of Mg deficiency

- Pre-plant soil test: 96 to 168 lbs Mg/acre (48 - 84 ppm) desired range (VT Rx)
- Example:
  - Soil test shows 50 lbs/acre Mg and pH of 6.1
  - Rx: adjust pH with dolomitic lime to raise pH to 6.8. This is likely to bring Mg within recommended range
  - If pH acceptable, adjust Mg with $MgSO_4$ (300 lbs/acre [50 lbs MgO/acre]

Correction of Mg deficiency

- Tissue analysis test of mature vineyard:
  - Desired bloom-time values of 0.30 - 0.50%
- Example:
- petiole sample shows 0.19 % Mg
  - Immediate foliar application of Epsom salts at 5 lbs/acre in sufficient water to ensure coverage
  - long-term correction by magnesium sulfate application to soil (banded).

Apparent magnesium deficiency of Chambourcin.

Symptoms may be due in part to low nitrogen

And, Chambourcin may have higher Mg requirement than those varieties for which standards were developed.

	Percent of dry weight					Parts per million				
Element	N	P	K	Mg	Ca	B	Zn	Mn	Fe	Cu
Sample	0.75	0.47	2.44	0.46	1.93	30	56	228	47	13
Low limit	1.2	0.15	1.5	0.30	1.00	30	35	25	40	7