



Mineral Nutrition for Muscadine Grapes

Dr. Mercy Olmstead, Extension Specialist
University of Florida

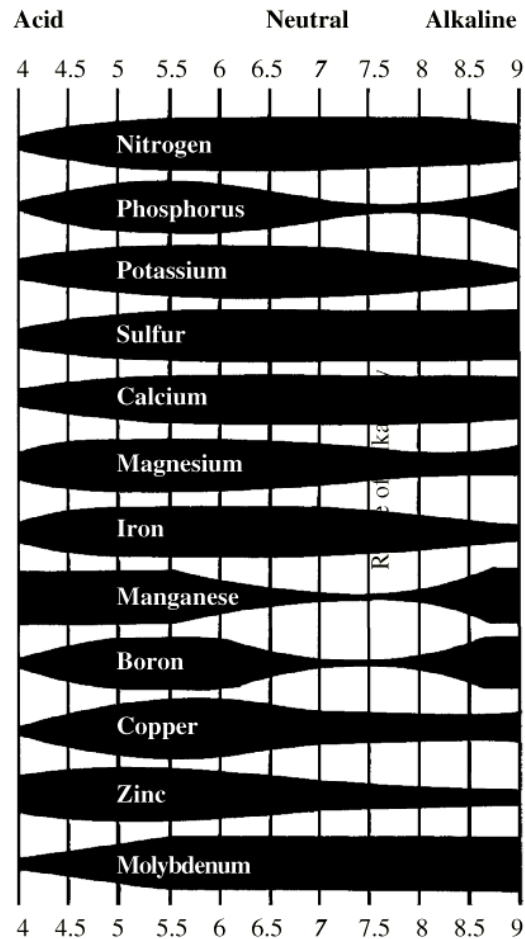
Importance of Nutrition



- Plants need essential elements to survive, produce high quality fruit
- Photosynthesis, cell wall growth, fruit set all depend upon optimum levels of nutrients
- Pre-plant analysis: What can the soil provide?
 - Amendments based on analysis since some elements are easier to fix before planting

Impact of pH on Nutrients

- Soil pH is important
- pH affects nutrient availability
 - Some nutrients more available in soil or solution
- Areas with significant rainfall have lower soil pH
 - Due to leaching of Ca^{2+} , Mg^{2+} , K^{+} and Na^{+}
 - Replaced with H^{+}



**The thicker the bar, the more available the nutrient

Impact of pH on Nutrients

Soil pH Adjustments

- Acidic soils must be adjusted before planting
- Rate of pH change:
 - Dolomitic lime (contains Mg) - Slow
 - Ground limestone - Slow
 - Pelletized limestone – Fast
- Use combination of materials to sustain effect

Irrigation Water pH

- Solutions for high pH water?
 - Acidify the water source
 - Monitor soil pH
 - Apply fertilizers with sulfur to bring pH down



Required Elements

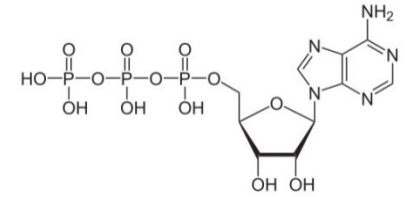
- **Macronutrients –**
 - Needed in large quantities
 - Reported in % on plant tissue analysis
- **Micronutrients**
 - Needed in much smaller quantities
 - Reported in parts per million (ppm)
 - Ppm = mg/L
 - Easy to go from deficiency to toxicity with improper application

Nitrogen

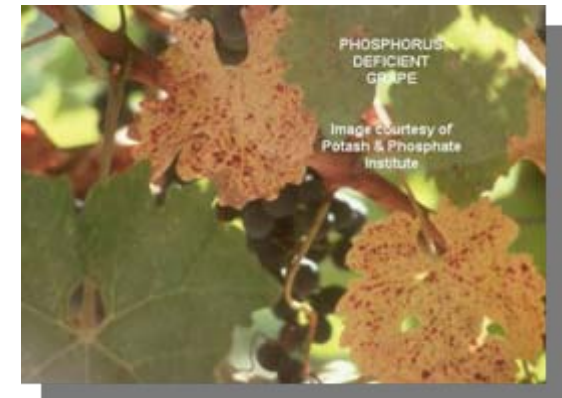
- Important in making amino acids & proteins, DNA and RNA, and chlorophyll
- Deficiency affects older leaves first
 - Yellowing, small leaves
- Excessive nitrogen promotes vigor and can leach into groundwater
 - Increased pressure by environmental groups
 - EPA Numeric Nutrient Criteria in Florida
 - Sets numeric limit on P and N in bodies of water



Phosphorus



- Important in cells that transfer energy
 - ATP and ADP – “molecular unit of currency”
 - Need to transfer electrons to make things happen
- Deficiency symptoms:
 - Dark green stems, smaller leaves
- Not often observed in muscadine production
- Doesn't move readily in the soil



Potassium

- Enzyme activation, translocation of sugars
- Deficiency symptoms:
 - Red in leaf margins
 - Corrected with potassium chloride
 - Timing of application
 - Early in season better than late
- Not common in muscadine production



Blackleaf Disorder

- Thought to be K deficiency
 - Growers responded by putting on excess K
- Research indicated it was due to UV-B damage and water stress
- Check vine nutrient status

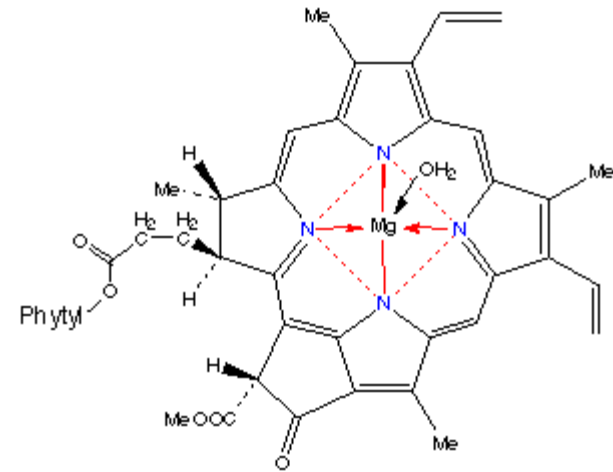


Calcium

- Important in cell wall and structure
- Deficiency symptoms:
 - Yellowing between veins and in margins
 - Cupping of leaves
- Calcium supplied in sufficient amounts when lime applied for pH adjustment

Magnesium

- Important in chlorophyll
- Most common deficiency in muscadines
- Deficiency symptoms:
 - Chlorosis, veins stay green
 - Older, basal leaves first, then young leaves
 - Since new growth is priority, Mg gets shuttled to terminal growth
- High Ca, K conditions can also cause Mg deficiency



Magnesium Deficiency

- Alleviating deficiency
 - Epsom salts (magnesium sulfate - $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$)
 - Sprayed onto vine through foliar spray
 - Also better than dolomitic lime when applied to soil
 - When soil pH >6.0, apply at 100 lbs/ac to correct deficiency
 - Dolomitic lime
 - Soil applied when trying to raise pH
 - **only correct *major* deficiencies – minor Mg deficiencies are normal for SE U. S.

Sulfur

- Important in two amino acids and other plant molecules
- No reported research on sulfur deficiencies in muscadines
 - Often applied in fungicide program
 - Complete fertilizer + micros



Micronutrients – Boron



- Important in fruit set
 - Pollen tube growth & fertilization
 - Results in “hens and chicks”
- Deficiency symptoms:
 - Dark brown areas near shoot tip, tendrils die back
 - Zig-zag shoot growth, “witches broom” growth
 - Young leaves show chlorosis
- Foliar micronutrient sprays alleviate symptoms

Boron

- To correct deficiency:
 - Borax (10%)
 - 5 lbs/acre every 2 years
 - Solubor (20%)
 - 1 lb/100 gallons annually
- Toxicity can occur quickly – be careful with B applications

Zinc

- Chlorosis on young leaves
- If soil pH is 5.0 – 7.0, deficiency not a problem
- Zinc levels & type of N
 - Ammonium nitrate
 - Ammonium sulfate



Iron

- Important in chlorophyll
- Deficiency symptoms:
 - Chlorosis in young leaves and shoot tip
 - Not easy to correct, but can use chelated iron
 - Expensive and doesn't provide immediate relief
 - Easy to cause leaf burn
- Not often observed in muscadine production

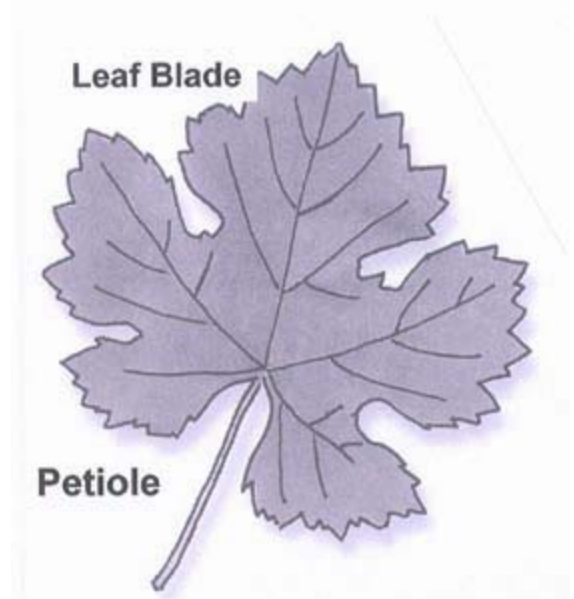


Copper, Manganese, Molybdenum

- Components of several enzymes, synthesis of chlorophyll and metabolism
- Deficiencies not often observed
- Foliar micronutrient spray contains adequate amounts

Sampling for Nutrition Analysis

- Annual tests should be conducted to monitor nutrition program
- Problem vines
 - Take samples from productive vines as well
- Where to sample?
 - Muscadines – leaf blade
 - Bunch grapes – whole leaf, incl. petiole

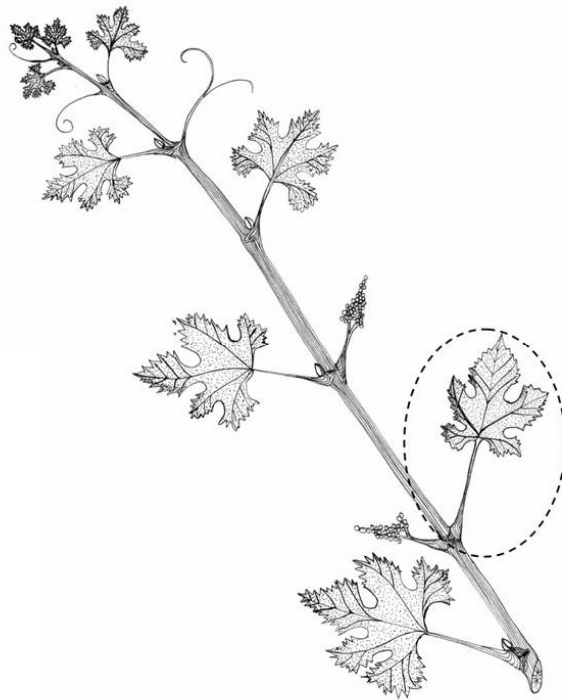


Sampling for Nutrition Analysis

- When to sample?
 - Bloom
 - Can be indicator to adjust for upcoming season
 - Fluctuates daily
 - Take leaf opposite fruit bunch, randomized throughout the plot
 - Veraison
 - More stable nutrition levels
 - Use to amend soils for next season
 - Take fifth leaf from shoot tip (count leaves that are fully expanded)

Leaf Position for Sampling

Bloom



Veraison



Nutrient Ranges for Muscadine

Element	Deficient	Sufficient	Excessive
N (%)	1.65	1.65-2.15	>2.15
P (%)	0.12	0.12-0.18	>0.18
K (%)	0.80	0.80-1.20	>1.20
Ca (%)	0.70	0.70-1.10	>1.10
Mg (%)	0.15	0.15-0.25	>0.25
B (ppm)	<15	15-25	>25
Cu (ppm)	<5	5-10	>10
Fe (ppm)	<60	60-120	>120
Mn (ppm)	<60	60-150	>150
Mo (ppm)	<0.14	0.15-0.35	>0.35
Zn (ppm)	<18	18-35	>35

Current Recommendations

- Year I - Establishment
 - Apply after growth begins (spring)
 - Transpiration will “pull” up water and nutrients
 - Use complete fertilizer
 - 10-10-10 or similar
 - 4-8 oz/vine (0.25-0.5 lb) around vine
 - Do not apply within 12 inches of vine trunk
 - 2nd application of 2-4 oz (~0.25 lb) in June – midsummer
 - Total: 13-23 lb N/acre
 - Vine density of 182 vines/acre

Current Recommendations

- Year 2
 - Increase amount of fertilizer
 - Apply after growth begins in spring
 - Complete fertilizer
 - 10-10-10 or similar
 - 8-16 oz (0.5 - 1lb) per vine
 - Additional N application (0.25 lb/vine) recommended in early June
 - Widen circle of band to accommodate larger root system
 - Total N applied: 34 lb N/acre
 - Total shoot growth = ~36 inches

Current Recommendations

- Year 3
 - Complete fertilizer applied in spring
 - 10-10-10 or similar
 - 2 lb/vine
 - Additional application of complete fertilizer in early summer
 - 0.25 – 1 lb/vine
 - Can band or broadcast throughout vineyard
 - Total: 40-50 lb N/acre
 - Total shoot growth = ~36 inches

Current Recommendations

- Year 4
 - Complete fertilizer applied in spring
 - 10-10-10 or similar
 - 2 lb/ vine (400 lb/acre)
 - Additional application of complete fertilizer in early summer
 - 1 lb/vine (200 lb/acre)
 - Can band or broadcast throughout vineyard
 - Total: 40-75 lb N/acre
 - Total shoot growth = ~36 inches

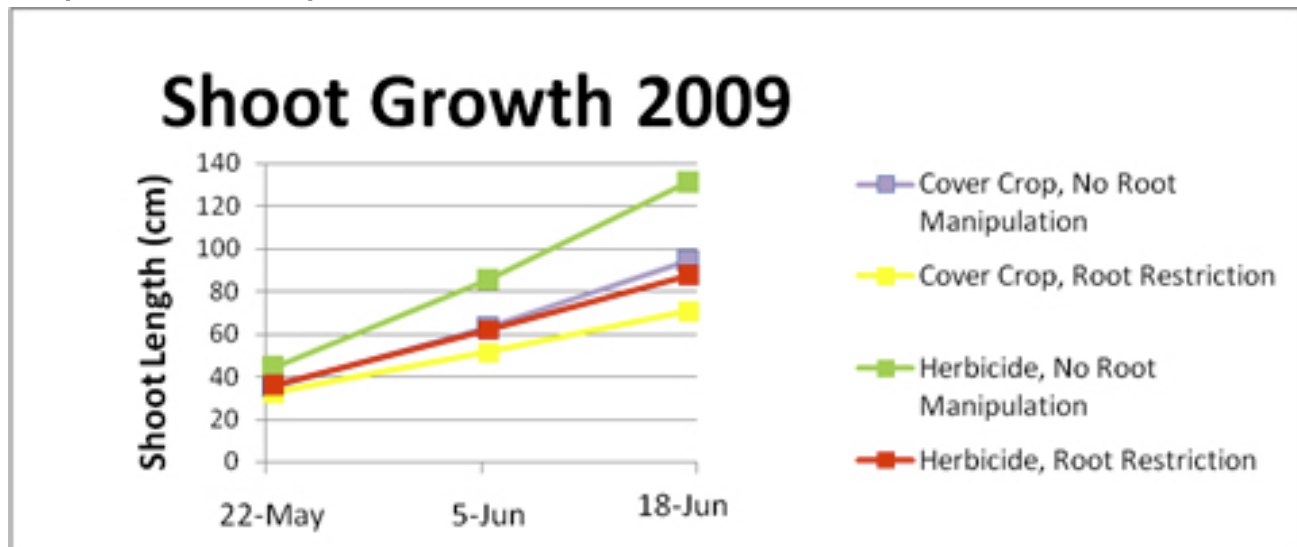
Improving Soil Health

- Cover crops can improve organic matter content
 - Legumes serve to add nitrogen to soil via mineralization
 - Symbiotic bacteria in nodules
 - Breakdown depends on temperature
 - Coordinate with vine growth needs
 - Grasses can tie up nitrogen



Cover Crops in Vineyards

- Can reduce vine vigor
 - Planted under vines
 - Research from Virginia Tech (T. Wolf)



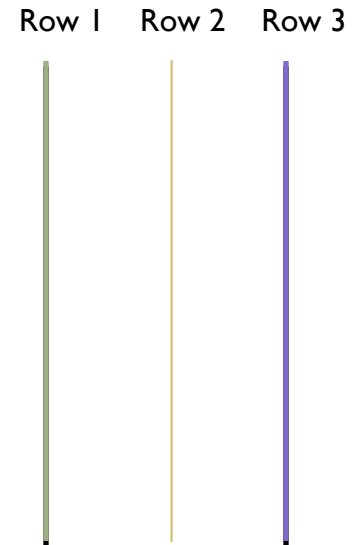
Evaporation



Trying New Techniques

- Research cover crop varieties
- Biopesticides, etc.

- Choose two rows of vines
 - Skip row between treatments
 - Apply treatment to row 1
 - Cover crop on either side of row
 - Apply control or standard to row 3
- Compare vine growth, yield, fruit quality, disease incidence



Summary

- Nutrients have specific roles in plant growth
 - An imbalance can have major or minor consequences
- Diagnostic tool in tissue analysis
 - Be aware of over applying nutrients and environmental consequences
- Need additional nutrition research
- Do research in your own vineyard!

