Grapevine Nutrition

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Grapevine Nutrition

- The best diagnostic tool is your eyes!

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Major and Minor Elements

Major		Minor	
Nitrogen	N	Molybdenum	Mo
Phosphorus	P	Boron	B
Potassium	K	Copper	Cu
Sulfur	S	Manganese	Mn
Calcium	Ca	Zinc	Zn
Iron	Fe	Chlorine	Cl
Magnesium	Mg	Cadmium	Cd

•following information on fertilizers from TFIO and OMAFRA publication Soil Fertility Handbook OMAFRA pub 611 – ISBN 0-7778-7730-9 1998

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General roles of major and minor nutrients

1. **Structural: Growth & development; e.g. N required for shoot and root growth.**
2. **Catalytic agents: Many micronutrients are important enzyme co-factors, e.g. Mn**
3. **Electrochemical reasons: Controlling charge & balance; e.g. K pumps control stomatal movement**

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Roles of various macro elements

	ROLE	DEFICIENCY	TOXICITY	OPTIMAL LEVEL
N	Shoot growth, root growth , overall vine growth Structural Enzymes Proteins	Chlorosis Weak growth Yield reduced	Waterberry EBSN	2.2-5%
P	Root growth, fruit set , plant energy Structural Nucleic acids ATP	Purple leaves Poor berry set	None noted	0.2-0.46%
K	Sugar transport to berries, water balance Electro potential gradients	Blackening of leaves Yield reduced	None noted	> 1.5%

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Roles of various secondary elements

	ROLE	DEFICIENCY	TOXICITY	OPTIMAL TISSUE LEVEL
Ca	Berry integrity Pectin Cell walls Organelles	Soft berries	Waterberry EBSN	1.2-3.2%
Mg	Photosynthesis Chlorophyll Co-factor Proteins	Chlorosis Necrosis	None noted	< 0.3%
S	S-metabolism Amino acids Proteins	Chlorosis	None noted	?

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Role of micronutrients

	ROLE	DEFICIENCY	TOXICITY	OPTIMAL TISSUE LEVEL
Fe	Photosynthesis Chlorophyll Ferredoxin	Chlorosis	None noted	50-200 ppm
Mn	Enzyme action Co-factor Chloroplasts	Chlorosis	None noted	25-200 ppm
Zn	Cell Division, fruit set Auxins Co-factor	Dwarfing Short internodes Zig-zag form	None noted	30-60 ppm

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Role of micronutrients

	ROLE	DEFICIENCY	TOXICITY	OPTIMAL TISSUE LEVEL
Cu	Photosynthesis	Dwarfing; rosetting Short internodes	Short internode Small leaves	10-300 ppm
B	Fruit Set (Pollen growth)	Stunting Poor fruit set Tendril necrosis	Leaf cupping, internode swelling	30-100 ppm
Mo	N-fixation	?	None noted	?

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Mobility and Form of Major Nutrients in Soil and Plants

Macronutrients

	Mobility in Soil	Plant Available Form	Mobility in Plant
Nitrogen	**Med – High**	**NH_4^+, NO_3^-**	**High**
Phosphorus	**Low**	**$HPO4^{-2}$, $H_2PO_4^-$**	**High**
Potassium	**Low – Med**	**Potassium ion K^+**	**High**

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Mobility and Form of Nutrients in Soil and Plants

Secondary Nutrients

	Mobility in Soil	Plant Available Form	Mobility in Plant
Calcium	Low	Ca^{+2}	Low
Magnesium	Low	Mg^{+2}	High
Sulphur	Medium	SO_4^{-2}	Low-med

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Mobility and Form of Nutrients in Soil and Plants

Micronutrients

	Mobility in Soil	Plant Available Form	Mobility in Plant
Boron	High	$B(OH)_3^0$, $H_2BO_3^-$	Low-med
Copper	Low	Cu^{+2}	Low
Iron	Low	Fe^{+2}, Fe^{+3}	Low
Manganese	Low	Mn^{+2}	Low
Molybdenum	Low-med	MoO_4^{-2}	Low-med
Zinc	Low	Zn^{+2}, $Zn(OH)_2^0$	Low
Chlorine	High	Cl^-	High

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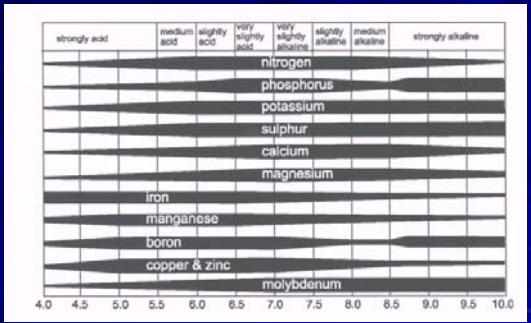

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What is a fertilizer?

- Technically any material added to the system that provides N,P or K or other mineral elements used by the plant

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What is a fertilizer?

- Must consider
  - Cost per unit
  - Stability for handling
  - Ease of application
  - Source/availability
  - Pollution/losses

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Nitrogen

- Organic Nitrogen →
- Ammonium (NH_4) →
- Nitrite (NO_2) →
- Nitrate (NO_3) (form used by the vine)

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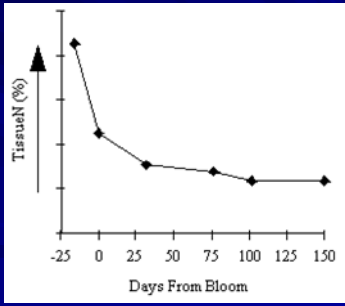
Nitrogen content Tissue



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Nitrogen Sources – Soil Applied

- Granular Urea 46-0-0
- Ammonium Nitrate 34-0-0
- Calcium Ammonium Nitrate 27-0-0
- Ammonium Sulphate 21-0-0
- Calcium Nitrate 15.5-0-0
- Potassium Nitrate 14-0-41
- Manures

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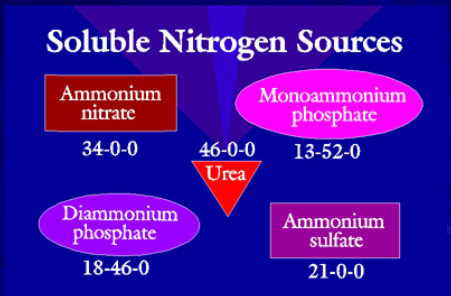
Nitrogen Sources – Soil Applied



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Nitrogen Sources

- Granular Urea 46-0-0
  - 98.5% pure chemical
  - Low cost
  - If applied during growing season must be incorporated to avoid N losses as NH_3

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Nitrogen Sources

- Ammonium Nitrate 34-0-0
  - More expensive per unit N than urea but stable
  - More hygroscopic than urea (Keep it dry!)
  - Dissolves in water to ammonium and nitrate ions (NH 4 and NO 3)

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Nitrogen Sources

- Calcium Ammonium Nitrate 27-0-0
  - 80% Ammonium Nitrate plus limestone
  - Lime partially balances the acidic release due to ammonium ion

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Nitrogen Sources

- Calcium Nitrate 15.5-0-0
  - Expensive source of N
  - Only where Ca and N definitely needed and soil acidification undesirable
  - 15.5% N and 19% water soluble Ca
  - Immediately available to plant

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Nitrogen Sources

- Potassium Nitrate 14-0-41
  - Expensive source of N
  - Not commonly used except for specific high value crops and needs

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Nitrogen Sources

- Manures – Solids per tonne
  - Hog - 1%, Dairy –1%, Beef – 0.6%, Poultry – 2.2%
- Liquids – per tonne
  - Hog – 3.7 %, Dairy – 2.9 %, Beef – 2.5%, Poultry – 7.5%

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Nitrogen Sources - Foliar

- Urea
- 1 to 2 pounds per 25 gallons of water
- Do not apply within 2 weeks of bloom period
- Do not apply after veraison

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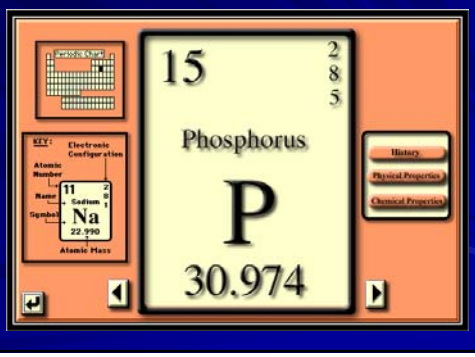
Phosphorus



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Phosphorus

- Stimulates root development
- Increases stalk and stem strength
- Flower formation and seed production
- Crop maturity uniformity
- May assist in plant disease resistance

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Phosphorus Sources – Soil

- Single Superphosphate 0-20-0
- Triple Superphosphate 0-46-0
- Mono – ammonium phosphate 11-52-0
- Di-ammonium phosphate 18-46-0
- Rock Phosphate
- Bone Meal
- Manures

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Phosphorus Sources

- Single Superphosphate 0-20-0
  - 20% available P, 12% Sulphur, 20 % Calcium
  - Expensive relative to other P sources
  - Do not blend with urea!

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Phosphorus Sources

- Triple Superphosphate 0-46-0
  - mostly mono calcium phosphate
  - Used in blends or direct application

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Phosphorus Sources

- Mono–ammonium phosphate (MAP) 11-52-0
  - Economical source of N and P
  - Safe to use
  - Less toxic than diammonium P in band use

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Phosphorus Sources

- Di-ammonium phosphate (DAP)18-46-0
  - Low cost per unit
  - N is 100% water soluble, P 90% water soluble
  - Concern over ammonia injury in alkaline soils

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Phosphorus Sources

- Rock Phosphate 0-15-0
  - Sedimentary
  - Wide range of solubility but generally low
  - Solubility low to nil in alkaline soils

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Phosphorus Sources

- Bone Meal 0-30-0
  - Very slow release
  - Used for organic production but source must be verified

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Phosphorus Sources

- Manures – Solids per tonne
  Dairy –.15%, Beef – .21%, Sheep -.54%
  Poultry – 1.24%, Horse – 0.24%
- Liquids – per tonne
  Hog – .18 %, Dairy – .12 %, Beef – .07%,
  Poultry – .24%

OMAF NMAN 2001 Software

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Phosphorus Sources - Foliar

Generally not recommended

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Potassium

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Potassium

- Potassium is one of the most frequent nutritional deficiencies of vines.
- A grapevine with inadequate potassium produces poor, unevenly ripened fruit and reduced yields.
- Severe deficiency results in defoliation.

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Potassium

- Leaves in the mid- to basal portions of shoots are affected.
- Clusters of deficient vines tend to be small with a few unevenly ripened berries.
- Shatter of berries occurs in extreme cases.

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Potassium Sources

- Muriate of Potash 0-0-60 and 0-0-62
  - Least expensive source of K
  - Red Muriate 0-0-60 – Fe impurities give red color
  - White Muriate 0-0-62 crystallization potassium chloride

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Potassium Sources

- Potassium Sulphate 0-0-50
  - Extract of brines from Utah
  - 50 to 52% potash and 17% S in soluble form
  - Used mainly on crops sensitive to Cl

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Potassium Sources

- Sulphate of Potash Magnesia 0-0-22
  - Mined from deposits in New Mexico
  - Sold as K-Mag and Sul-Po-Mag
  - Compact 21% K_2O, 10% Mg, 21% S
  - Crystalline 22% K_2O, 11%Mg, 22% S
  - Useful form of soluble Mg, high cost source of K
  - Used as source of K and Mg for high pH soils (will not raise pH)

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Potassium Sources

- **Manures – Solids per tonne**

Sheep – 0.75%, Dairy –0.48%, Beef – 0.61%, Poultry – 1.59%, Horse -.66%

- **Liquids – per tonne**

Hog – .26 %, Dairy – .35 %, Beef – .19%, Poultry – .32 %

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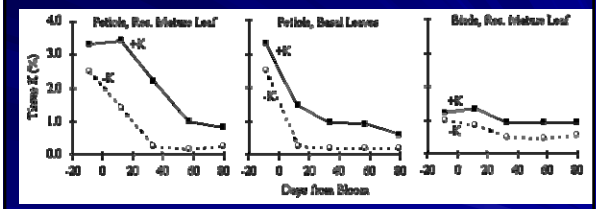
Potassium over time



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Soil and Tissue Sampling

- **Establish base levels of nutrients**
- **Diagnose problem areas**
- **Monitor nutrient levels**
- **Assist in establishing fertilizer and lime requirements**

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What a soil analyses provides

- General composition & texture of the soil
- Soil pH at time of sampling

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What a soil analyses provides

Limitations

- Nitrogen content fluctuation over season
- Does not address relationships between elements, e.g., antagonistic action of K and Mg
- Does not reflect what perennial crops such as vines actual take out of the soil

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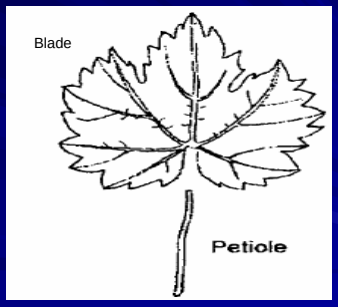
Tissue Sampling



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What a tissue analyses provides

- General concentration in tissue
- Results will be variable with tissue selected and time of season selected
- Nitrogen content will fluctuate over season
- Sample location either petiole of leaf opposite fruit cluster at bloom or mid way leaf petiole on current season growth just after veraison

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What a tissue analyses provides

- Plant stresses not taken into consideration – e.g. drought, excessive crop level, recent pruning, shading
- Sample size must be cultivar specific with about 100 to 150 petioles per sample needed for analyses

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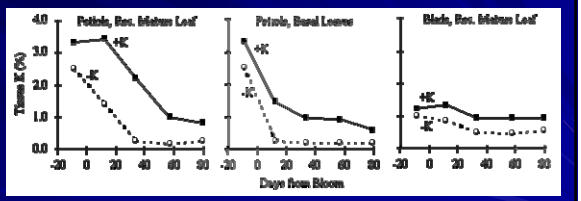
Seasonal Changes



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Foliar Nutrients

Nutrient	Timing	Material
Magnesium	Leaf emergence	Epsom salts
Zinc	3 weeks pre bloom	Neutral zinc, zinc oxide or chelates
Boron	Soil berm spray or foliar 3 weeks prior to bloom	Solubor (20%) max 5 Lbs per year
Manganese	When visual deficiency appears	(manganese sulfate)
Iron	Visual symptoms	Iron chelates

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Fertilization issues

- Bud Break to Prebloom
  - Nitrogen, Phosphorus, Zinc, Boron. Magnesium, Iron
- Bloom to Veraison
  - Magnesium, potassium, nitrogen, iron
- Veraison to Harvest
  - Potassium, phosphorus, calcium

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