Terry Richmond's Fertilizer Package – *mentioned in the panel discussion March 14, 2013.*

Roles of the 16 essential nutrients in plant development

Sixteen plant food nutrients are essential for proper crop development. Each is equally important to the plant, yet each is required in vastly different amounts. These differences have led to the grouping of these essential elements into three categories; primary (macro) nutrients, secondary nutrients, and micronutrients.

Primary (macro) nutrients

Primary (macro) nutrients are nitrogen, phosphorus, and potassium. They are the most frequently required in a crop fertilization program. Also, they are need in the greatest total quantity by plants as fertilizer.

Nitrogen

· Necessary for formation of amino acids, the building blocks of protein
· Essential for plant cell division, vital for plant growth
· Directly involved in photosynthesis
· Necessary component of vitamins
· Aids in production and use of carbohydrates
· Affects energy reactions in the plant

Phosphorus

· Involved in photosynthesis, respiration, energy storage and transfer, cell division, and enlargement
· Promotes early root formation and growth
· Improves quality of fruits, vegetables, and grains
· Vital to seed formation
· Helps plants survive harsh winter conditions
· Increases water-use efficiency
· Hastens maturity

Potassium

· Carbohydrate metabolism and the break down and translocation of starches
· Increases photosynthesis
· Increases water-use efficiency
· Essential to protein synthesis
· Important in fruit formation
· Activates enzymes and controls their reaction rates
· Improves quality of seeds and fruit
· Improves winter hardiness
· Increases disease resistance

Secondary nutrients

The secondary nutrients are calcium, magnesium, and sulphur. For most crops, these three are needed in lesser amounts that the primary nutrients. They are growing in importance in crop fertilization programs due to more stringent clean air standards and efforts to improve the environment.

Calcium

· Utilized for Continuous cell division and formation
· Involved in nitrogen metabolism
· Reduces plant respiration
· Aids translocation of photosynthesis from leaves to fruiting organs
· Increases fruit set
· Essential for nut development in peanuts
· Stimulates microbial activity

Magnesium

· Key element of chlorophyll production
· Improves utilization and mobility of phosphorus
· Activator and component of many plant enzymes
· Directly related to grass tetany
· Increases iron utilization in plants
· Influences earliness and uniformity of maturity

Sulphur

· Integral part of amino acids
· Helps develop enzymes and vitamins
· Promotes nodule formation on legumes
· Aids in seed production
· Necessary in chlorophyll formation (though it isn’t one of the constituents)

Micronutrients

The micronutrients are boron, chlorine, cooper, iron, manganese, molybdenum, and zinc. These plant food elements are used in very small amounts, but they are just as important to plant development and profitable crop production as the major nutrients. Especially, they work "behind the scene" as activators of many plant functions.

Boron

· Essential of germination of pollen grains and growth of pollen tubes
· Essential for seed and cell wall formation
· Promotes maturity

· Necessary for sugar translocation
· Affects nitrogen and carbohydrate

Chlorine

· Not much information about its functions
· Interferes with P uptake
· Enhances maturity of small grains on some soils

Copper

· Catalyzes several plant processes
· Major function in photosynthesis
· Major function in reproductive stages
· Indirect role in chlorophyll production
· Increases sugar content
· Intensifies color
· Improves flavor of fruits and vegetables

Iron

· Promotes formation of chlorophyll
· Acts as an oxygen carrier
· Reactions involving cell division and growth

Manganese

· Functions as a part of certain enzyme systems
· Aids in chlorophyll synthesis
· Increases the availability of P and CA

Molybdenum

· Required to form the enzyme "nitrate reductas" which reduces nitrates to ammonium in plant
· Aids in the formation of legume nodules
· Needed to convert inorganic phosphates to organic forms in the plant

Zinc

· Aids plant growth hormones and enzyme system
· Necessary for chlorophyll production
· Necessary for carbohydrate formation
· Necessary for starch formation
· Aids in seed formation

In addition to the 13 nutrients listed above, plants require carbon, hydrogen, and oxygen, which are extracted from air and water to make up the bulk of plant weight.

ESSENTIAL PLANT MINERAL NUTRIENTS				
NUTRIENT	**PRIMARY FORMS ABSORBED BY PLANT**		**PLANT FUNCTIONS**	**GENERAL DEFICIENCY SYMPTOMS**
Macronutrients				
primary	*cations*	*anions*		
Nitrogen (N)	NH_4^+	NO_3^-	Protein synthesis and structure, chlorophyll synthesis and structure, vitamin component	yellowing of leaves (chlorosis)-starting with older leaves
Phosphorus (P)		$H_2PO_4^-$	Photosynthesis, metabolic processes, plant growth, fruit and seed development, tranfer of hereditary traits	Slow growth, stunting, distorted leaf shape, purplish foliage color, chlorosis of older leaves
Potassium (K)	K^+		Photosynthesis, respiratory regulation, protein synthesis, control of ionic balance, disease resistance, fruit formation, winter hardiness, drought tolerance	"Burnt" leaf margins, slow growth, small, shriveled seeds and fruits, susceptibility to disease secondary
secondary	*cations*	*anions*		
Calcium (Ca)	Ca^{2+}		Plant strength, cell formation, enzyme activator, root and leaf development	Stunted root growth, death at growing points, foliage darker than normal, weak stems, premature blossom shedding
Magnesium (Mg)	Mg^{2+}		Photosynthesis-central to chlorophyll molecule, enzyme activator	Chlorosis between veins of older leaves, leaf curling along margins, yellowing of margins
Sulfur (S)		SO_4^{2-}	Enzyme and vitamin formation, protein structure, seed production, chlorophyll formation	Uniform yellowing starting in young leaves, thin and weak stems, retarded growth
Micronutrients				
	cations	*anions*		
Boron (B)		H_2BO_{3-}	Necessary for pollination, seed and cell wall formation, sugar transport, protein formation	Stunted plants, young tissue affected first
Chloride (Cl)		Cl^-	Metabolic reactions, enzyme activator, cation transport, disease resistance	Wilted leaves, bronze in color, dead spots (necrosis)
Copper (Cu)	Cu^{2+}		Chlorophyll formation, metabolic catalyst	Young leaves affected, darker than usual, mishaped leaves with necrotic spots
Iron (Fe)	Fe^{2+}		Carries oxygen, chlorophyll formation, enzyme activator	Leaves pale green with dark green veins, starts in young leaves
Manganese (Mn)	Mn^{2+}		Enzyme systems, activates various metabolic reactions, aids in chlorophyll synthesis	Chlorosis between veins of younger leaves, may have necrotic spots
Molybdenum (Mo)		MoO_4^{2-}	Converts nitrate to ammonium in plant, N-fixation in legumes, convert inorganic Phosphorus to organic forms	General yellowing and stunting
Zinc (Zn)	Zn^{2+}		Plant growth, metabolic reactions, chlorophyll and carbohydrate production	Buds have a white color, young leaves may develop yellow bands
Cobalt (Co)*	Co^+		Required by nodulating bacteria in Nitrogen-fixing plants	
*Not considered an essential element for higher plants, but is required by nitrogen fixing bacteria of legumes				
Deficiency symptoms are intended as general guides, not absolutes				

Green Valley 10-8-6 Fertilizer
Rhodo & Azalea Food

This product is a result of a joint effort between Green Valley and the Vancouver Rhododendron Society. This complete fertilizer contains slow release nitrogen and a full micronutrient package. Apply fertilizer around the area of the plant. Application should be performed twice per year, early spring and then following bloom.

Specifications:

10% Total Nitrogen (N)
50% of the Nitrogen derived from Polymer Coated Sulphur Coated Urea
8% Available Phosphoric Acid (P_2O_5)
6% Soluble Potash (K_2O)
8% Sulphur (S)
5% Magnesium (Mg)
1.8% Iron (Fe)
0.04% Zinc (Zn)
0.02% Boron (B)
0.04% Manganese (Mn)
0.02% Copper (Cu)

Ingredients include: Urea, Polymer Coated Sulphur Coated Urea, Mono-Ammonium phosphate, Muriate of Potash, K-Mag, Iron Oxysulphate, and fritted trace elements.

Application Rates: 50 to 150 gm per m2.

Bag size: 25kg

Manufactured by:

Green Valley Fertilizer Limited
33815 Enterprise Avenue
Abbotsford, BC V2S 7T9
Ph: 604-870-3378
Fax: 604-852-9655
www.jri.ca

Distributed by:

Taylor's Turf Care Products Ltd.
Tel: 604-552-3960
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www.taylorsturfcare.com

LANGBEINITE (0-0-18-11-22)
K-MAG
SUL-PO-MAG

RHODODENDRON FERTILIZERS

Chemical (inorganic fertilizers)

The fertilizer I prefer in this category is green valley 10-8-6 with fritted trace elements. To a 10 kg bag of 10-8-6 I add [redacted] kg prilled dolomite lime and [redacted] kg epsom salts.

Organic/Natural fertilizers

Organic materials that can be used to create an organic fertilizer contain between one and all three of the macro-nutrients (N-P-K) and many trace elements. The seed meals, soybean, cottonseed, canola, flaxseed, sunflower, neem, etc. generally have an N-P-K value of about 5-2-1 plus trace elements. Kelp meal is reported to contain every element presently known.

*It should be noted that most chemical fertilizers and even some organic materials high in nitrogen, such a fresh manure, blood meal and vampire bat guano, will burn the roots of dwarf and small rhododendrons. The same is true for caustic fresh wood ash.

Below is a list of some of the organic/natural materials and their most important (N-P-K) nutrient.

NITROGEN – (N)

Canola Meal	(5.5-2-1)
Cotton seed	(6-2-1)
Neem meal	(5-1-2)
Alfalfa powder	(2-.5-2)
Fish meal	(3-2-1)
Blood meal	(12-0-0)
Bat guano	(10-3-1)

SOY BEAN MEAL (7-2-1)

PHOSPHORUS – (P)

Bone meal	(2-12-0)
Shrimp meal	(0-3-0)
Rock phosphate	(0-3-0)

BLOOD + BONE (4-14-0)

POTASSIUM – (K)

Kelp meal	(1-.5-3)
Green sand	(0-0-3)
Langbeinite	(0-0-18)

SECONDARY ELEMENTS

CALCIUM – (CA)

Dolomite lime	20-30%
Agricultural lime	32%
Gypsum	22%
Wood ash	9%
Bone meal	22%
Fish meal	6%

MAGNESIUM – (MG)

Dolomite lime	10%
Epsom salts	10%
Langbeinite	11%

SULPHUR – (S)

Langbeinite	23%
Elemental sulphur	70-100%

FISH MEAL

My favourite organic materials are alfalfa, bone meal, kelp, rabbit manure and earth worm castings. Earth worm castings are 7 or neutral Ph and contain .86% nitrogen, .37% phosphoric acid, .25% potash, 2.3% calcium, .72% iron plus a multitude of trace elements. RABBIT MANURE CONTAINS (2.7N, 1.5P, 1K) PLUS TRACE ELEMENTS.

FRITTED TRACE ELEMENTS

The desired minor (trace) elements (i.e. boron, copper, iron, manganese, molybdenum, zinc, etc.) are mixed with silicates, fused by heating to 1000°C, quenched in cold water and then ground to a fine powder. The product produced is known as a fritted trace element mixture (FTE), and in this form has a much lower solubility than the original inorganic salts, thereby giving a release over a long period and at the same time providing a greater margin of safety against phytotoxicity. The FTE mixture can be produced in any desired ratio of elements.

CHELATED MINERALS

A chelated mineral is a mineral, such as copper, zinc, manganese, cobalt or iron etc, that is bonded to "small proteins," peptides or amino acids. It's well documented that nature has evolved its own exceptionally efficient process of absorption of free inorganic matter into living organic organisms, and the process is called natural chelation. Simply stated, chelation is the process whereby an organic free form amino acid picks up a molecule of a mineral, wraps it within its structure, actually enveloping it, making it easier for organic organisms to absorb it.

1 PART MAGNESIUM SULPHATE
9 PARTS BORDEN'S ORGANIC FERTILIZER
5 PARTS WORM CASTINGS, WELL ROTTED MANURE OR GOOD QUALITY COMPOST
5 PARTS SMALL BARK OR FISH WASTE
20 COMPOSTED IN BARK.

BORDEN'S ORGANIC FERTILIZER

SOYA MEAL (7-2-1)
CANOLA MEAL (5.5-2-1)
ALFALFA POWDER (2-.5-1)
BLOOD + BONE MEAL (4-14-0)
ROCK PHOSPHATE (0-3-0)
KELP MEAL (1-.5-3)
DOLOMITE LIME (CALCIUM + MAGNESIUM)