

Effects of Foliar Fertilizers on Wild Blueberry Physiology and Pest Pressure

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Effects of Foliar Fertilizers on Wild Blueberry

Granular Fertilizer

Foliar Fertilizers

Past Research

2019-2020 Foliar Fertilizer Trial



How many of you...

GROW WILD BLUEBERRIES?

FERTILIZE YOUR WILD BLUEBERRIES?

WOULD LIKE TO FERTILIZE .. BUT DON'T?

FERTILIZER

Any material of natural or synthetic origin that is applied to the soil OR plant tissues to supply one or more essential nutrients to the plant.

Essential Nutrients to the plant:

Basic nutrients in large quantities:

→ **Macronutrients** → N, P, and K

Essential nutrients in smaller quantities:

→ **Micronutrients** → B, Fe, Zn, Cu, Mn, etc.





Fertilizing Wild Blueberry

Traditional Method

Soil applied granular fertilizers:

MAP (monoammonium phosphate, 12-61-0)

DAP (diammonium phosphate, 18-46-0)

New Method – in Question

Foliar Fertilizer:

Foliage applied liquid fertilizers

Various products – to be discussed...

Plants require more than just nitrogen and phosphorous!

Granular Fertilizer



Soil Applied Granular Fertilizers

- Robust way to combat deficiencies in macronutrients.
- Single application/season.
- Pest resistance
- Established results



Soil Applied Granular Fertilizers

- Costly (depending on needs)
- Require water for transportation
- Pest incidence
- Potential for loss
 - Leaching
 - Soil interaction





Photo by: Lily Calderwood

Potential for Interaction

Interaction between soil chemistry & fertilizer can reduce fertilizer efficacy and alter the soil microbiome.

→ “ion antagonism” or “nutrient antagonism”

EXCESS ELEMENT	NUTRIENT(S) AFFECTED
Nitrogen	Potassium, Calcium
Potassium	Nitrogen, Calcium, Magnesium
Phosphorus	Zinc, Iron, Copper
Calcium	Boron, Magnesium, Phosphorus
Magnesium	Calcium, Potassium
Iron	Manganese
Manganese	Iron, Molybdenum, Magnesium
Copper	Molybdenum, Iron, Manganese, Zinc
Zinc	Iron, Manganese
Molybdenum	Copper, Iron
Sodium	Potassium, Calcium, Magnesium
Aluminum	Phosphorus
Ammonium Ion	Calcium, Copper
Sulfur	Molybdenum

Elements affect one another!

Chemical interactions can enhance or interfere with the uptake of other elements.

pH, water availability, soil texture and other environmental conditions also affect uptake.

Foliar Fertilizer



Foliar Fertilizers

The Claim:

- Simple, Fast, & “Readily Absorbed”.
- Reduced potential for soil problems or environmental contamination.
- Relatively low cost - less fertilizer required. Frequent but small applications.

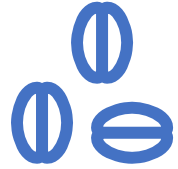
Growth Enhancers:

Macronutrients (N, P, K)

Micronutrients (minerals: iron, boron, copper etc.)

Plant Growth Regulators (PGR)





Plant Growth Regulator (PGR's)

Also referred to as plant hormones. Can be natural or synthetic.

“act as chemical messengers for intercellular communication within the plant”

Five families of PGR's:

1. Cytokinins – cell division (enhanced growth) and bud development.
2. Gibberellins – stem elongation and stimulates flowering.
3. Auxins – stem and root elongation and bud development.
4. Abscisic Acid – seed germination and water stress resistance.
5. Ethylene – aging or ripening hormone.

Two of our products contained PGR's: Cytokinins & Gibberellins

Macronutrients

Nitrogen – protein content, photosynthesis, amino acids

Phosphorus – root and seed development and photosynthesis, nucleic acids

Potassium – enzyme actions, ion transport, crop quality

Micronutrients

Boron – seed set, cell wall, stress resistance

Chlorine – stomatal regulation, nutrient transport, acclimation, the chemical breakdown of water

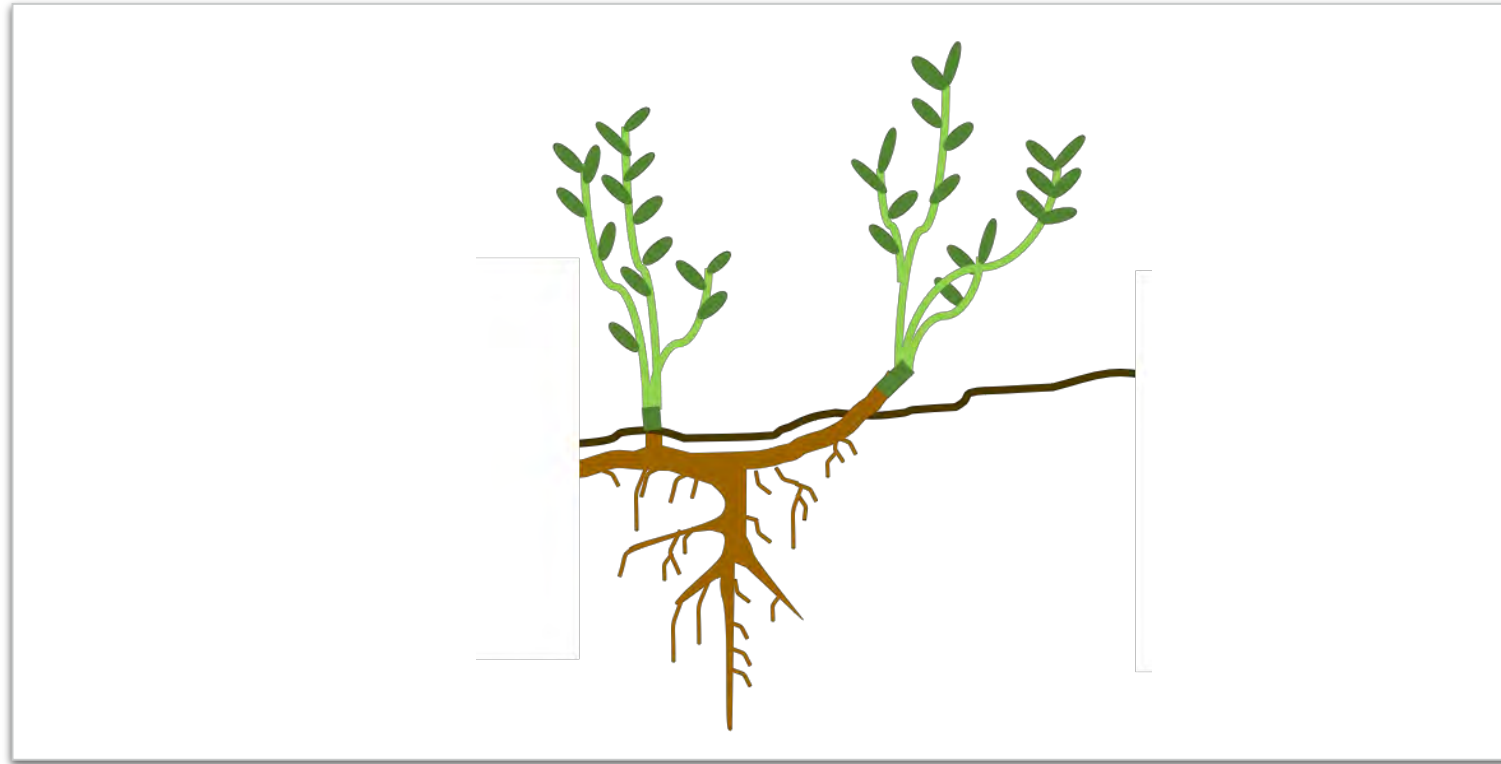
Manganese – photosynthesis (chlorophyll synthesis), enzyme activation

Iron – chlorophyll formulation and synthesis

Copper – chlorophyll formulation, *most immobile nutrient

Zinc – protein synthesis, growth regulation, hormone production *lacks mobility

EACH NUTRIENT PLAYS A KEY ROLE!

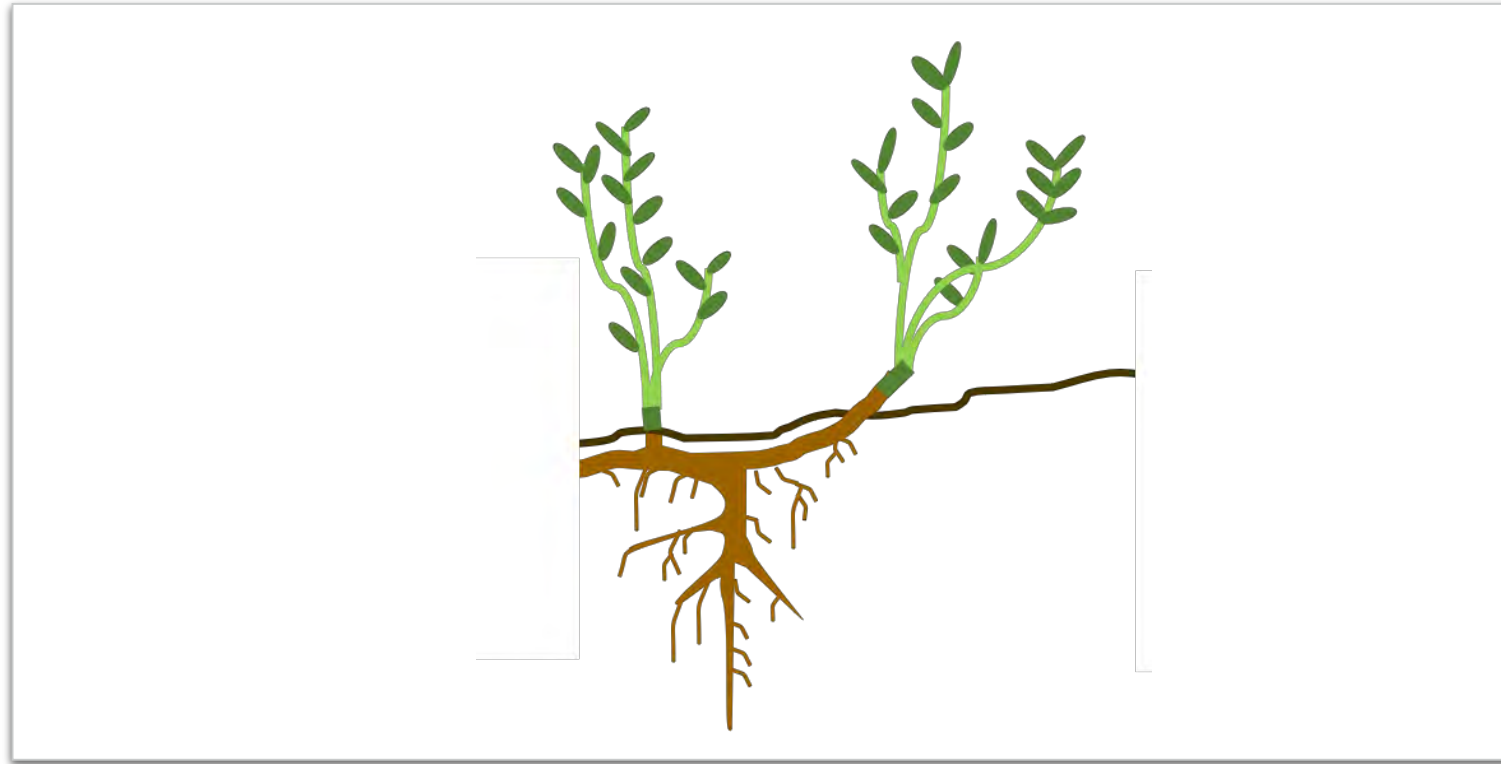


Fertilizing: Leaf Tissue vs. Roots

95% of the water and nutrients are transported to the leaf for utilization.

Nutrients need water to be transported

Dry conditions or drought = decreased nutrient transport



Fertilizing: Leaf Tissue vs. Roots

Foliar applications are NOT dependent on:

- Soil properties or soil water conditions

- Plant water transport system

Higher nutrient concentrations within the cells force greater uptake and use.



Photo by: Jennifer D'Appollonio

Leaf Tissue



Stomata – major location of nutrient and water uptake by the leaf tissue.

Physiologically, blueberry has a waxy leaf cuticle.

- Sprays can lose efficacy depending on the nutrients applied or environmental conditions.
- Some foliar products contain adjuvants aiding in absorption.

Past Research: Foliar Fertilizer



Other Research using Foliar Fertilizer

Multiple studies have found foliar fertilizer to effectively correct leaf nutrient deficiencies and improve yield in highbush blueberries (*Vaccinium corymbosum* L.)

→ Hart et al. 2006; Karlsons & Osvalde 2019; Wach & Błazewicz-Woźniak 2012

Karlsons & Osvalde 2019:

Applied between 0-4 applications of micronutrients (Fe, Zn, Cu, Mo, B) to Highbush blueberry & found repeated applications improved the:

- Provision of elements in the leaves.
- Photosynthetic performance
- Quality (in terms of fruit development)
- Yield

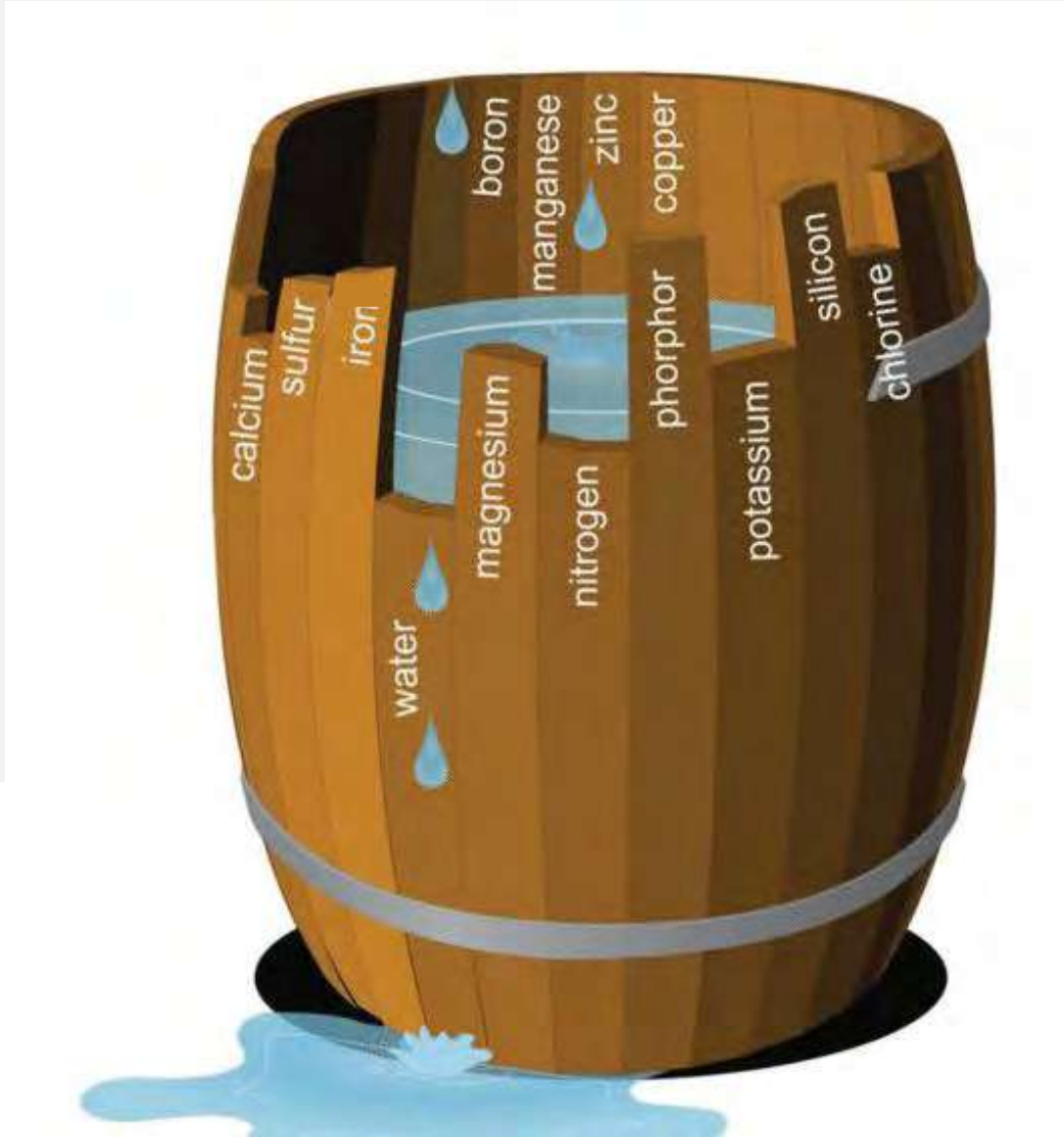
Other Research using Foliar Fertilizer

Smagula (1993) found Boron applied as a foliar spray increased leaf tissue content and the number of blossoms/stem, but did NOT increase fruit set in wild blueberry.

Eaton et al. (2007) found repeated applications of foliar Boron reduced winter injury.

Smagula (2008) found Iron (Fe) chelate and copper (Cu) foliar spray raised leaf concentrations, but did not increase yield or stem height.

It is clear that more research into the role of micronutrients in wild blueberry production is warranted.



Liebig's Law of Minimum



Indirect Effect of Fertilizer: Pest Pressure

Blueberries aren't the only living organisms in the field that benefit from added nutrients!

- Adding supplemental nutrients improves the pests natural ability to resist pests.
- While some pests (weeds, insects or disease) benefit from supplemental nutrients.

Increased Pest Pressure with Fertilizer

Weeds

Mummy berry (*Monilinia vaccinii* sp.) - (Drummond et al. 2012)

Valdensia leaf spot - (Hildebrand and Renderos, 2012)

Insects