

Tuning Up Nature with Trace Minerals



*BORON (B), COPPER (CU), IRON (FE),
MANGANESE (MN), MOLYBDENUM (MO),
AND ZINC (ZN)*

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2019 NOFAMASS WINTER CONFERENCE

SATURDAY JANUARY 12, 2019 - WORCESTER, MASS

THIS IS A DRAFT PPT PRESENTATION, SOME
SLIDES ARE NOT FINISHED. SEE ALSO 2 PAGE
HANDOUT FROM WORKSHOP ONLINE...

Approaching Agriculture - Our Philosophy



Brix Bounty Farm

Growing Food with Respect for the Earth & Future Generations

Minerals & Biological Activity - Keys to Healthy Crops

- 1) By addressing mineral deficiencies in our soils,
- 2) Increasing biological activities to ensure these minerals are available and biologically complexed,
- 3) And ensuring adequate moisture and air in our soils...

We can achieve healthy crops

**Yields and Farm Viability (\$) are
Connected with Soil Health and Fertility Investments**

Honoring Complexity

Humble



Energy Returned on Energy Invested (ERoEI)



Fixed Costs
&
Labor



June 23 2018

The Case for Considering Trace Minerals



“Just Right”: Enough, Deficiencies & Balance



Definitions



Anion

Cation

Pounds per Acre (lbs/acre)

Parts Per Million (PPM)

Trace Minerals

Minerals in the Soil



- An average acre furrow slice weighs 2,000,000 pounds (top ~6")... that's 2 million pounds
 - Targets for major cations may be:
 - ~3,000 lbs/acre Ca
 - ~200 lbs/acre K (200 lbs/acre = 100 PPM) minimum
 - ~200 lbs/acre Mg minimum
- For folks following mineral balancing protocol
 - 65-70% Ca, 10-12% Mg, 3-5% K

Trace mineral targets are much, much lower...

Trace Mineral Targets



Trace Mineral Targets – using Mehlich-3 extraction (Logan Labs)

Copper (Cu) - 2-6 PPM

Iron – at least 2x Manganese, usually sufficient in NE soils

Manganese (Mn) - 25-55-90 PPM

Zinc (Zn) - 4-12 PPM

○ Boron – 1-3 PPM

○ Molybdenum - .25 - .5 PPM

Considering these amounts in practical terms



Boron – Anion

B

Trace Mineral



- Function
- Availability
- Mobility
- Application Rates and Notes
- Economics
 - Boron is mobile...

Target Level

(Mehlich 3)

1-3 PPM

1/1000 Ca level (Aster)

Boron Considerations & Addressing Deficiencies



Boron – Practically Speaking



Molybdenum – Anion

Mo Trace Mineral



- Function
- Availability
- Mobility
- Application Rates and Notes
- Economics
 - Molydenum

Target Level
(Mehlich 3)
.2 - .5PPM

Molybdenum Consideration - Addressing Deficiencies



Mo & Copper

Sodium Molybdate

39% Mo

Say Target .5PPM Mo and test shows .05 PPM

“Need” .45 PPM or .9 pounds per acre Mo

This would require 2.3 # Sodium Moly... too much in one go and not economical!

Molybdenum Practically Speaking



In general higher pH = higher Mo availability

Foliar vs Field Application

A targeted approach vs. “broadcast”

Role in natural nitrogen cycles... legume cover crops

Copper – Cation

Cu Trace Mineral



- **Function**
 - Nitrogen Utilization
 - Lignin formation
- **Availability**
 - Copper may “lock-up” with OM reducing avail.
 - Molybdenum (Mo) reduces Cu availability within livestock
- **Mobility**
 - Copper is not very mobile in soils
- **Application Rates and Notes**
 - Copper Sulfate (25% Cu), **Max 10 lbs. Copper Sulfate per acre/per year**
 - **Chelated Copper**
- **Economics**
 - Once soil copper levels are raised, they often stay adequate for long periods.
 - at 5 - 10 lbs/acre of Copper Sulfate (\$2/lb.) = \$10 - \$20 per acre
 - Garden: 2 – 4 oz. Copper Sulfate per 1000 sq. ft. = \$.50 – \$1 per 1000 sq. ft.

Target Level

(Mehlich 3)

2-6 PPM

½ Zn level (Astera)

Copper Considerations



- Copper Mining
- Soil Test – Copper Levels & Organic Matter
- Fungicidal & Algaecidal Properties
- Sheep

Copper in the Soil & in Plants



- Add picture of Cu Deficiency

Copper Availability



- Organic Matter
- pH
- Molybdenum
- Zinc
- Mycorrhizal Fungi

Addressing Copper Deficiencies



Soil Applications:

- Copper Sulfate
- Chelated Copper

Foliar Sprays

- Copper Sulfate
- Chelated Copper – Biomin Copper (1-0-0,) w/citric acid

<http://jhbiotech.com/plant-products/biomin-copper/>

- Therm – X -

Copper – Practically Speaking



Critical Periods

OMRI Approved Copper Fungicides

Considering Copper in Relation to Nitrogen

picture

Iron - Cation

Fe Trace Mineral



- **Function**

- Assist in the function of enzymes in chlorophyll prod.

- **Availability**

- Decreases as soil pH goes up...
- “Overly”-Aerated soils reduce availability
- Can rapidly become unavailable, tied up
- Soil applied Fe often mixed with Sulfur...

- **Mobility**

- **Application Rates and Notes**

- Greensand
- Iron Sulfate
- Foliar applications

- **Economics**

Target Level
(mehlich III)
150 PPM

Iron Considerations



Iron in the Soil & in Plants



Iron Availability



Addressing Iron Deficiencies



Iron – Practically Speaking



Manganese – Cation

Mn Trace Mineral



- **Function**

- Catalyst in photosynthetic process
- Role in Fat Forming Enzymes
- Important Reproductive Energy

- **Availability**

- Decreases as soil pH goes up...
- “Overly”-Aerated soils reduce availability
- Use of acid-creating fertilizer increases availability

- **Mobility**

- **Application Rates and Notes**

- Manganese Sulfate - **Max 20 lbs. Manganese Sulfate per acre/per year**
- Foliar Applications – often recommended for financial reason and availability

- **Economics**

- Manganese Sulfate \$1-1.50 per pound

Target Level

(mehlich III)

25-50-90 PPM

Manganese Considerations



- “Fruiting” Energy
- Mn and Fe
- At a higher pH less Mn is available... (i.e. soils with high applications of lime).
- Manganese Sulfate (32% Mn) = \$60/ 50 lb.
- Field and Foliar - if 20 lbs per acre = \$24 per acre
- Resulting in... “improved fruit production, better seed quality AND...

Manganese in the Soil & in Plants



- Need to drop 1 manganese slide or incorporate pics

Manganese Availability



- pH
- Aerated Soils
- Waterlogged Soils

Addressing Manganese Deficiencies



- Soil Applications
 - Manganese Sulfate
 - Chelated Manganese
- Foliar Sprays
 - Manganese Sulfate
 - Chelated Manganese

Manganese – Practically Speaking



- Fruiting Energy!
- Manganese – Extension “Advice”
- Manganese – Foliar Sprays
- Picture

Capturing Energy, Mobilizing Nutrients Through Fruit



Sun Cherry, August 2012



Yellow Mini, August 2012



Zinc – Cation

Zn Trace Mineral



- **Function**
 - Zinc >
- **Availability**
 - Decreases as soil pH goes up
 - Timing is critical
- **Mobility**
 - Not very mobile in soils
 - Not very mobile in plants
- **Application Rates and Notes**
 - Zinc Sulfate - Max 25 lbs. Zinc Sulfate per acre/per year, rec start 5-10#/acre
 - Foliar – Zinc Sulfate
- **Economics**
 - 5 lbs. Zinc Sulfate = \$5, 10 lbs. Zinc Sulfate = \$10, 20 lbs. = \$20
 - Garden: 2-8 oz. per 1000 sq. ft. = \$.20 – \$2.00

Target Level

(Mehlich 3)

4-8-12 PPM

1/10 Soil P (Aster)

Zinc Considerations



- Zinc from ...
- Soil Test – Zinc Levels and
- Compost and Zinc Levels
- Zinc – Needed Early in Growth Cycle

Zinc in the Soil & in the Plant



Zinc Availability



- Zinc in soils & cool season soils
- Umaine

Addressing Zinc Deficiencies



- Soil Applications
 - Zinc Sulfate
 - Compost
- Foliar Sprays

Zinc – Practically Speaking



- Zinc & Moisture Management -
- Zinc in a “Starter Fertilizer”
- Zinc needs in cool & wet springs
- Zinc levels in seed may impact Zn needs in crop...
- pH & nutrient tie-ups
- Zinc

Takeaways ...



Foliar Application Rates - Reference



Sourcing Materials & Prices



Thank You



Handouts & Presentation
Available at www.brixbounty.com

For more information on this
presentation contact:

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Cobalt, Nickel, &

