High Bionutrient Crop Production 2011-12

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Day 1
Addressing Limiting Factors

• General principle and objective
• Life will do the best with what she has
• Identify limiting factors and endeavor to address them.
• Minerals, biology, carbon, water, air.
**Life is the Objective**

- Supporting and empowering soil life is the key to healthy plants.
- Things that you do or let be done that harm soil life harm your plants.
Quality Objective

• Nutrient Level
• Flavor
• Shelf Life
Correlations of Health

- Soil Health
- Plant Health
- Human Health
- Cultural / Environmental Health
Topics for Today

• Soil Testing / Mineral Balancing
• Biological Inoculation
• Potting Soil
• Tillage
• Fertigation / Irrigation
• Foliar Spraying
Target levels of macro minerals

- Base Plus or “Agri-Dyn II” Test
- A Strong Acid test
- Sulfer - 75 ppm
- Phosphorus - 75 ppm
- Calcium - 60-75%
- Magnesium - 12-18%
- Potassium - 3-5%
Target levels of trace elements

- Boron - 3 ppm
- Manganese 80-90 ppm
- Copper - 4 ppm
- Zinc - 8 ppm
- Cobalt - 2 ppm
- Molybdenum - 1 ppm
- Selenium - .5 ppm
Conversions

• 500lbs per acre = 11.5 lbs per 1000sq ft
• 100lbs per acre = 2.3 lbs per 1000sq ft
• 20lbs per acre = 0.46 lbs per 1000sq ft
• 5lbs per acre = 2 ounces per 1000sq ft
Math for Minerals

- PPM - Parts per Million -
- PPA - Pounds per Acre
- 2,000,000 pounds of soil in the top six inches of an acre
- PPA = PPM X 2
- Necessary level of Phosphorus and Sulfur 75 PPM = 150 PPA
Sulfur for Example

- Need 75 PPM or 150 PPA
- Report level 25ppm = 50 ppa
- Needed level = 100 ppa
- Gypsum is CaSO4 + 2H2O
- Atomic weight Ca = 40, S = 32, O = 16, H = 1
- $40 + 32 + (6 \times 16) + 4 = 172$
- $100/172 = 0.59$, $40 \times 0.59 = 23.5$, $32 \times 0.59 = 19$
- 100lbs gypsum = 23.5lbs Ca, 19lbs S
Max yearly application Sulfur

• Sulfur - with Calcium needed, 500 pounds per acre (ppa) gypsum
• Sulfur - with Magnesium and Potassium needed 300-500 ppa Sul-Po-Mag or K-mag
• Sulfur - with Potassium needed 200-300 ppa potassium sulfate.
• Sulfur - with Magnesium needed 200 ppa magnesium sulfate (epsom salt)
• Sulfate forms of the trace elements
Max yearly application
Phosphorus

- Phosphorus - with calcium needed, 500-2000 ppa colloidal soft rock phosphate, Tennessee brown rock phosphate, Black hard rock phosphate
- Phosphorus - with potassium needed, animal manure, or animal manure based compost.
Max yearly application Calcium

- Calcium - 500-2000 lbs Calcium Carbonate (Calcite or Hi-cal Lime) Also Aragonite, Coral Calcium, Egg Shells,
- Calcium - with Magnesium needed 500-2000 ppa Calcium Magnesium Carbonate, (Dolomite, or Dolomitic Lime)
- Calcium - with Sulfur needed, 500 ppa gypsum
- Calcium - with Phosphorus needed, 500-2000 ppa Soft Rock Phosphate.
- Calcium - Phosphorus and Traces and Paramagnetic needed 500-2000 ppa Carbonatite
Max yearly application
Magnesium

• Magnesium - with Calcium needed 500-2000 ppa Dolomite
• Magnesium with Sulfur and Potassium needed 300-500 ppa Sul-Po-Mag or K-mag
• Magnesium - with Sulfur needed, 200 ppa magnesium sulfate (epsom salts)
Max yearly application
Potassium

- Potassium - Spread well, clean wood ash
- Potassium - with Magnesium and Sulfur needed, 300-500 ppa Sul-Po-Mag or K-mag
- Potassium - with Sulfur needed, 200-300 ppa potassium sulfate
- Potassium - with Phosphorus needed, animal manure or animal manure based compost
Max yearly applications -
Traces

Boron - 30ppa per year borax.
    15 ppa per year solubor

• Manganese - 5-20ppa manganese sulfate
• Copper - 5 ppa Copper Sulfate. If very low (below 2ppm) up to 10 ppa
• Zinc - 5-10 ppa Zinc Sulfate.
• Sodium Molybdate .5 lb actual molybdenum per acre/per year
• Sodium Selenate .25 lb actual selenium per acre/per year
• Cobalt Sulfate - 4 ppa per year
Percents in Macro Minerals

- Greensand 7-9% K - 52% Silica
- K-Mag (Sul-po-mag) 22%K - 22%S - 11%Mg
- Rock Phosphate 22% P - 20% Ca
- Hi-cal Lime 38-40% Ca
- Dolomitic Lime 30% Ca - 10% Mg
Percents in Trace products

- Solubor = 20% BORON
- Borax = 11% boron
- Cobalt Sulfate = 27% Cobalt
- Copper Sulfate = 37% Copper
- Manganese Sulfate = 32% Manganese
- Zinc Sulfate = 35% Zinc
- Molybdenum need up to 1/2lb per year, check percentages
- Selenium need up to 1/4lb per year, check percentages.
Bionutrient Food Association

• Evolute of Real Food Campaign, RTE
• Membership based, multiple constituencies
• “Increasing Quality in the Food Supply”
• Education - Courses
• Outreach - Handbook, Website, Articles
• Research - Bionutrient Meter, 3 yr plan
Inoculants

• Collostrum
• Critical symbiotes for plants. Foundational life in the food chain
• Bacterial and Fungal species
• Ideally present at germination
Seed

- Seed size
- Seed history
- Seedling vigor - culling
- Yield potential - spacing
Potting soil

• Besides Compost, peat, vermiculite and perlite, Consider, Kelp, Alfalfa, Zeolite, Humate, Montmorillonite, Lime, Rock Phosphate, Gypsum, Trace Elements, and critical role of biological inoculants and enzyme stimulants.
Tillage

• Effect of tillage on soil life
• Strategy for minimal tillage
• Permanent raised beds - green or brown mulch
Complexing Compounds

• Simple sugars
• Complete carbohydrates
• Complete proteins
• Lipids / essential oils
• Phytonutrients, phytoalexins, antioxidants, plant secondary metabolites
Evolution of pest and disease resistance

- Complete carbs - soil borne pathogens Fusarium, verticilium, alternaria
- Complete proteins - larval forms of insects aphids, cabbage looper, tomato hornworm, corn earworm, colorado potato beetle larvae
- Complete lipids - air borne pathogens mildews and blights
- Complete Phytoalexins - Cucumber beetle, potato beetle, flea beetle, japanese beetle
Fertigation / Irrigation

- Drip tape, sprinkler, hose
- Maintain water at good level in soil at all times. Critical.
- “Good Level” able to pick up soil, clench it into ball and have it stay as a ball.
- Plan to have this system in place
- Fertigation capacity to feed in season
Foliar Spray

• Plant feeding through the leaf surface.
• Backpack sprayer, squirt bottle, etc.
• Best response when an immediate turn around is desired.
• Very powerful if all other pieces are working.
• Plan to be able to do this now.
Homework

- Build permanent beds
- Mulch, apply minerals and cover crops
- Procure inoculants
- Good seed
- Potting soil
- Fertigation and Foliar infrastructure
- Read, read, read