

Soil Fertility Recommendation Worksheet (January 2018 version 2.6) by Derek Christianson, Brix Bounty Farm

This worksheet is intended for assisting with development of fertility recommendations from a Logan Labs Soil Test (AEA Base+). A history of field amendments applied (past 3 years) is often used when developing recommendations. Saturated Paste Test Analysis, Water Analysis, & Tissue Analysis are additional tools to create a comprehensive fertility plan.

The AEA Base+ test focuses on chemistry (and to a degree the physical conditions in a soil). The Logan Labs test is a Mehlich-3 extraction (about as strong as “vinegar”). On calcareous or recently limed soil the Mehlich-3 test may dissolve free lime, therefore it will overestimate TEC. A Modified Morgan (UMass) test may provide a better sense of P availability in the Northeast. The Saturated Paste test will provide additional insight into the chemical, physical, and biological conditions of your soil. We generally recommend biological inoculants and compost for soils which are in a “build-up” phase which will assist with nutrient availability.

Key Resources

The Art of Balancing Soil Nutrients by Bill McKibben - <http://www.acresusa.com/books/closeup.asp?prodid=2108&catid=6&pcid=2>

Bionutrient Food Association Website - <http://bionutrient.org/>

Brix Bounty Farm Website – www.brixbounty.com

Hands-On Agronomy by Neil Kinsey - <http://www.kinseyag.com/Publ.htm>

Pike Agri-Lab - <http://www.pikeagri.com/>

The Intelligent Gardener: Growing Nutrient Dense Food by Steve Solomon w/Erica Reinheimer

<http://www.newsociety.com/Books/I/The-Intelligent-Gardener> and their **OrganiCalc Worksheet** <http://growabundant.com/organicalc/>

Advancing Eco Ag (John Kemof) Website - <https://www.advancingecoag.com>

The Ideal Soil: A Handbook for the New Agriculture, v 2.0 by Michael Astera - <http://www.soilminerals.com/>

Nourishment Home Grown by A.F. Beddoe (Carey Reams) – http://www.advancedideals.org/016_book_ordering.html#rbtifarm

Logan Labs Newsletter - <http://www.loganlabs.com/> Spectrum Analytic Library - <http://www.spectrumanalytic.com/doc/library/Start>

Notes – *Gardeners - pounds per acre is roughly equivalent to grams per 100 square feet*

Converting from PPM to Lbs/Acre and Vice Versa: The average acre of soil (~top 6”, an acre furrowslice) weighs 2,000,000 pounds. To convert from parts per million to pounds per acre multiply by 2. To convert from pounds per acre to parts per million divide by 2.

Foliar Applications of Trace Minerals: Foliar applications of Copper, Manganese, Zinc (etc.) are often the least expensive method for improving crop tissue levels, but don’t directly address underlying deficiencies. We recommend using foliar applications for specific nutrients as your budget allows you to build up your soil levels of these nutrients.

Humic Substances: Humic Substances are often used to buffer mineral excesses and help to chelate nutrients; making mineral applications less volatile and improving crop availability. Their use is valuable when applying highly leachable minerals like Boron.

Maximum Yearly Applications: The maximum yearly applications for amendments listed below are based on a biological approach focusing on balancing soil minerals slowly, so as not to disrupt soil biology and cause nutrient tie-ups.

Nitrogen: The Soil Fertility Recommendation Worksheet does not include test results for Nitrogen. Fertility Recommendations for Nitrogen inputs are farm and crop specific and are calculated by considering “organic matter” credits, compost or manure use, field history, cover crop cycles, biological activity, and expected yields.

Sampling Depth: Fields are usually sampled at 6” depth if tillage is used; or 4” if the field is in hay or pasture.

Target Levels and Timing of Applications: Target levels below are generalizations for “high value” vegetable crops. We suggest fall applications of amendments intended to address significant nutrient imbalances (especially limestone), while reserving pre-plant applications for “available forms of nutrients” and specialized fertilizers.

Trace Minerals (including those not tested): A broad spectrum trace mineral amendment is often used to supply trace minerals not tested (i.e. chromium, nickel, vanadium, etc.).

Soil Fertility Recommendation - Worksheet

Recommendation Completed By: _____ Recommendation Date: _____
Farm Name: _____ Sample Date: _____
Sample Location: _____ Sample ID: _____
Sample Depth in Inches: _____ Previous Crop Performance: _____
Total Exchange Capacity (M.E.): _____ Planned Crops _____
p.H. of Soil Sample _____ Organic Matter, Percent _____

Nitrogen **Recommendation:**

“Major” Anions

Sulfur: Target – 25-50-75 ppm _____ ppm _____ lbs/acre

Recommendation:

Phosphorous (Mehlich-3): Target – 75-150 ppm _____ ppm _____ lbs/acre

Recommendation (note high Mehlich-3 P doesn't guarantee availability):

Exchangeable Cations

Ideal Amounts for Ca, Mg, & K are determined by your Total Exchange Capacity (TEC)

Calcium (ppm): Desired Value _____ ppm _____ lbs/acre
Value Found _____ ppm _____ lbs/acre
Deficit _____ ppm _____ lbs/acre

Recommendation:

Magnesium (ppm): Desired Value _____ ppm _____ lbs/acre
Value Found _____ ppm _____ lbs/acre
Deficit _____ ppm _____ lbs/acre

Recommendation:

Potassium (ppm): Desired Value _____ ppm _____ lbs/acre
Value Found _____ ppm _____ lbs/acre
Deficit _____ ppm _____ lbs/acre

Recommendation:

Sodium (ppm): _____ ppm _____ lbs/acre

Base Saturation

Calcium (60 to 70%)	_____ %
Magnesium (10 to 20%)	_____ %
Potassium (2 to 5%)	_____ %
Sodium (.5 to 3%)	_____ %
Other Bases (Variable)	_____ %
Exchangeable Hydrogen (10 to 15%)	_____ %

Trace Elements

Boron (ppm): Target: 1-3 ppm _____ ppm _____ lbs/acre *Note: Astera 1/1000th Ca*

Recommendation (careful with B sensitive crops and cool springs):

Note: Max. Yearly (split applications) – 3lbs/acre actual B - 15 lbs/acre Solubor (22% B) or 30 lbs/acre Borax (~10% B)

Iron (ppm): Target 150 ppm (~2x Mn) _____ ppm _____ lbs/acre

Note:

Manganese (ppm): Target: 25-50-90 ppm _____ ppm _____ lbs/acre *Note: DK Target ½ Fe*

Recommendation:

Note: Max Yearly – 20 lbs/acre Manganese Sulfate (32%)

Copper (ppm): Target: 2-8 ppm _____ ppm _____ lbs/acre

Recommendation:

Note: Max Yearly – 5-10 lbs/acre Copper Sulfate (25% Cu)

Zinc (ppm): Target: 4-12 ppm _____ ppm _____ lbs/acre *Note: Astera - 1/10th P*

Recommendation:

Note: Max Yearly Application – 10-20 lbs/acre Zinc Sulfate (36% Zn)

Aluminum (ppm): _____ ppm

Other Traces and EC: _____ **Recommendations:**

Cobalt (1- 2 ppm): _____ ppm _____ lbs/acre

Molybdenum (.5 - 1 ppm): _____ ppm _____ lbs/acre

Selenium (.25 - .5 ppm): _____ ppm _____ lbs/acre

Silicon (50 ppm): _____ ppm _____ lbs/acre

Recommendations:

Addressing Deficiencies with Common Mineral Amendments:

Minerals listed below with “common” analysis, confirm mineral analysis from your supplier.

These are just a few of the commonly applied mineral amendments; other sources are available

Nitrogen

Sulfur	Elemental Sulfur (90% S)	Sulfate Forms of other nutrients	Sul-Po-Mag (~20% Sulfur)
Phosphorous	Bone Char or Bone Meal	Rock Phosphates	Soft Rock Phosphate (9% P~3%avail Phos.)
Calcium	Gypsum (23% Ca, 17% S)	High Calcium Lime (25-40% Ca)	Rock Phosphates (~20% Ca) Carbonatite
Magnesium	Dolomitic Limestone (~11%Mg+20% Ca)	Magnesium Sulfate – Epsom Salts (10% Mg)	Sul-Po-Mag (~11% Mg)
Potassium	Greensand (~7% Potash)	Potassium Sulfate (50% Potash)	Sul-Po-Mag (~22 % Potash) High K Seaweed
Sodium	Sea Salt (35% Na)	Sodium Nitrate	Bone Char
Boron	Borax (~10% B)	Calcium Borate (10%B)	Solubor (21% B)
Copper	Copper Sulfate (25% Cu, 12%S)	Biomim Copper (4% Cu) – see note - http://growabundant.com/copper/	
Iron	Greensand (~9% Fe)	Iron Sulfate (30% Fe, 18% S)	
Manganese	Manganese Sulfate (32% Mn, 19% S)		
Zinc	Zinc Sulfate (36% Zn, 17%S)		

Micro Traces	Cobalt Sulfate (21% Co)	Sodium Molybdate (39% Mo)	Sodium Selenate or Selenite (21-30% Se)
Silicon	Diatomaceous Earth	Equisetum (Horsetail)	Soft Rock Phosphate Wollastonite
Animal/Plant – Carbon / Nitrogen/etc	Compost	Fish	Crab/Lobster Meal Kelp Manure
Broad Spectrum	Azomite (Aluminum...hmm...)	Carbonatite	Planters II Bio Link Micro
Sea Minerals	Sea Water	Sea-90	SeaCrop
Sugars	Dextrose	Kelp – “natural sugars”	Molasses Milk

Biological Inoculants

Amendment Sources (a few of the folks who source mineral amendments, bio-inoculants, & fertilizers)

- Conklin Limestone (RI) - http://www.conklinlimestone.com/About_Us/about_us.html - local source of hi-cal lime
- Crop Services International (MI) - <http://www.cropservicesintl.com/> - array of biological inoculants and more
- Fedco Organic Growers Supply (ME) - <http://www.fedcoseeds.com/ogs.htm> - also available through the NOFA Bulk Order
- Kreher Enterprises, LLC – Composted Chicken Manure (NY) for commercial growers – Duwayne Grabenstatter – 716-759-6802
- Josephine Porter Institute (VA) - <http://www.jpibiodynamics.org/> - source for biodynamic preparations
- Lancaster Ag Products (PA) - <http://www.lancasterag.com> - good source of custom blended inputs for farm scale applications
- NOFA Mass Bulk Order (available Jan. 1st, deadline is Feb. 1st) - <http://www.nofamass.org/programs/bulkorder/index.php>
- North Country Organics – (VT) - <http://www.norganics.com/> **Progressive Grower – West Wareham ph: 508-273-7358**
- Bionutrient Food Association Mineral Depots – Location and Availability Varies
- Organic Gem (New Bedford, MA) - <http://www.organicgem.com/> - is a good source of fish; folks on the North Shore often use Neptune's Harvest (www.neptunesharvest.com).
- Rock Dust Local sourcing regional rock dusts - <http://www.rockdustlocal.com/>

Additional Recommendations and/or Notes (page 5)

Soil Balancing Costs

- Total from worksheet pages Cost = \$ _____ / ac.

General Recommendations:

- These recommendations are focused on addressing mineral deficiencies and will not supply necessary nutrients for annual crop removal. We suggest addressing annual crop removal w/ fertilizer inputs (i.e. blended fertilizers). Cost = \$250-500/ac.

(Careful: Compost applications used repeatedly to address Nitrogen needs often oversupply P & K)

- Biological inoculants are suggested for maximizing nutrient availability and yield. Cost = \$10-60/ac. +/-
- Nutrient Drenches at transplanting time and/or throughout the season will promote strong root growth and healthier crops. Cost = \$20-120/ac +/-
- Foliar Sprays are useful to achieve the highest quality production. Cost = \$20-80/ac. +/-
- Fall Digestion Sprays are useful for capturing nutrients within your farm system. Cost = \$20-60/ac. +/-

Possible Recommendations Addressing Long-Term Fertility Needs

- If Soil P & K levels are low, Compost applications are suitable to raise P & K Cost = varies by farm
- Consider initial/annual applications of clay containing amendments (i.e. carbonatite, greensand, flora-stim, etc.) to increase exchange capacity in future humus developed through carbon induction
- Consider 1000# Soft Rock Phosphate Application to increase Phosphorous levels. Cost = \$200/ac +/-
Note: Reams – 500# SRP per acre to replace colloidal minerals with heavy yields & crop removal
- Consider 500-1000# Greensand Application (or Zeolite or similar amendment) to build exchange capacity, moisture holding capacity, & long term Potassium Reserve. Cost = \$150-300/ac.
- Adding a few tons of Rock Dust per acre is one strategy to improve soil energy levels and to supply minerals for future fertility needs. *Note: Small amounts recommended to not tie up biology* Cost = \$50-200/ac.

Other Fertility Costs to Consider:

Soil Testing

Cost – varies by farm

- Cover Crop Seed – costs depend on selection of varieties and if you use OG seeds Cost = \$100-250/ac.
- Labor Cost = varies by farm
- Required Equipment and/or Supplies Cost = varies by farm
- Potting Soil Cost = varies by farm