



**NOFA / Mass**  
Northeast Organic Farming Association  
Massachusetts Chapter

# Reading Your Soil Report

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A farmer's guide to Logan Labs results,  
nutrient functions, and soil balance



Learn more at [www.nofamass.org/soil-health-services](http://www.nofamass.org/soil-health-services)

# WHY TEST SOIL?



**Healthy soil is the foundation of resilient crops, strong yields and nutrient-dense food.**

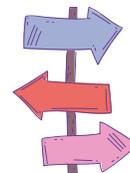
A soil test is like a bank statement - it shows:

- what nutrients are available
- what's missing, and
- what's out of balance

When we understand our soil report, we can:

- reduce wasted inputs,
- strengthen plants naturally, and
- support soil biology for the long term

# HOW TO USE THIS GUIDE



**This booklet is designed to help you:**

1. Understand what each number on your Logan Labs report means.
2. Learn the role of each nutrient and how they interact.
3. Spot when one nutrient may be blocking another.
4. See how soil type and microbes affect nutrient availability.
5. Put it all together into practical management decisions.



**Tip:** Circle your values on your Logan Labs report as you read along - this makes the learning real

# pH



**Ideal range:** 6.2-6.8 for most crops  
Controls nutrient availability - too acidic or alkaline locks things up

*Think of it as a dial that opens or closes the nutrient pantry*

# Organic Matter (OM%)



**Ideal range:** 3-5% (mineral soils),  
5-8% (intensive crops).

Increases nutrient storage, water-holding, and microbial food supply  
*The pantry stockpile for soil life.*



Tip: Compare with these ranges - where are you balanced and where are you out of range?

# Cation Exchange Capacity (CEC)



**Ideal range:**

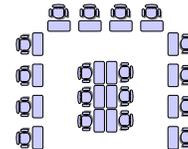
Sandy: 5-10 meq/100g

Loam: 10-20 meq/100g

Clay/OM: 20-40+ meq/100g

Measures how many nutrients the soil can hold. *The pantry size - small vs. big storage.*

# Base Saturations



**Ideal ranges:**

**Ca:** 60-70%

**Mg:** 10-20%

**K:** 3-5%

**Na:** <2%

**H:** <10%

*Shows how the "pantry shelves" are filled.*

# Macronutrients & Supporting Elements

	Nutrient	Ideal Range	Function	Antagonist	Antagonist
	Calcium (Ca)	2000-4000ppm, 60-70% base sat	Structure, roots, soil flocculation	Mg, K, Na	Mg, K, Na
	Magnesium (Mg)	200-400ppm 10-20% base sat	Chlorophyll, enzymes	Ca, K	Ca, K
	Potassium (K)	150-300ppm 3-5% base sat	Water balance, sugars	Ca, Mg	Ca, Mg
	Sodium (Na)	<100ppm; <2% base sat	Can displace cations	Ca, Mg, K	Ca, Mg, K
	Phosphorus (P)	100-200 lbs/ac (Mehlich 3)	Roots, Flowering, energy (ATP)	Zn, Fe, Cu, Mn	Zn, Fe, Cu, Mn
	Sulfur (S)	20-50 ppm	Amino acids, oils flavors	Ca, Na	Ca, Na
	Nitrogen (N)	(Unstable in soil test; check OM)	Proteins, chloro- phyll, growth	K, Cu	K, Cu

# Micronutrients & Supporting Elements

	Nutrient	Ideal Range	Function	Relatable Role	Antagonist
	Iron (Fe)	50-150 ppm	Photosynthesis electron transfer	Blood	P, Zn, Mn
	Manganese (Mn)	25-50 ppm	Enzyme activator stem strength	Builder	Fe, Ca
	Zinc (Zn)	5-10 ppm	Hormones, root growth	Growth Hormone	P, Fe, Mn
	Copper (Cu)	2-5 ppm	Disease resistance, fertility	Protector	Zn, P
	Boron (B)	0.8-1.5 ppm	Cell walls, flowers pollen	Matchmaker	Ca, K
	Molybdenum (Mo)	0.1-0.5 ppm	Enables N-fixation	N-fixer's helper	pH sensitivity
	Cobalt (Co)	0.1-0.2 ppm	Needed for Rhizobia & N-fixers	Microbe vitamin	Few
	Silicon (Si)	50-100 ppm Soluble	Plant defense, pest resistance	Shield	Weakly with P



**Activity:** Circle 2 nutrients on your report that are out of range. Use this table to see what their role is, and what might be pushing them out of balance

# Antagonisms in Reports

	If this is High...	Check These Nutrients	What Happens & Why it Matters
	Ca (>75% base sat)	Mg, K, B	Suppresses Mg/K uptake B->poor flowering/fruit
	Mg (>25% base sat)	Ca, K	Soil gets tight; Ca & K suppressed
	K (>7% base sat)	Mg, Ca	Blocks Mg uptake-> bitter pit, grass tetany; weak Ca balance
	Na (>3-4% base sat)	Ca, Mg, K	Displaces Ca/Mg; poor structure & drainage
	P (>300 lbs/ac)	Zn, Fe, Mn, Cu	Locks up trace metals, stunted roots, chlorosis disease issues
	Fe (>150 ppm)	Mn, Zn	Suppresses Mn; imbalance leads to yellow leaves
	Mn (very high, low pH)	Fe	Suppresses Fe; can cause chlorosis
	Zn (>10ppm)	Fe, Cu	Antagonizes Fe & Cu uptake
	Cu (>5ppm)	Zn, Fe	Suppresses Zn/Fe balance
	N (nitrate >50ppm)	K, Cu	Suppresses K/Cu uptake; weakens disease resistance
	S (>50ppm)	N	Excess S leaches N; upsets N:S balance

# Ratios to Watch

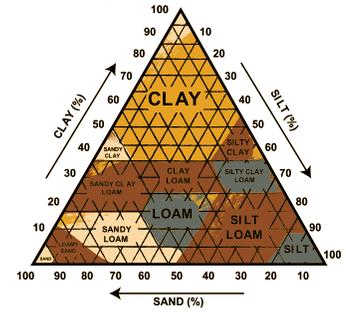
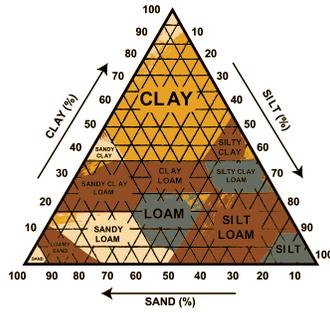
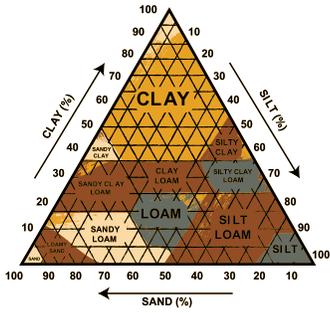
Nutrient & Ratio	Ideal	Meaning	
Ca:Mg	5-7:1	Balance between soil structure & compaction	<3:1=tight, sticky soil >10:1= loose droughty soil
K % Base Saturation	3-5% of CEC	K just enough to regulate sugars w/o crowding Mg & Ca	>7%=Mg gets blocked <2%=weak fruit fill & plant energy
Ca:K	10-15:1	Balances sugars, fruit size & quality	Too low= K hogging; too high = K suppressed
Fe:Mn	2:1	Prevents leaf yellowing (chlorosis)	Too much Fe suppresses Mn; too much Mn in acidic soil suppresses Fe
N:S	10:1	Balanced protein and energy metabolism	Too high= lush growth weak flavor; too low = stunted growth, poor proteins



## Tip:

Ratios tell you more than single nutrient numbers.  
*Think of nutrients as siblings. If one sibling hogs the food, the others go hungry. Balanced sibling = harmony at the soil's dinner table*

# Soil Type + Biology



## Sandy Soil (CEC <10)

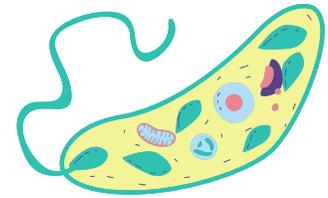
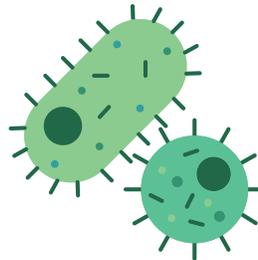
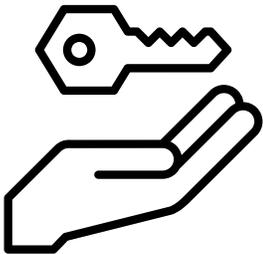
- Small pantry → nutrients leach easily.
- Needs frequent feeding and organic matter additions.
- Strategy: Build OM, cover crops, compost teas.

## Loam Soil (CEC 10–20)

- Medium pantry → flexible nutrient balance.
- Holds nutrients fairly well, but responsive to management.
- Strategy: Maintain OM, balanced amendments.

## Clay/Organic Soil (CEC 20–40+)

- Big pantry → stores lots of nutrients, but many are “locked up.”
- Can be sticky or compact without biology.
- Strategy: Use biology (fungi, acids) to unlock nutrients.



## **Biology: The Keyholders**

Soil microbes unlock the pantry and move nutrients:

- Mycorrhizal fungi → release P, Zn, Cu (but are suppressed if P >300 lbs/ac).
- Rhizobia bacteria → fix nitrogen (but are suppressed if nitrate-N >50 ppm or Mo <0.1 ppm).
- Sulfur oxidizers & redox microbes → mobilize S, Fe, Mn.
- Organic matter feeders → keep the cycle moving.
-  Balanced biology = better nutrient flow, less dependence on inputs.

# From Numbers to Management

## ✓ 3 Steps to Reading a Soil Report

### 1 Check the Basics

- pH (6.2–6.8)
- Organic Matter (3–5%+)
- CEC (know your pantry size)
- Base Saturations (Ca 60–70%, Mg 10–20%, K 3–5%, Na <2%)

### 2 Scan for Antagonisms

- Look for nutrients that are too high and pushing others down.
- Use the Quick Check Table (Page 6).

### 3 Look at Ratios

- Ca:Mg (5–7:1), Ca:K (10–15:1), Fe:Mn (~2:1), N:S (~10:1).
- Balanced siblings = harmony at the soil's dinner table.



## Remember the Biology

- **Too much Phosphorus (>300 lbs/ac) → suppresses mycorrhizal fungi.**
- **Too much Nitrate-N (>50 ppm) → suppresses Rhizobia (N-fixers).**
- **Excess Copper (>5 ppm) or Zinc (>10 ppm) → reduces microbial diversity.**
- **Low Organic Matter (<3%) → weakens microbial habitat & nutrient cycling.**
- 
- ☞ Soil life are the keyholders that unlock nutrients. Keep them fed, and they'll keep plants healthy.



## Soil Test = Bank Statement

- Nutrients in checking (soluble) → ready to use.
- Nutrients in savings (bound) → need microbes/chemistry to release.
- Your role as a grower = manage the whole system so nutrients flow smoothly, biology thrives, and plants can eat.





# Soil Test Reference Ranges (Logan Labs)



## Micronutrients



## Macronutrients

Nutrient	Ideal Range	Notes
<b>Fe</b>	50-150 ppm	Photosynthesis electron transport
<b>Mn</b>	25-50 ppm	Enzyme activator
<b>Zn</b>	5-10 ppm	Root growth, hormones
<b>Cu</b>	2-5 ppm	Disease resistance
<b>B</b>	0.8-1.5 ppm	Flowers, pollen
<b>Mo</b>	0.1-.05 ppm	N-Fixation lperhe
<b>Co</b>	0.1-0.2 ppm	Essential for -FixersN
<b>Si</b>	50-100 ppm ublesol	Plant defense

Nutrient	Ideal Range	Notes
<b>Ca</b>	2000-4000 ppm	Structure roots
<b>Mg</b>	200-400 ppm	Chlorophyll, enzymes
<b>K</b>	150-300 ppm	Water regulation, sugars
<b>Na</b>	<100 ppm	Higher levels= Structure risk
<b>P</b>	100-200 lbs/ ac Mehlich3	Roots, energy
<b>S</b>	20-50 ppm	Proteins, oil, flavors
<b>N</b>	Not stable in soil test	Fuel for growth



# Soil Test Reference Ranges (Logan Labs)

## General Soil Health

## Ratios

Parameter	Parameter	Parameter	Ratio	Ideal Range	Meaning
pH	6.2-6.8	Nutrient availability widest in this range	Ca:Mg	5-7:1	Soil structure balance
OM%	3-5% (mineral) 5-8% (vegetable)	Improves CEC, biology, Water-holding	Ca:K	10-15:1	Sugar/fruit Balance
CEC	Sandy 5-10 Loam 10-20 Clay 20-40	Pantry Size: low=leaching high=tie-up	Fe:Mn	2:1	Prevents chlorosis
Base Sat	Ca:60-70% Mg: 10-20% K: 3-5% Na: <2% H:<10%	Balance controls soil structure	N:S	10:1	Balanced protein & energy
			K% Base sat	3-5%	Avoids Mg suppression



# Key Soil & Fertility Formulas

Formula	Example
<b>Acreage from square feet</b> Square feet ÷ 43,560	10,000 ft <sup>2</sup> ÷ 43,560 = 0.23 acres
<b>PPM ↔ lb/acre conversion</b> 1ppm = 2lb/ac	15 ppm K = 30 lb/ac K
<b>Nutrient supplied</b> lbs product x decimal fraction	100 lb gypsum × 0.23 Ca = 23 lb Ca
<b>Product required</b> lbs nutrient needed / decimal fraction	Need 50 lb S; gypsum 18.6% S (0.186) → 50 ÷ 0.186 = <b>269 lb gypsum/ac</b>
<b>Convert P<sub>2</sub>O<sub>5</sub> → Elemental P (%):</b> %P = %P <sub>2</sub> O <sub>5</sub> /2.29	Fertilizer = 20% P <sub>2</sub> O <sub>5</sub> → 20 ÷ 2.29 = <b>8.7% P</b> Soil test = 50 ppm P = 100 lb/ac P
<b>Convert K<sub>2</sub>O → Elemental K (%):</b> %K = %K <sub>2</sub> O/1.20	Fertilizer = 60% K <sub>2</sub> O → 60 ÷ 1.20 = <b>50% K</b> Soil test = 75 ppm K = 150 lb/ac K
<b>Ratios</b> %Ca base sat ÷ %Mg base sat	65% Ca ÷ 10% Mg = <b>6.5 : 1</b>
<b>Depth adjustment</b> for ppm → lb/ac	<ul style="list-style-type: none"> <li>• 1 ppm = 2 lb/ac (6–7")</li> <li>• 12" sample = 4 lb/ac</li> <li>• 3" sample = 1 lb/ac</li> </ul>