Get to Know Your Soil:

Texture, Fertilizers, and Getting Ready to Grow

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Friday April 30, 2021

What we will cover today (in English and in Spanish)

- Soil texture 101: ribbon test, jar shake test
- Overview of the soil testing process
- Taking a look at real soil test results from a lab!!!!
- Identifying soil fertility deficiencies and imbalances
- Zooming in on types of fertilizers
- Sourcing your fertilizer products: framing the choices and options
- Simple math: calculating what fertilizer you need
- Measuring your garden / field
- Applying fertilizer
- Incorporate? or not?

Housekeeping: Please send an email to bushelcraftfarm@gmail.com and drazuleyja@gmail.com to receive the recording from this session and the presentation slides.

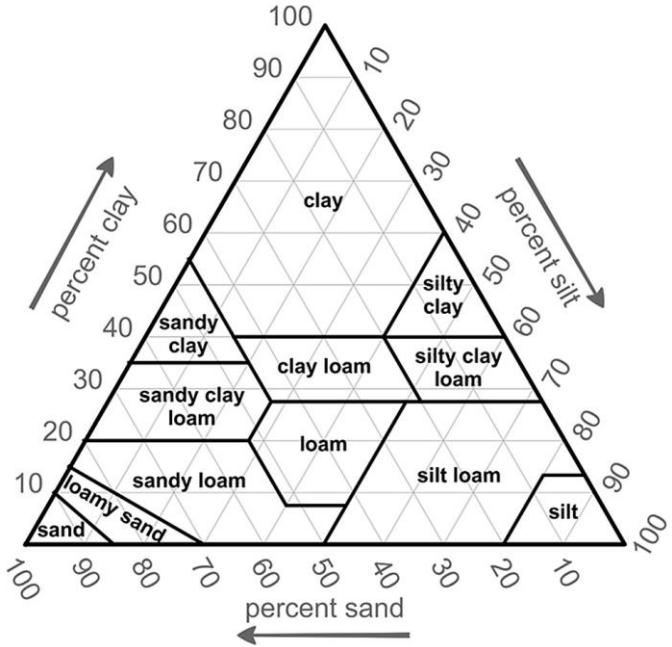
What is soil texture?

Sand (largest particle size), Silt (medium particle size), Clay (finest/smallest size)

Texture Triangle

See link

Where is YOUR soil on the texture triangle?



Soil Texture - Test #2: the Ribbon Test

See link from last class' recorded video. Skip ahead to ~ the 19:08 minute mark

If you can't roll the soil into a ball that holds its shape, your soil is very very sandy

Can you crush the ball with your thumb? Does it fall apart?

The longer your ribbon, the more clay content your soil has.

Soil texture: Jar test

Fill a jar that has lines on it (Ball jars are great!) to half way or more, or to a particular line (ex. 600 mL line).

Fill rest of jar with water, leaving some room near the top.

Put a strong lid on the jar and thoroughly shake for 2 minutes. Complete shake!

Let settle and do not disturb. After 2 mins, the sand will settle out. After 2 hrs, the silt component settles out. After 2 days, the clay suspended in water will settle out. Then you can measure the % of each component and determine your ‘SOIL TEXTURE’

My home garden...very sandy!

Clay

Silt

Sand

Overview of the soil testing process

Collect 10-20 core soil samples from throughout your garden (to a consistent depth of 6” or more). LABEL your sample (date, location, name, email/phone #)

Mix the core samples together and remove stones, roots, sticks, etc.

Dry soil sample for a few days

Mail the sample to a nearby lab (again, properly labeled)

Should get your results within 1 week of submitting, often by email

Link to video

Real soil test results from a soil testing lab

Organic Matter

Phosphorus

Potassium

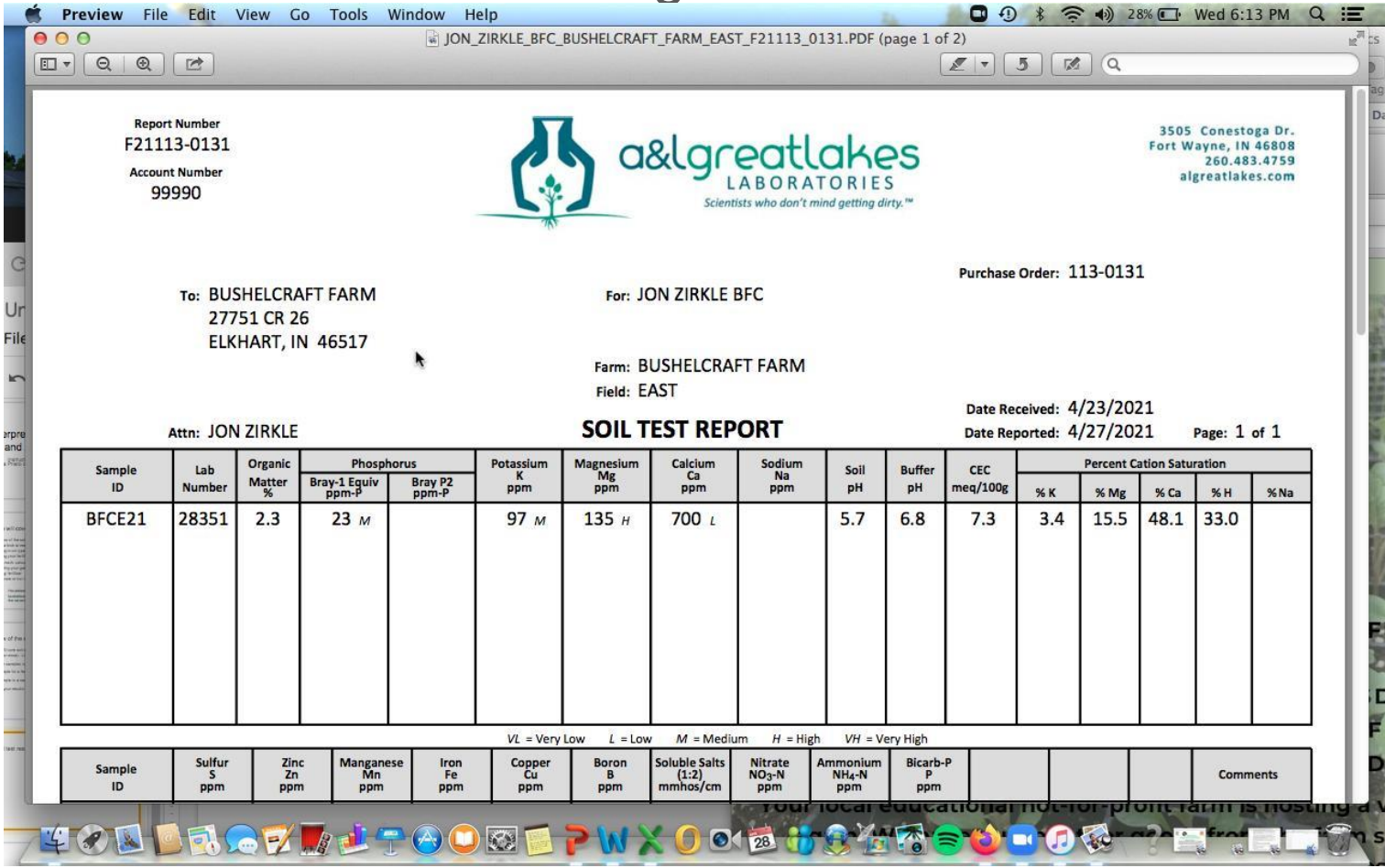
Magnesium

Calcium

pH

Buffer pH

CEC



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Report Number
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To: BUSHELCRAFT FARM
27751 CR 26
ELKHART, IN 46517

For: JON ZIRKLE BFC

Farm: BUSHELCRAFT FARM
Field: EAST

Attn: JON ZIRKLE

SOIL TEST REPORT

Date Received: 4/23/2021
Date Reported: 4/27/2021
Page: 1 of 1

Sample ID	Lab Number	Organic Matter %	Phosphorus		Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Soil pH	Buffer pH	CEC meq/100g	Percent Cation Saturation				
			Bray-1 Equiv ppm-P	Bray P2 ppm-P								% K	% Mg	% Ca	% H	% Na
BFCE21	28351	2.3	23 *M*		97 *M*	135 *H*	700 *L*		5.7	6.8	7.3	3.4	15.5	48.1	33.0	

VL = Very Low *L* = Low *M* = Medium *H* = High *VH* = Very High

Sample ID	Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts (1:2) mmhos/cm	Nitrate NO_3-N ppm	Ammonium NH_4-N ppm	Bicarb-P P ppm				Comments

Surveying the Results: example from Bushelcraft Farm

VL = Very Low L = Low M = Medium H = High VH = Very high

Organic Matter:	2.3%	
Phosphorus	Medium	Analysis:
Potassium	Medium	
Magnesium	High	Organic matter is on the low side
Calcium	Low	We need lime, and need to raise the soil pH
pH		5.7 (acidic)
Buffer pH	6.8	
CEC	7.3	

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Date Received: 4/23/2021
Date Reported: 4/27/2021

SOIL TEST REPORT

Sample ID	Lab Number	Organic Matter %	Phosphorus		Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Soil pH	Buffer pH	CEC meq/100g	Percent Cation Saturation				
			Bray-1 Equiv ppm-P	Bray P2 ppm-P								% K	% Mg	% Ca	% H	% Na
ZP21E	28356	2.9	53 *VH*		117 *M*	165 *H*	1050 *M*		6.3	6.9	8.1	3.7	16.9	64.6	14.8	
ZP21W	28359	2.4	28 *M*		113 *M*	150 *H*	800 *L*		5.7	6.8	7.9	3.6	15.7	50.4	30.2	

VL = Very Low *L* = Low *M* = Medium *H* = High *VH* = Very High

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TAKE A MINUTE TO LOOK AT YOUR SOIL TEST

What stands out to you?

Soil Organic Matter (%)

Ideally your soil organic matter is 3% or higher. If 2 to 3%, this isn't a big problem, but it should be a goal to actively raise SOM, which can take time. At field scale, don't expect to gain more than about 0.1-0.15% per year in SOM.

For gardens, the SOM level can be raised more quickly by adding compost, manure, and mulching with leaves, rotting straw or hay, and cover cropping.

If below 2%, your garden--and thus your crops--may struggle.

We want to think about SOM and soil texture at the same time (esp. sand vs. clay)

Soil pH

Ideally, your soil pH would be between 6.5 and 7. Corn can handle slightly acidic soil (5.8-6.5), but closer to 7 is good. In general, a pH of 6.0 - 7.5 is fine, though outside of that range, there can start to be challenges.

If your soil is below 6, you probably need to begin working to raise the pH with lime (agricultural calcium lime or dolomitic lime). And you don't want to be adding fertilizers that could potentially lower soil pH. A low pH can often be a problem on sandy, light soils that have little clay.

Soils higher in clay or soils that have received lots of compost, manure, or are on 'muck soils' are commonly above 7.0. Definitely try to stay below 8.

*Note the 'buffering capacity' factor: if a soil is high in clay or high in SOM, it's hard to change soil pH quickly. These soils have lots of binding sites (high CEC)

Address soil pH problems before you zoom in on particular soil nutrient deficiencies

<6.0 Raise the pH

6-6.5 It's worth trying to raise pH a bit, could be done gradually / later

7.0 You're all set (note: if you're growing an acid-loving crop...ex. Blueberries, you'll need to lower. But most crops can handle neutral pH)

7-7.5 Don't lots of 'cations' (calcium, magnesium, potassium) unless you have to, in which case you may want a fertilizer with sulfate in it (ex. potassium sulfate)

>7.5 May need to consider acidifying soil (sulfur/sulfur products can help) OR don't add fertilizers, compost, manure, etc that could raise pH more.

Identifying soil fertility deficiencies (VL, L, maybe M)

If a soil test indicates a nutrient is VL (very low) or L (low), you definitely want to add fertilizer. It can be a challenge if a crop is already in the ground if a large volume needs to be applied.

Solution: could be added in a sequence of ‘doses’, potentially mixed with compost or some other carbon-containing amendment.

Example: if recommendations say to add 1 ton of lime per acre, do this in 2-4 doses. If all at once, that can be hard on plants if they’re already in the ground!

If a soil test indicates a nutrient is M (medium), you probably want to add fertilizer, but it may not be urgent to add to your soil right away. Make a note to add it in the fall, winter, or next spring, unless erosion or leaching is of concern.

If soil nutrients are high (H) or very high (VH)

If a test indicates a nutrient is high (H), not to worry (unless your garden is prone to erosion or leaching into nearby water sources or a well. *Growing crops will result in removing nutrients. Don’t add fertilizer.

If a test indicates a nutrient is very high (VH), *definitely don’t add fertilizer.* This probably isn’t a big problem, though it would be worth zooming in on problem levels. If too high, an overabundance of a nutrient can start to outcompete other nutrients and may affect soil pH or be an indication that soil pH is quite acidic or too alkaline (basic)

An overview of fertilizer info:

NPK = % Nitrogen (N), Phosphorus (P), and Potassium (K) per weight unit

3-6-2

1-2-4

22-3-8

Example: one 50lb bag of 10-10-10 has 5 lbs N, 5 lbs P, and 5 lbs K in it.

..and 35 lbs of somethin' else!

Link:
https://www.canr.msu.edu/field_crops/uploads/archive/E0896.pdf

General Concept

Most fertilizers contain more than one nutrient, and aren't pure N, P, K, Ca, Mg etc

Ask yourself: if I add both, do I need both? Will one of those nutrients put me over a threshold I don't want to be over?

Sometimes this is a good thing! Maybe you need calcium and sulfur and you can just add gypsum (calcium sulfate)

Zooming in on types of fertilizers: 1) sources of calcium

Lime: lime is a source of calcium or $CaCO_3$ is a common means of raising the soil pH. Note: there are a few kinds of lime out there!

Ag lime vs dolomitic lime (agricultural lime is known for its calcium content only; dolomitic lime contains $MgCO_3$ in addition to $CaCO_3$).

Gypsum, or calcium sulfate ($CaSO_4$)supplies calcium but also sulfur to your soil. Gypsum will not likely affect your soil pH. Calcium is more readily available to plants than calcium from lime. Gypsum is 23-29% calcium, 18-23% sulfur (depending if the gypsum is hydrated or not). Want to learn more? See https://www.canr.msu.edu/news/gypsum_as_a_soil_additive_use_it_or_lose_it

Natural sources of calcium: crushed eggshells, wood ashes (*ashes may contain K, P, etc)

Link: https://cdn.shopify.com/s/files/1/0979/5626/files/FS07_-_Calcitic_or_Dolomitic_Limestone.pdf?14031145444614994333

Zooming in on types of fertilizers: 2) sources of potassium

Conventional:

KCl (0-0-60, also known as muriate of potash)

“Sul-Po-Mag” (0-0-22-11.2Mg-22.7S)

Potassium Nitrate

Natural:

Potassium sulfate (0-0-50-17S)

Fish and sea-based products (ex. kelp powder)

Langbeinite (0-0-22) - OMRI

Manure (chicken & swine highest)

Wood ashes: NPK varies: might be ~(0-1-10) see Purdue Ext. article about

Zooming in on types of fertilizers: 3) sources of phosphorus

Conventional:

Diammonium phosphate (18-46-0 and monoammonium phosphate (11-46-0)

Natural:

Rock phosphates - concentration depends on the type of rock! (ex. Tennessee brown)

Bone meal (3.5-25-0, and 20+ Ca)

manure (note: each animal species manure differs - swine is highest, then liquid cow)

fish products (dried blood and meal ~5-5-6)

Resource: https://extension.umn.edu/phosphorus-and-potassium/understanding-phosphorus-fertilizers

Zooming in on types of fertilizers: 4) sources of nitrogen

Conventional:

Urea (46-0-0)

Ammonium sulfate (21-0-0-24S)

Anhydrous ammonia (82-0-0)

Natural sources:

Urine (*varies considerably, 11-1-2.5), blood meal (12-1-0), feather meal (13-0-0),

manure (*varies by species: dried chicken(~5-2-1), dried sheep (~2-2-1)

See article about urine, if you're interested

Zooming in on types of fertilizers: 5) sources of magnesium

Epsom salt ($MgSO_4$) - many crops really love $MgSO_4$ (tomatoes), but don’t apply this blindly.

Dolomitic lime (also contains plenty of calcium)

Sul-Po-Mag

What about compost?

Compost will not be particularly high in any given nutrient, but it will generally have all of the TYPES nutrients you're looking for, but slowly released to plants.

Compost isn't a quick fix, but it 'lifts all boats'

You can test your compost by sending it to a lab for analysis!

pH is typically higher than 7

When to apply?

It depends….

Don’t apply tons of fertilizer onto a standing crop! Before is good, but…

Nitrogen fertilizer is fickle. You can ‘waste’ it. Soils need to be warm, somewhat dry, not waterlogged. Don’t apply nitrogen fertilizers during flowering or fruiting.

Is your soil sandy? Clayish? Wet? Prone to erosion because of a slope? These are all factors as to when you should apply

Applying Fertilizers: first, do the math...

Measure the area of your garden:

Example: 35’ x 65’ = 2,275 sq feet 1 acre = 43,560 sq feet

2,275/43,560 = 0.052 acres

If you need 1 ton (2000 lbs/acre) of lime, how much lime for this garden?

2000 lbs x 0.052 = 104 lbs of lime

How to apply fertilizer

By hand - sling it straight from a bag

By hand, but mixed with compost, etc

With a chest spreader

Watch out for wind if using a powdery fertilizer!

If a heavy rock fertilizer, this may be a challenge to apply evenly

Fertilizer could be mixed with sand or dry compost to help it spread more evenly

With a lawn fertilizer (drop seeder), or ‘walk it on’

Fertilizer sources

*Sunrise Seeds - Topeka, IN (on CR 350 S between Topeka and LaGrange)

*Arbico Organics (online) - https://www.arbico-organics.com

*Some hardware and big box stores carry natural fertilizers (blood meal, bone meal)

*Manure from a neighbor or nearby farm (ask questions about weeds...seeds may come through manure, esp. Horse manure, and can be true of cow manure). Also be cautious when applying fresh manure, which can burn crop roots or produce harmful effects esp in light soils (salt effects). Try to incorporate manure whenever possible.

Soil As a System: Are Your Soil Nutrients Cycling Well?

This is where soil tests have limitations. You can have the right nutrients, but other problems with your soil that could prevent them from cycling

*COMPACTION

*PLOW PAN or HARD PAN (from tilling year after year)

*POOR DRAINAGE (wet)

*VERY LIGHT SOILS (always dry, prone to losing nutrients)

*CHEMICAL DAMAGE (doubtful for most gardeners)

IMPROVED CYCLING IN YOUR SOIL

Adequate organic matter is quite important

Make sure your soil stays loose and deep. Seasonal cover crops can really help with this! Roots are amazing at breaking up the soil (try a grass+legume + radish)

Consider adding compost, liquid compost, aged manure, or sheet mulching to improve the microbial diversity and the stability of the soil (covering soil surfaces will encourage earthworms and a greater diversity of microbial life to be happy!)

Corn and what it needs

Lots of nitrogen (leaves, stalks, photosynthesis). Note: 1% SOM gives ~20-30lbs of nitrogen per year (ex. 3% SOM = 60-90 lbs/year). You'll need to add N every year for corn, most likely

Adequate phosphorus (for making seeds, ears, roots)

Plenty of potassium (strong stalks, protect against drought)

Corn can also have micronutrient deficiencies which show visually...

Questions?

Please stick around to ask questions,

Or email Jon Zirkle at bushelcraftfarm@gmail.com

Or email Zuleyja Prieto at drazuleyja@gmail.com

Thanks for coming! Stick around if you'd like to ask questions

If you'd like to make a donation, go to www.bushelcraftfarm.org.
Bushelcraft Farm is having an online auction until Thursday May 6 at 9am.