Soil Health Parts 1-2

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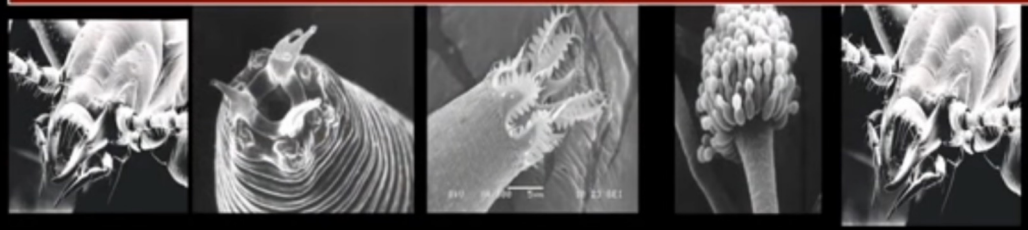
Red Clay Farm
Thatcher Farm

Did you know that weeds are indicators of your soil health?

Did anyone ever tell you to take care of the soil? Cover it, mimic nature? Holistic cycles of growth?

Holism-Ecology:
the study of
relationships
between people,
animals, and plants,
and their
environment.
Interconnectedness

Soil Surface



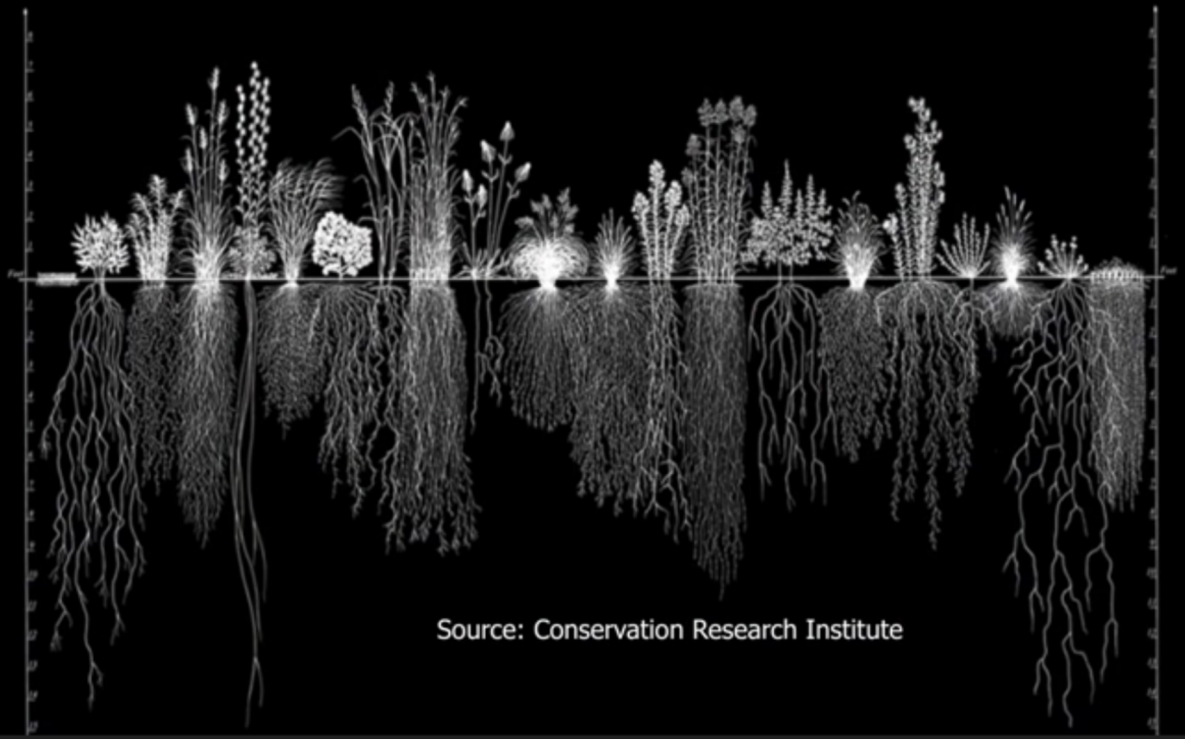
Native American Proverb (Sioux):

"With all things and
in all things, we are
relatives"

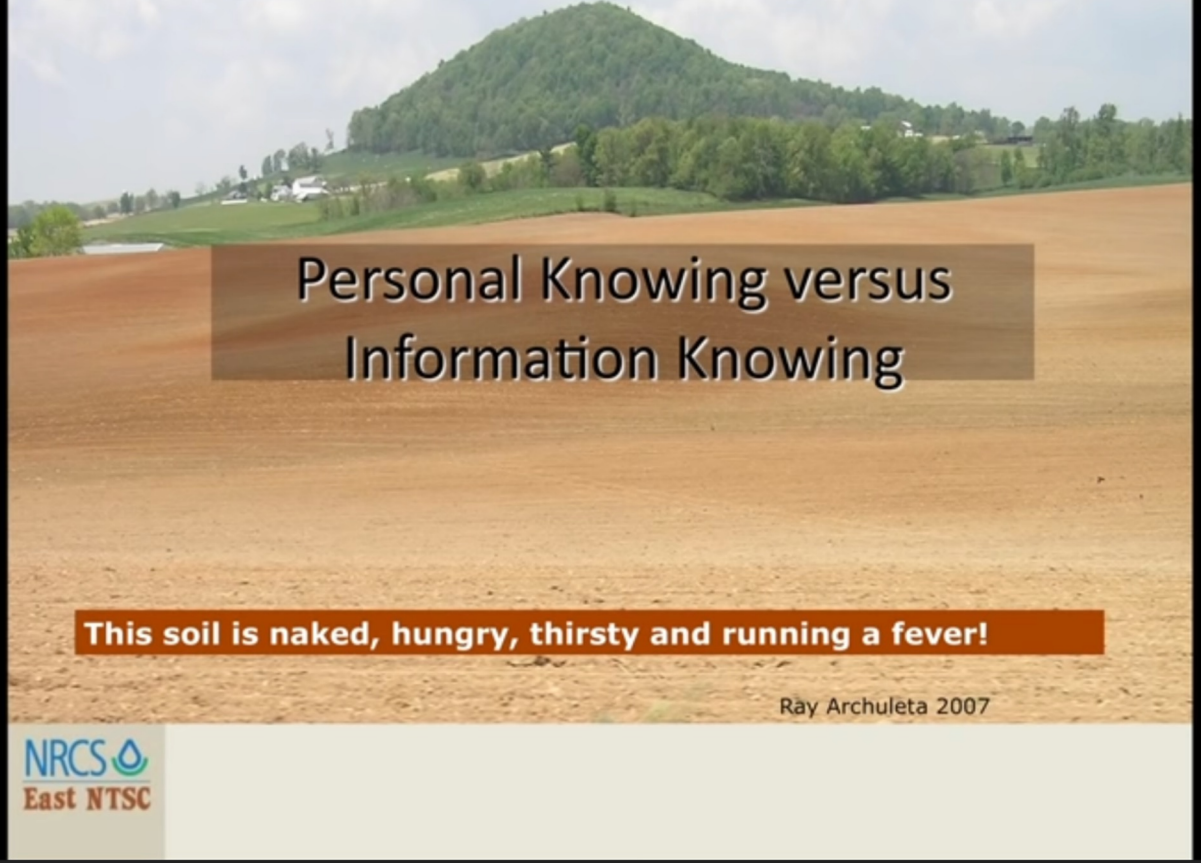
JOB 12: 7

But ask the beasts and they will teach you; the birds of heaven, and they will tell you or the bushes of the earth and they will teach you and the fish of the sea will declare to you

Ecological Architecture:



Source: Conservation Research Institute


Personal Knowing versus
Information Knowing
This soil is naked, hungry, thirsty and running a fever!
Ray Archuleta 2007
NRCS
East NTSC

The definition of soil health: **“The ability of the soil to function.”** Doran and Parkin 94

If you remember nothing from this lecture remember this:

Biomimicry, mimic nature on your farm

Always do a soil test once a year. And follow the recommendations

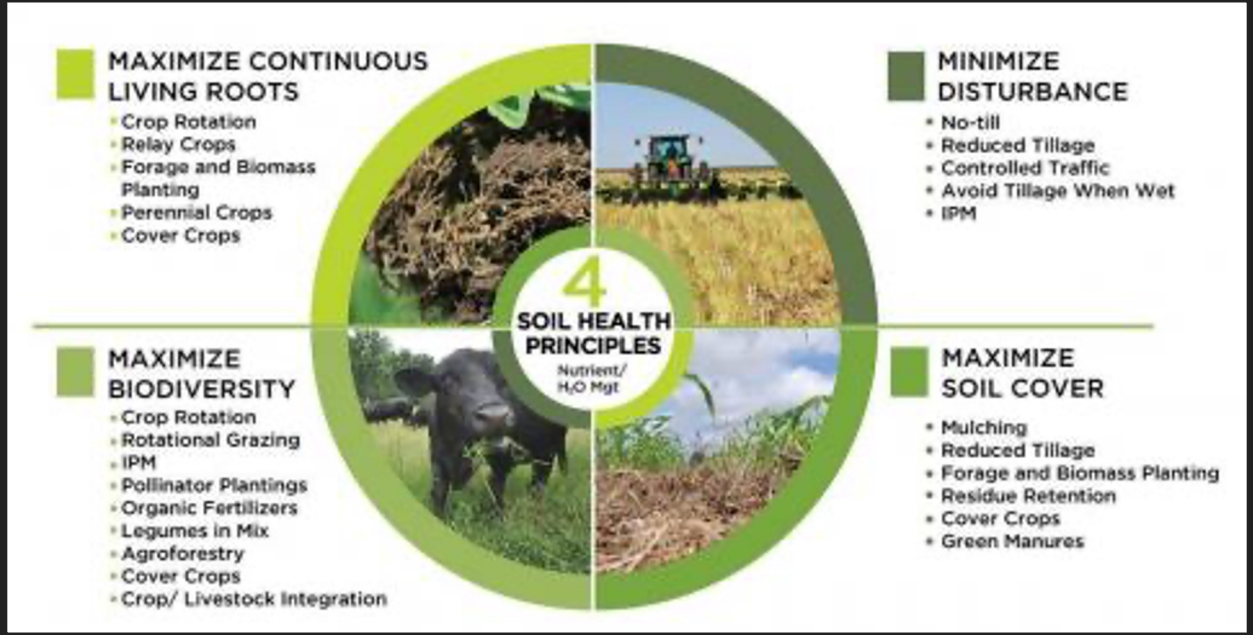
Keep soil covered as much as possible

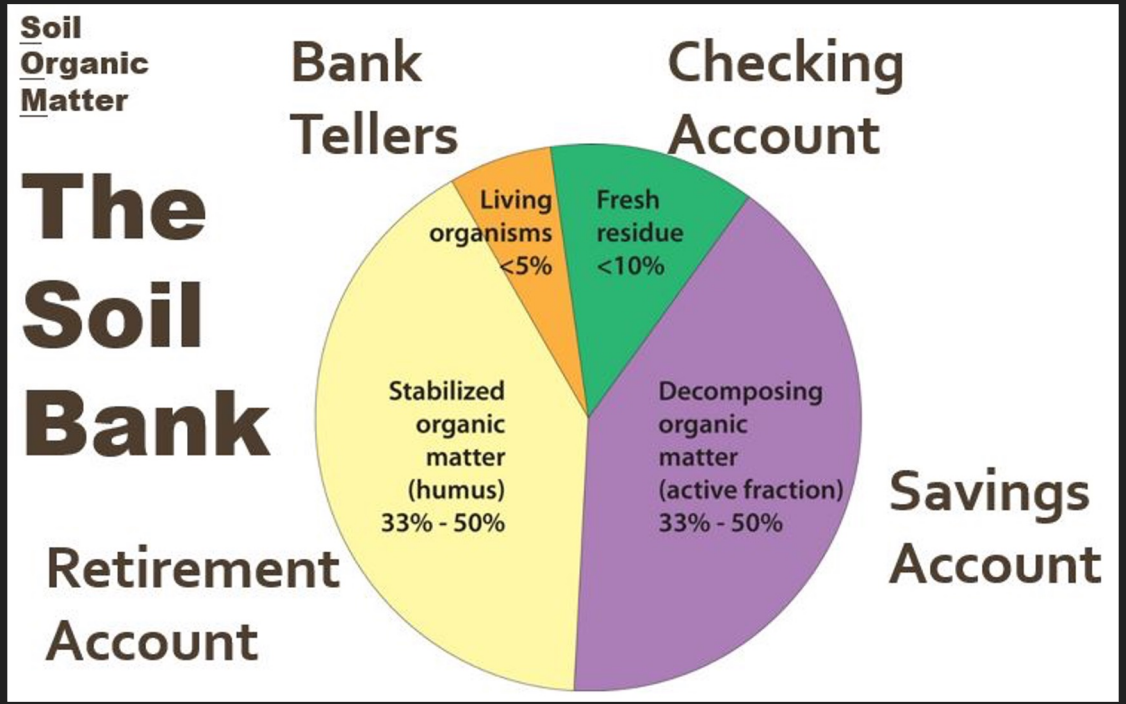
Dig in the dirt, walk your land

The Dust Bowl

The Dust Bowl 1930-36 Soil not cared for left bare, lots of plowing, soil wind erosion. NRCS soil conservation was established in 1933. In 2014 we had another dust bowl event happen in TX.

5 Principles of Soil Heath:

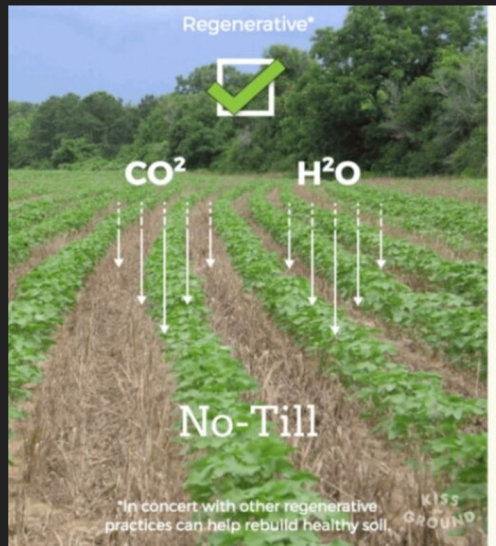


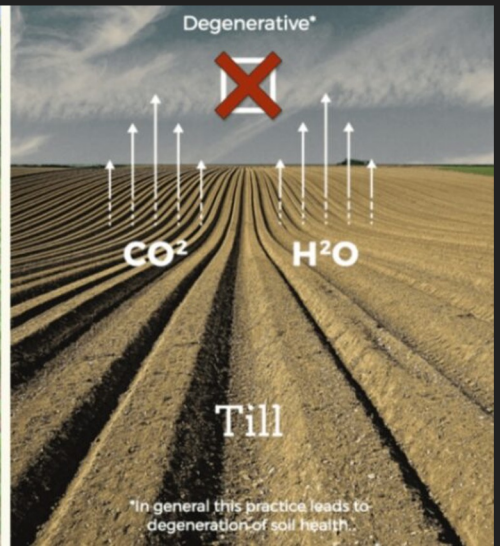

Soil Organic Matter
The Soil Bank
Bank Tellers
Checking Account
Savings Account
Retirement Account
Living organisms <5%
Fresh residue <10%
Stabilized organic matter (humus) 33% - 50%
Decomposing organic matter (active fraction) 33% - 50%

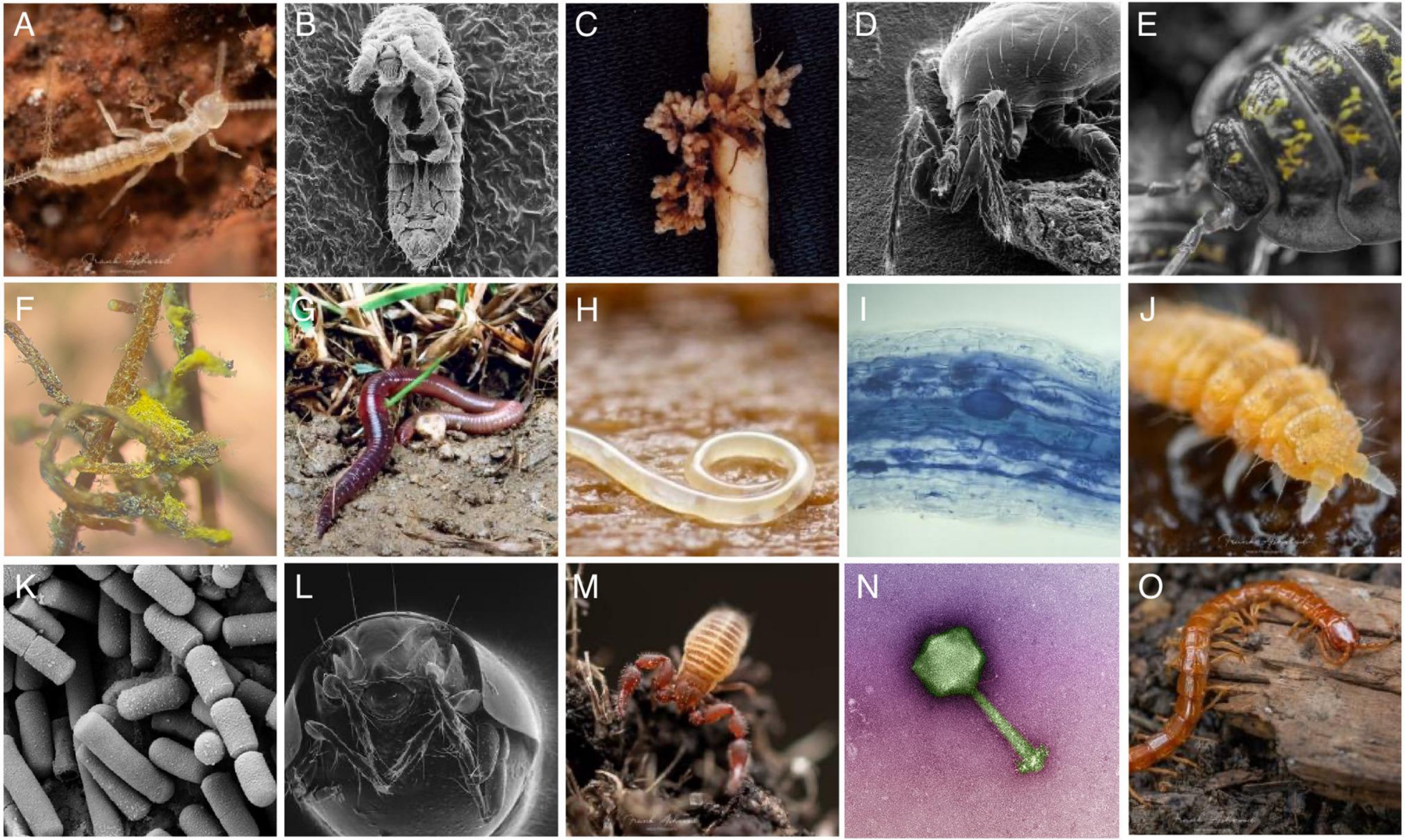
Soil Structure

No Till is not the answer, **BIOLOGY, life is the answer.**

Go home, take a shovel and dig up some soil and look at it. Ideally what you want is a **GRANULAR STRUCTURE**, **cottage cheese structure**, to the soil.
Usually soil that has been worked (Tilled) is **blocky** or **platey** compressed soil.






A
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This soil structure is **platey**.

When you dig up soil, it comes away in layers, the soil granules have been pressed together removing the ability of water and air infiltration and preventing root/ plant growth and the ability of the plants to gather needed nutrients.

What causes this? You've worked the soil when it was wet

You tilled it and then it rained and all that nice “fluffy soil” mashed down together. It’s also possible to have this type of soil structure if you have heavy machinery driving over fields when wet.

If soil cannot get O2, decomposition stops.

If the CO2 buildup gets to be too much, decomposition stops.

In this anaerobic state, you get **fermentation** instead of **decay**. This fermentation will **sterilize your soil** and it can also produce methane gas.

How do you prevent soggy soils and fermentation from happening? **Build your soil.**

Add biology, covers, green manure, compost,

Don't touch it when wet, allow nature to work things out.

If the area is small enough you could bring in soil to raise the level up.

Hardpans

What is a hardpan? A hardpan forms after repeated tillage at a certain depth, say 8 inches.

How do you get around this? LImit tillage or plowing, especially when the soil is wet.

Remember **tillage** of any kind**, compacts the soil** and causes your **organic matter to be eaten faster.**

Is the hardpan the problem? No.

Is the wet soil the problem? No.

Are the weeds that grow because of limited O2 in the soil the problem? No.

These are simply symptoms.

Possible solution: **Calcium to Magnesium ratio in the soil is off**. **If the calcium is too low to balance the magnesium then that is the actual problem**.

Base saturation of magnesium around 15% and the base saturation of calcium above 75%.

Calcium will (group together) the soil clays into aggregates. This means that there will be more pore space, better aeration and more root development.

Magnesium causes dense, tighter soil that will decrease microbial activity and root growth.

Another cause of hardpans in soil is **excess salt**: High levels of sodium can destroy the aggregate structure of fine- and medium-textured soils.

Soil Organic Matter

It is the Biology that builds the aggregate, which makes the organic matter which makes the chemistry.

Soil organic matter is the fraction of the soil that consists of plant or animal tissue in various stages of breakdown (decomposition).

Most soils have 3- 6% organic matter. In FL, SOM is usually around: 1-3%

1% of organic matter per acre can hold up to **16,000 gallons of water.**

How do you increase SOM? Covers, compost, feed the soil. **Keep soil armored**.

What is Soil Organic Matter?

1. Plant residues and living microbial biomass.
2. Active soil organic matter is also referred to as detritus.
3. Stable soil organic matter, often referred to as humus.

SOM, is the source of the power without which the plant -food elements could not be changed to a usable forms. William Albrecht

There are 3 areas of benefits for stable organic matter: Physical, Chemical and Biological.

Physical:

1. Enhances aggregate stability, improving water infiltration and soil aeration, reducing runoff.
2. ☐ Improves Water Holding Capacity. 16,000 gallons per 1% OM
3. ☐ Reduces the stickiness of clay soils
   making them easier to till.
4. ☐ Reduces surface crusting, facilitating
   seedbed preparation.

Chemical:

Increases the soil’s CEC or its ability to hold onto and supply over time essential nutrients such as calcium, magnesium and potassium.

☐ Improves the ability of a soil to resist pH change; this is also known as buffering capacity

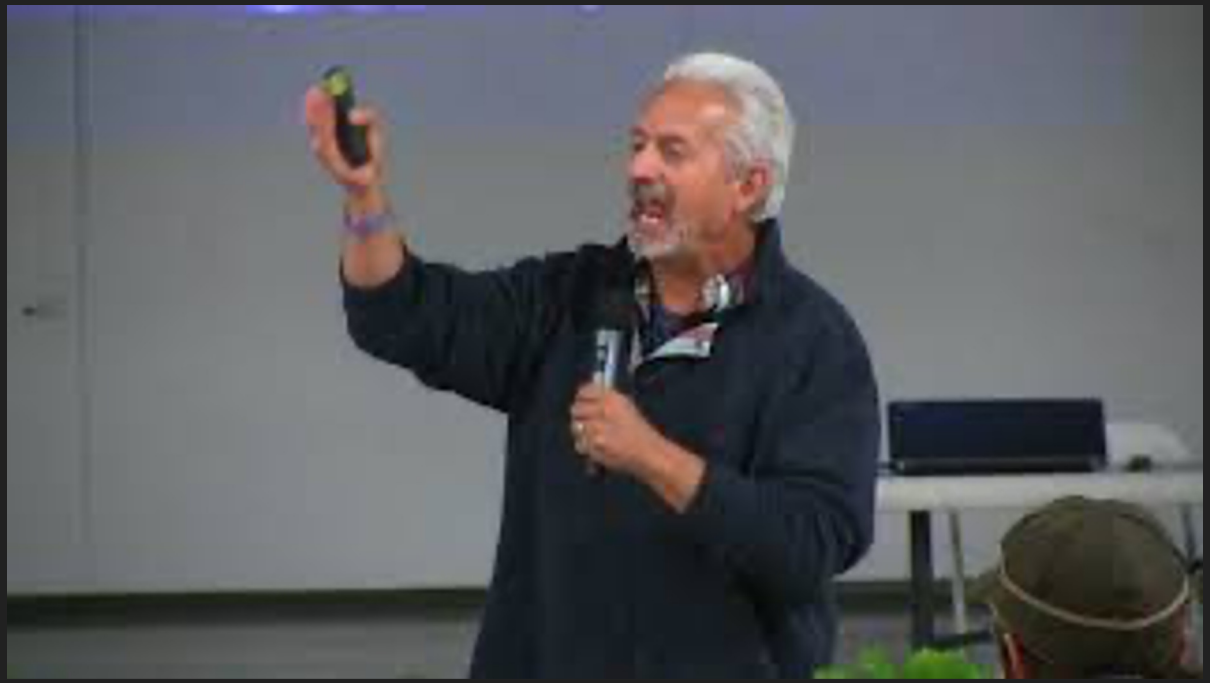
☐ Accelerates decomposition of soil minerals over time, making the nutrients in the minerals available for plant uptake.

Physical:

Provides food for the living organisms in the soil.

- ☐ Enhances soil microbial biodiversity and activity which can help in the suppression of diseases and pests.
- ☐ Enhances pore space through the actions of soil microorganisms. This helps to increase infiltration and reduce runoff.

Root Exuding sunlight Ray Archuleta



Cation Exchange Capacity(CEC)

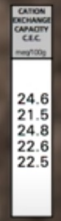
- Cation exchange capacity (CEC) is a measure of the soil's ability to hold positively charged ions. It is a very important soil property influencing soil structure stability, nutrient availability, soil pH and the soil's reaction to fertilizers and other amendments.
- CEC refers to how many charged particles can be captured by the soil and exchange elements by forming temporary bonds or attractions with different nutrients such as N or K in the soil and hold these nutrients in place until the crops need them.
- Yearly soil tests should list your soils CEC capacity follow this information closely, adding to much fertilizers can cause nutrient leaching into the groundwater, polluting it and having harmful effects downstream.

Cation Exchange Capacity(CEC)

- Cation Exchange Capacity or CEC is the holding capacity of your soil. It’s a measurement of:
- The type of clay in your soil
- The amount of clay in your soil and the amount of organic matter in your soil.

Cation Exchange Capacity(CEC)

Cation Exchange Capacity



x 10 = The holding capacity of your soil.

AgPhD

Cation Exchange Capacity

Example: CEC is 16

16 x 10 = 160 lbs/acre

Already had 40 lbs of N

160 - 40 = 120 lbs/acre

The most N you should apply is **120 lbs/acre**

Cation Exchange Capacity(CEC)

- How can you increase your CEC? Increase your OM levels in your fields.
- How do you do that?
- Reduce tillage
- Keep the ground covered and keep roots in the soil
- Use manure and compost

High Cation Exchange Capacity(CEC)

- Soil’s holding capacity may be too high
- Increase your soil porosity
- Increase the calcium levels in your soil and you need to open your soils if they are compacted.
- Add lime to your fields according to the recommendation from your soil test.
- Compacted soils can benefit from tillage radishes or a cereal cover crop
- Tile your fields to get rid of the extra moisture held in the soil.

Organic Materials

Over time, the application and incorporation of organic materials can result in an increase in stable soil organic matter levels. Sources of organic materials include:

Crop residues. Animal manure.

Compost

- Cover crops (green manure)
- Perennial grasses and legumes.

The quickest increases are obtained with sources that are high in carbon such as compost or semi-solid manure.

Earthworm Video

Fertilizers/Soil Testing

Confucius said, “The best fertilizer for any soil is the footsteps of the farmer” Walk your fields, get to know them intimately.

DO A SOIL TEST BEFORE ANYTHING ELSE

Water’s Agricultural Lab based in Ga and Ky.

University labs like University of TN or University of FL.

The labs will give you the results usually in less then a week and will also give you a breakdown of what nutrients the crops will need.

How to do a soil sample

For cultivated crops and gardens, sample at 1 - 6" depth.

For lawns and pastures, a sample from the upper 6" is satisfactory; remove plant residue.

For tree and fruit crops, 2 samples should be submitted, one taken at 0 - 8" depth, the other at 8 - 16" (subsoil layer).

Take samples in a zigzag pattern around your growing area and then mix all the samples for the growing area in a bucket and take about a 2 handfuls of soil from the mix, label it and send it in.

Fertilizers

When adding fertilizers to your fields or crops make sure to add only what is needed at that time.

Do not add all the fertilizer that the crops need for the entire season in one sitting.

Fertilizer requirements for plants, especially vegetables, change as the plant changes from growing foliage to growing fruit.

Usually this change is more Nitrogen to Magnesium fertilizer as plant growth changes.

Most fertilizers and herbicides are salt based. Commercial fertilizers are not bad, just like any tool **use properly.**

Cover Crops

Cover crops are a simple way of restoring and maintaining your soil.

Covers, keep moisture in your soil, keep soils warmer or cooler sometimes up to 20 degrees depending on the time of year.

Microorganisms are most active between 50% and 75% soil moisture content (by weight) and at a temperature of between 40°F and 80°F.

For every 10°F temperature increase between 40°F and 80°F, the activity of soil microbes will approximately double if adequate moisture is present. (A Soil Owner’s Manual)

Covers scavenge nutrients that you would lose and store them till the next planting season

Holistic approach, working with nature.

Covers can and should be used, before, during and after your cash crops.

Monocrops are not the best and neither are mono-covers.

Covers and cash crops go hand in hand plant them together

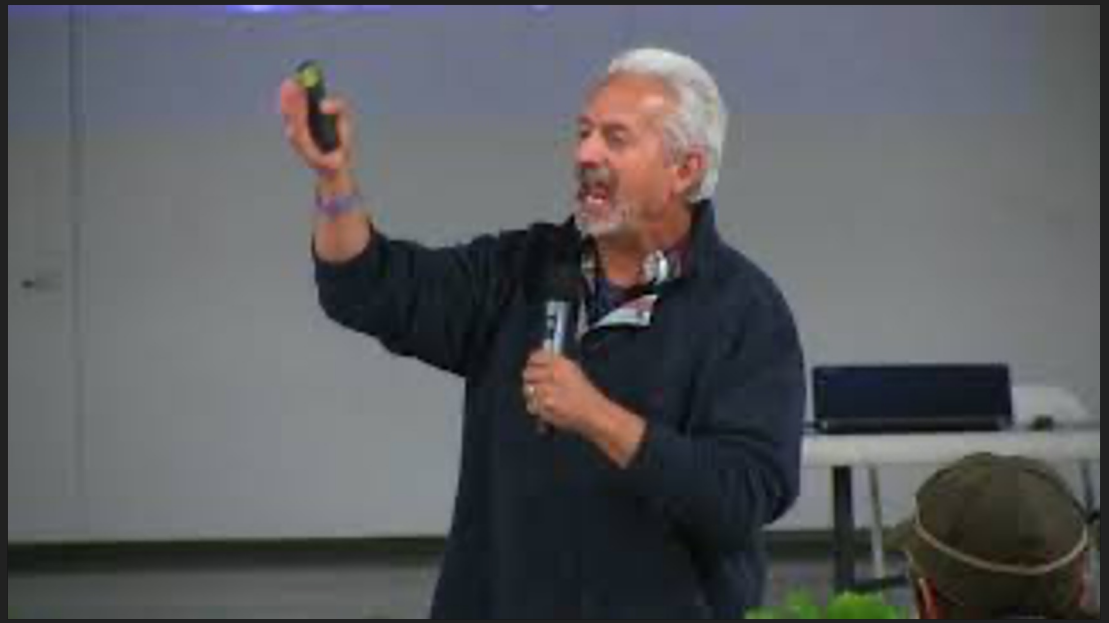
Once you are done with your cash crop put in covers to hold nutrients for the next planting season

Terminate covers before they go to seed, most often this is done in the milky doe stage for grains or when they flower

Termination can be: Mowing, crimping, chemical burn down or tillage

Leave the residues in the field, feed the biology, create LIFE

Cover Crops and Soil Health with Ray Archuleta



Weeds

The Anglo Saxon Definition of the word Weed, is little herb. What do herbs do? They help heal us. So logically **weeds help heal the soil.**

Weeds tell us what is going on in the soil

Many weeds gather and hold nutrients especially at deeper depths then our crops can reach.

They penetrate hard pans and break them up, they create pores in the soil that then allow softer plants to gather nutrients through.

Weeds are not your "problem" They are only **indicators of the "problem**".

The poor condition of the soil is the real "problem".

Reduce herbicide use: 2 gallons of molasses and 2 gallons of Calcium per acre

The molasses is a carbon source that feeds the bacteria in the soil.

The calcium changes the soil environment preventing weeds from growing.

Weeds are our friends, they are the best indicators of what is happening below ground.

Soil PH

Soil PH is the acidity or alkaline measurement of the soil.

PH goes from 0-14 with the middle being 7 which is a good stable number.

Most plants like a PH of 6.2-6.5.

In FL. The PH is usually 6.1 but it varies based on the parent material of the soil.

Soil PH is constantly changing.

Soil compaction can raise PH as can soil moisture.

Soil PH is an indication of the hydrogen present.

Think of Soil pH as energy flow.

A low pH means the energy flows rapidly and in some cases the nutrients flow past the root too quickly to be attracted to it.

A higher pH will mean that the nutrients flow more slowly and can be drawn to a root more easily.

In the soil, calcium is the element that causes soil particles to move apart to enhance water and air movement.

Magnesium makes the particles stick together.

ALL IS ONE.

Biology needs to be added to your fields.

Grow living roots 24/7

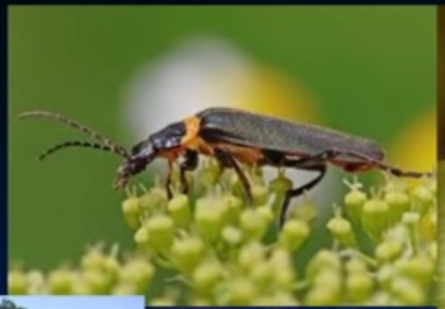
Cover the soil, diversity is key

Use **all** your tools

Mimic nature

Most importantly, **CHANGE YOUR MINDSET**

Build it… they will come!



Resources

Gabe Brown
Ray Archuleta
Youtube soil health videos
Soil Health Academy
USDA-NRCS
Extension agents
Weeds Guardians of the Soil by Joseph A. Cocannouer

https://s3.wp.wsu.edu/uploads/sites/2076/2019/03/C141-Vegetable-Fertilizer-Guide-15a.pdf

https://extension.umd.edu/resource/fertilizing-vegetables/

https://soiltesting.cahnr.uconn.edu/wp-content/uploads/sites/3514/2022/06/Fertilizer-Conversions-Garden-Measurements.pdf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