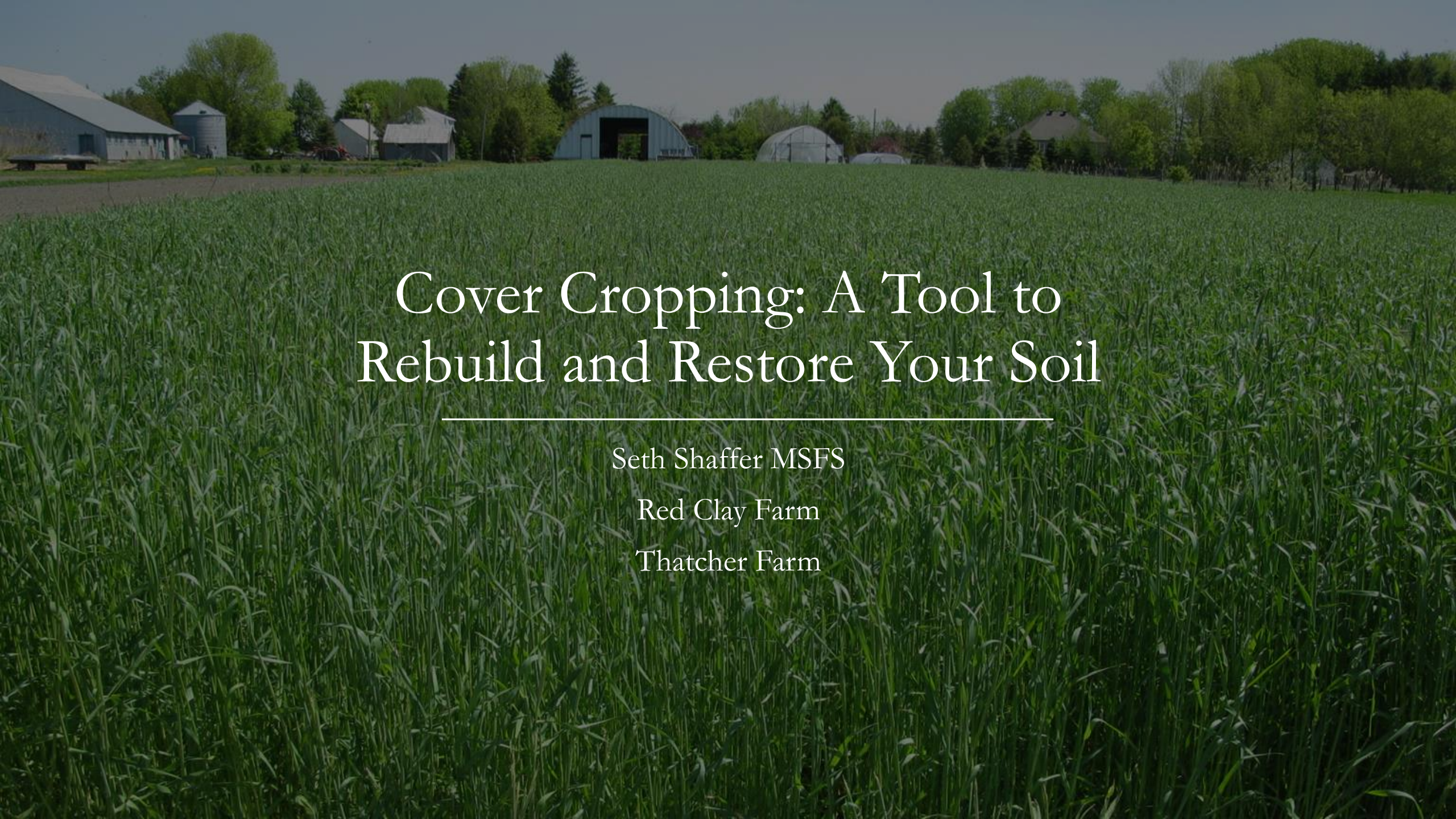


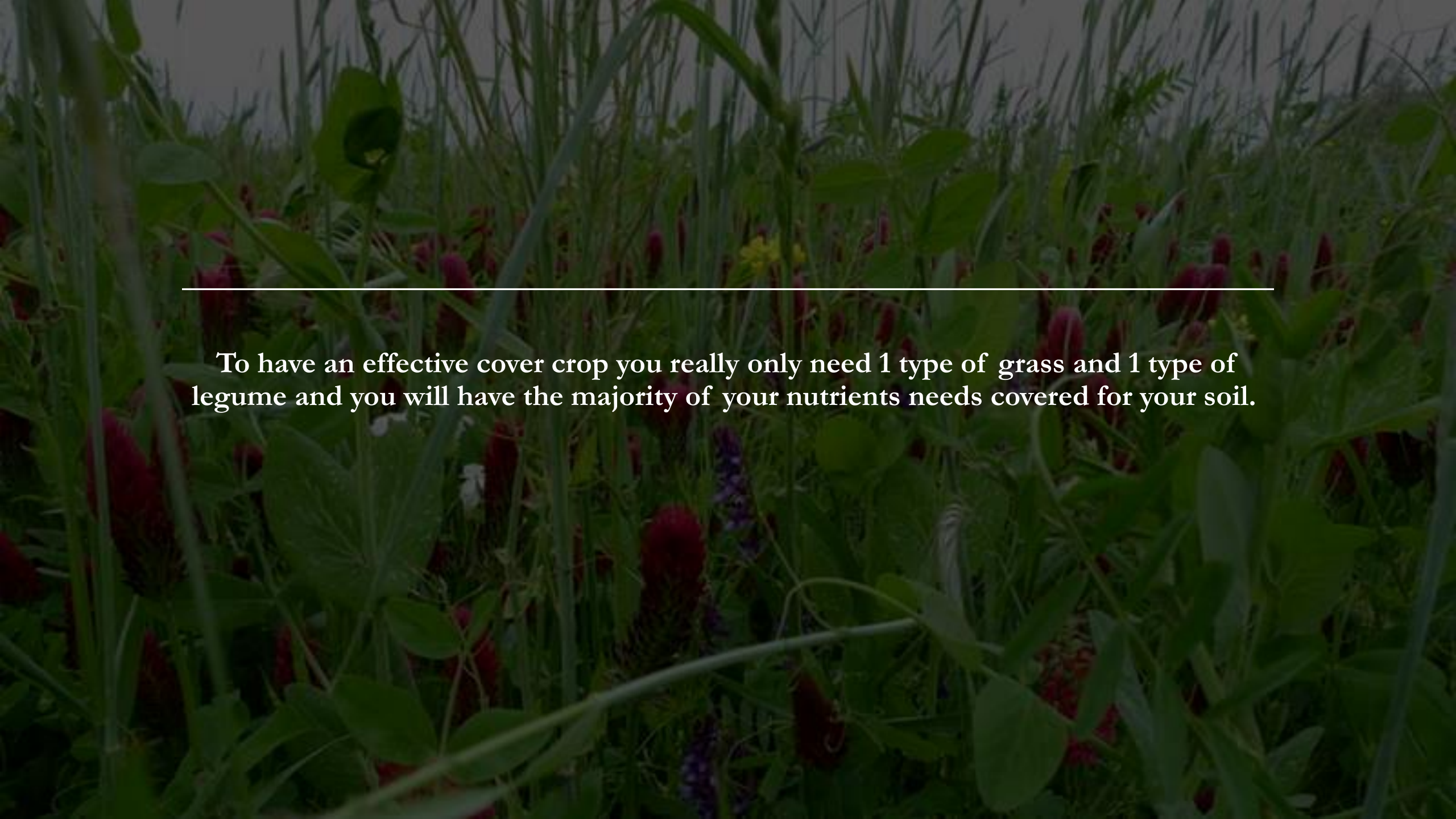
Cover Cropping: A Tool to Rebuild and Restore Your Soil

Seth Shaffer MSFS

Red Clay Farm

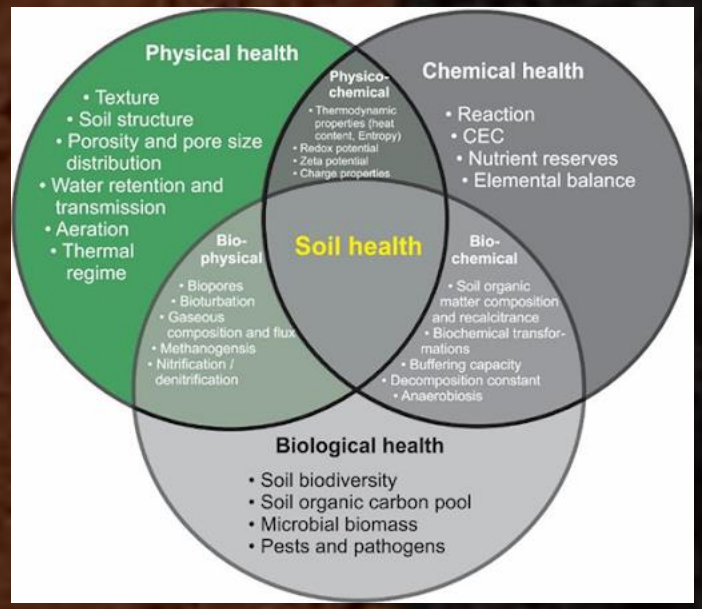
Thatcher Farm

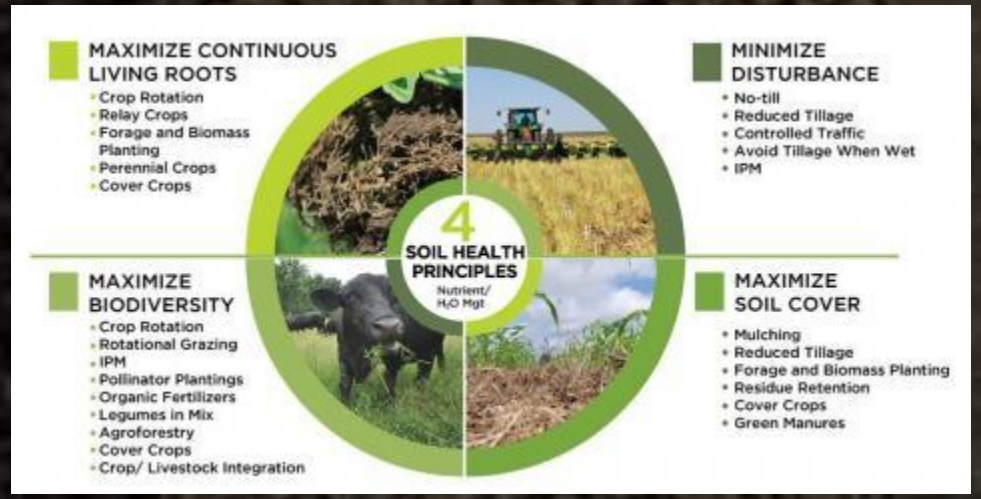

Soil Organic Matter
The Soil Bank
Bank Tellers
Checking Account
Savings Account
Retirement Account
Living organisms <5%
Fresh residue <10%
Stabilized organic matter (humus) 33% - 50%
Decomposing organic matter (active fraction) 33% - 50%



To have an effective cover crop you really only need 1 type of grass and 1 type of legume and you will have the majority of your nutrients needs covered for your soil.

Soil Health





CLAY LOAM SAND SIL

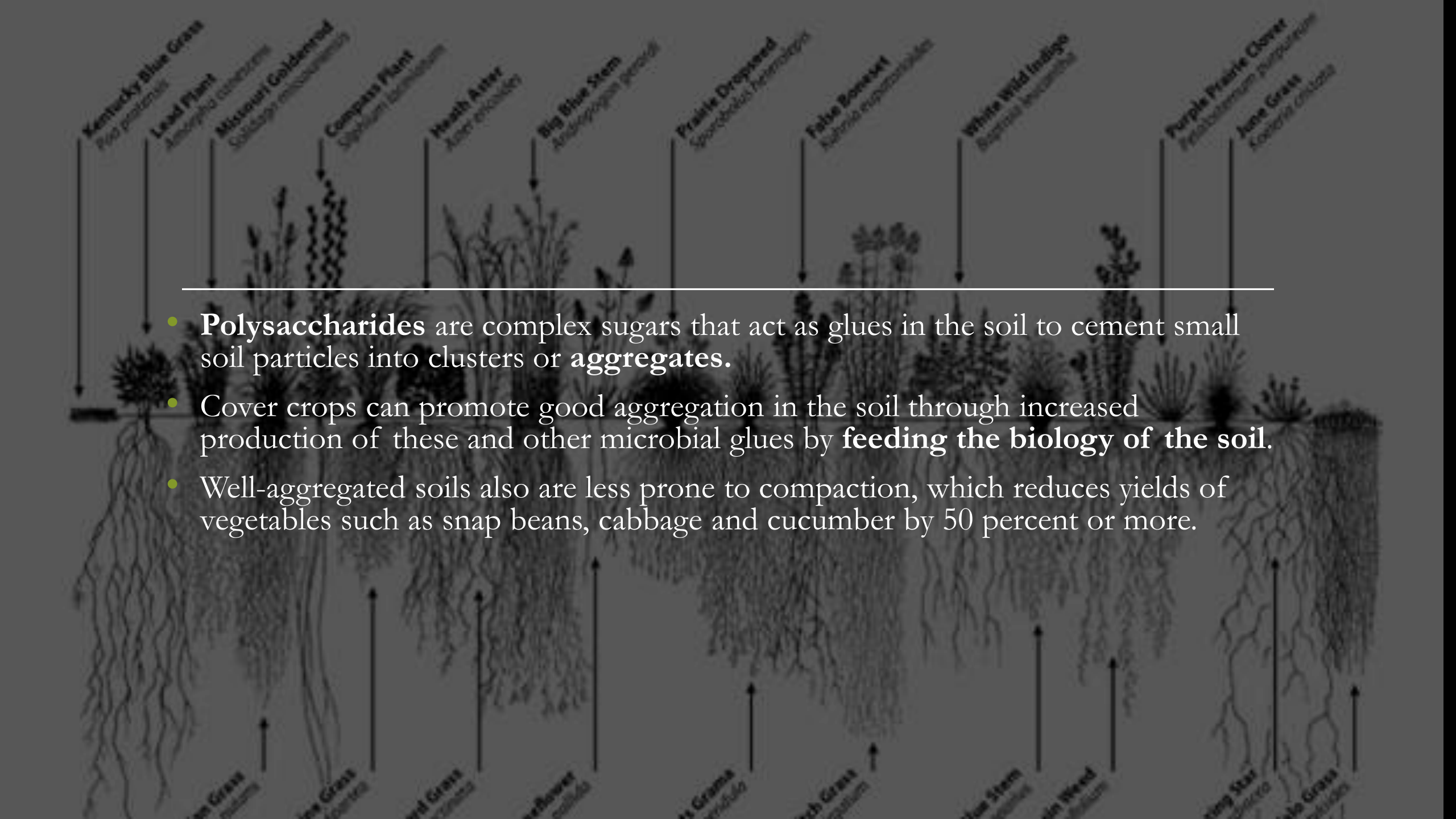
Why use cover crops?

- Cut fertilizer costs
- Reduce needs for herbicides
- Improve yields **OVER TIME**
- Prevent erosion
- Conserve soil moisture
- Protect water quality

- Cover crops are not a 1 stop shop for everything:
- **Clarify** your primary **needs**
- **Identify** the best **time** and **place** for a cover crop in your system
- **Test** a few options.

Cover crops build soil organic matter (OM)

- The benefits include: Improved **soil structure**, increased **infiltration and water-holding capacity**, increased **cation exchange capacity** (the ability of the soil to act as a short-term storage bank for positively charged plant nutrients) and more **efficient long-term storage** of nutrients.



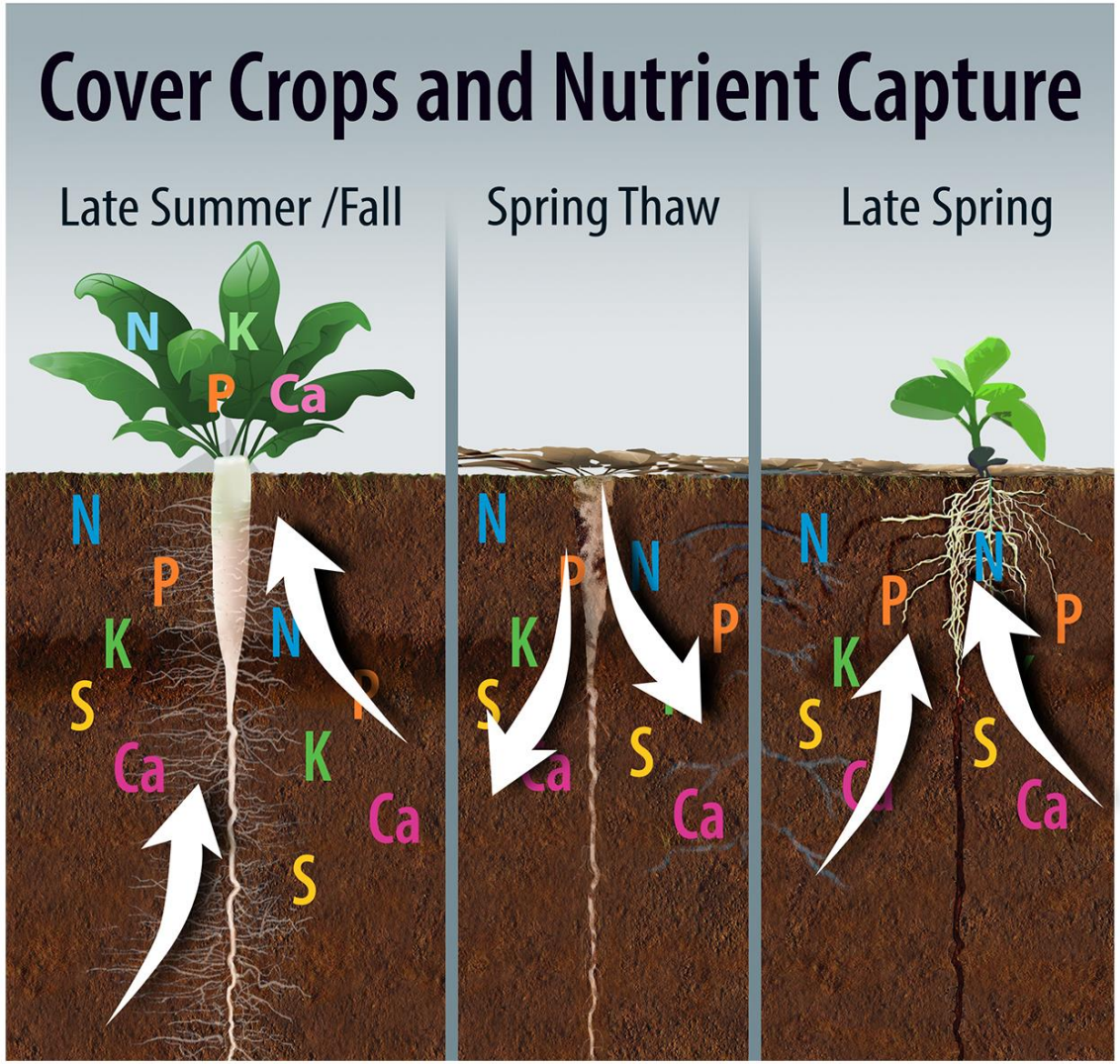
- **Polysaccharides** are complex sugars that act as glues in the soil to cement small soil particles into clusters or **aggregates.**
- Cover crops can promote good aggregation in the soil through increased production of these and other microbial glues by **feeding the biology of the soil**.
- Well-aggregated soils also are less prone to compaction, which reduces yields of vegetables such as snap beans, cabbage and cucumber by 50 percent or more.

- **Plant materials that are succulent and rich** in proteins and sugars (**tillage radishes**) will release nutrients rapidly but leave behind little long-term organic matter.
- **Plant materials that are woodier or more fibrous (Rye, clovers)** will release nutrients slower, but will promote more stable organic matter, or humus, leading to better soil physical conditions, increased nutrient-holding capacity and higher cation exchange capacity.
- By focusing on biology we help the physical and chemical sections of the soil.

- Tillage methods are important considerations when using cover crops to build soil
- *It is difficult to build up organic matter under conventional tillage regimes.*
- Tillage speeds up organic matter decomposition by exposing more surface area to oxygen, warming and drying the soil, and breaking residue into smaller pieces with more surfaces that can be attacked by decomposers

- The resulting loss of organic matter causes the breakdown of soil aggregates and the poor soil structure often seen in over tilled soil.
- Many cover crops are ones you can seed into growing crops or no-till plant into crop residues.

Cover Crops and Nutrient Capture

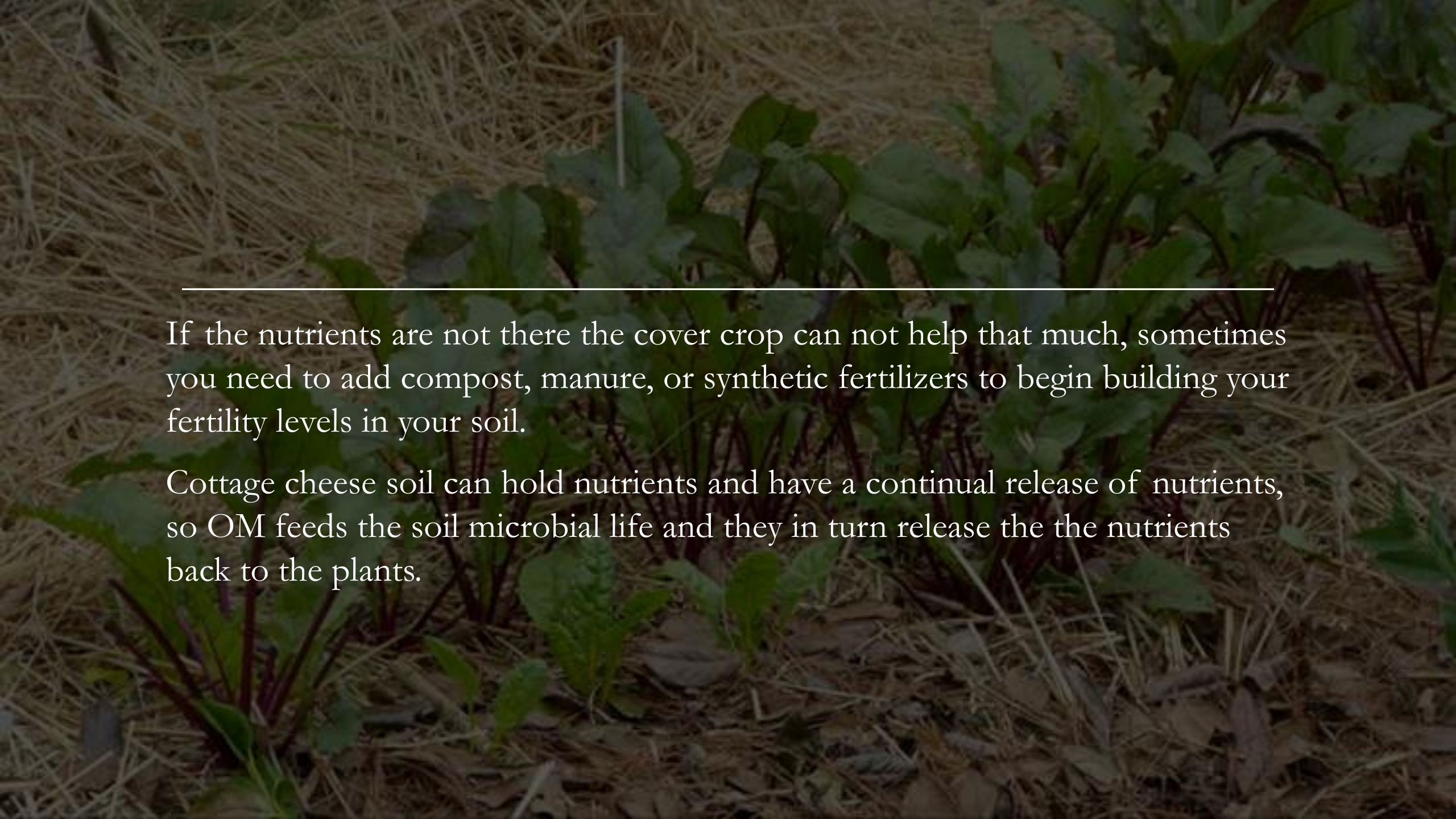


Cover crops can increase the amount of nutrients available for the next crop by taking up nutrients that remain in the soil and holding them in plant tissue until they are released the next spring, when they can be used by the following crops. *Courtesy: Cover Crop Solutions*

- Cover crops reduce nitrate leaching in two ways:
- They soak up available nitrate for their own needs
- They also use some soil moisture, reducing the amount of water available to leach nutrients.
- For much of the continental U.S., cereal rye is the best choice for catching nutrients after a summer crop.

What to do if Cover Crops tie up Nutrients?

- Are you sure the nutrients are there to begin with? How do you know there is deficiency?
- Wait a few weeks after incorporating the cover so the carbon in the cover crop can be broken down and the nutrients will become available to the following crop.
- Supply another source of fertilizer preferably in liquid form as a foliar application.



If the nutrients are not there the cover crop can not help that much, sometimes you need to add compost, manure, or synthetic fertilizers to begin building your fertility levels in your soil.

Cottage cheese soil can hold nutrients and have a continual release of nutrients, so OM feeds the soil microbial life and they in turn release the the nutrients back to the plants.

What we want to do is add **biology** to the soil, we want to make sure that we have living roots and soil that is well aggregated so that our crops can access the nutrients. Between the microrisal fungi and other macro organisms in the soil they will help break down the organic matter and make sure that nutrients are available for the crops over time.

VEGETABLE CROP ROTATION WITH COVER CROPS

- Identify your need
- Provide nitrogen
  - Add organic matter
  - Improve soil structure
  - Reduce soil erosion
  - Provide weed control
  - Manage nutrients
  - Furnish moisture-conserving mulch

- Vegetable systems have many windows for cover crops
- 1-2 months between harvest and planting can be filled with buckwheat, cowpeas, sorghum-sudangrass
- Many vegetable crops can be overseeded with a cover crop that will continue to grow after the vegetable harvest.
- Select cover crops that tolerate shade and harvest traffic, especially where there will be multiple pickings.

Spring Summer Covers

- Buckwheat – $30-40/A
- – Weedsuppression
  – Fastgrowing
  – Easytokill
  – Killbeforeseedproduction
- • SorghumxSudangrass – $25-35/A
- – Weedsuppression
  – Highbiomassproduction – Canbeusedasforage
  – Winterkills
  – Nscavenger

Spring Summer Covers

- Hairyvetch – $35-75/A
- – Nproducer(90-200#) – Weedsuppression
  – Soilbuilder
- • Berseemclover – $20-40/A
- – Weedsuppression
  – Nproducer(75-220#) – WinterKills
  – Frostsusceptible

Fall/Winter covers

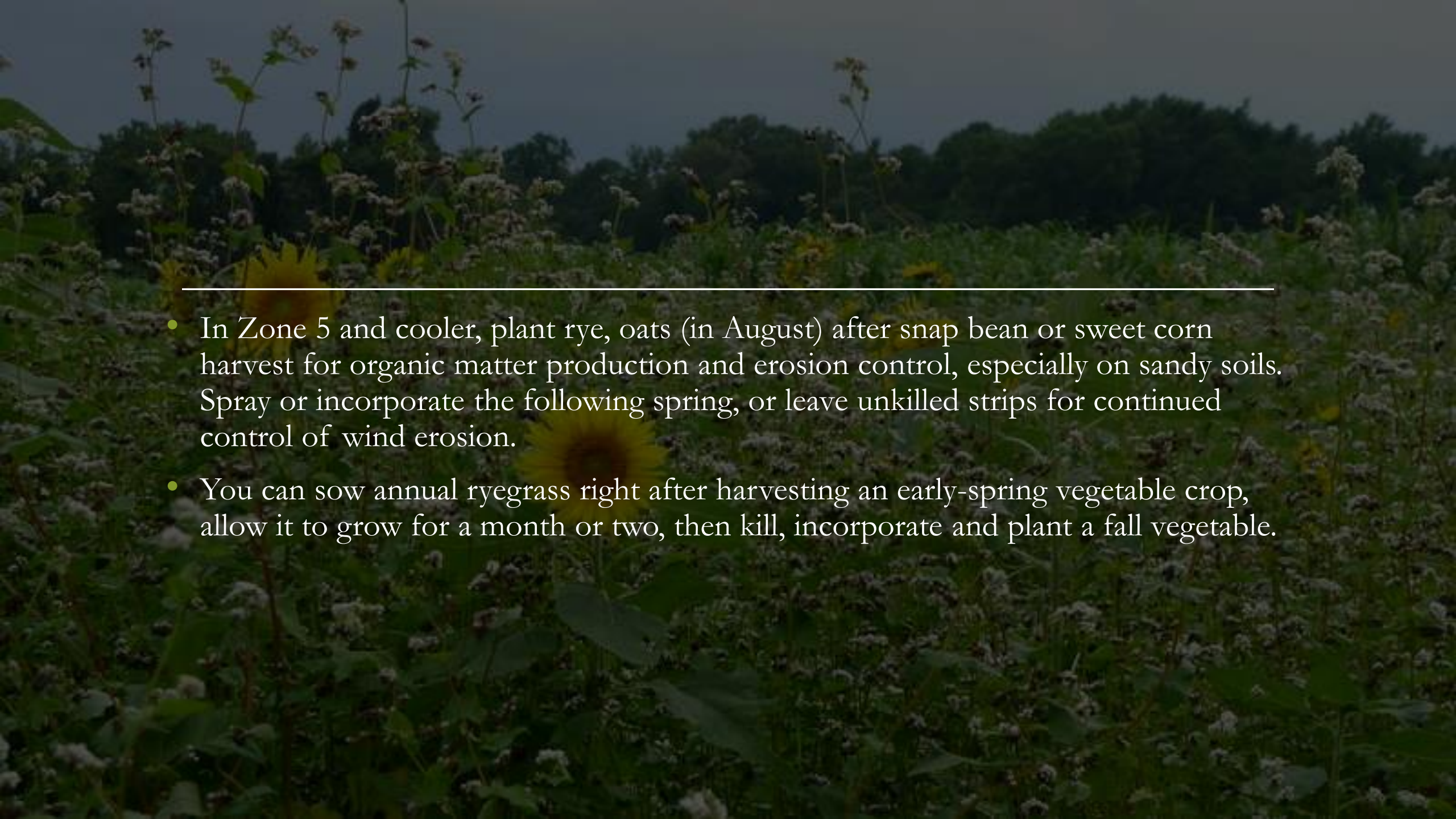
- Oats
  – $25-35/A
- – Quickgrowth
  – Nscavenger
  – Weedsuppression – Winterkills
- • CerealRye – $25-35/A
- – Weedsuppression
  – Durableresidueforno-tillplanting – Highbiomassproducer
  – Nscavenger

Fall/Winter covers

- Tillageradish – $25-30/A
- – Weedsuppression
  – Winterkills
  – Potentialbiofumigant
  – Nscavenger
  – Plantlaterinfall
  – Increaseearthwormactivity
- – Breakcompaction

Fall/Winter Covers

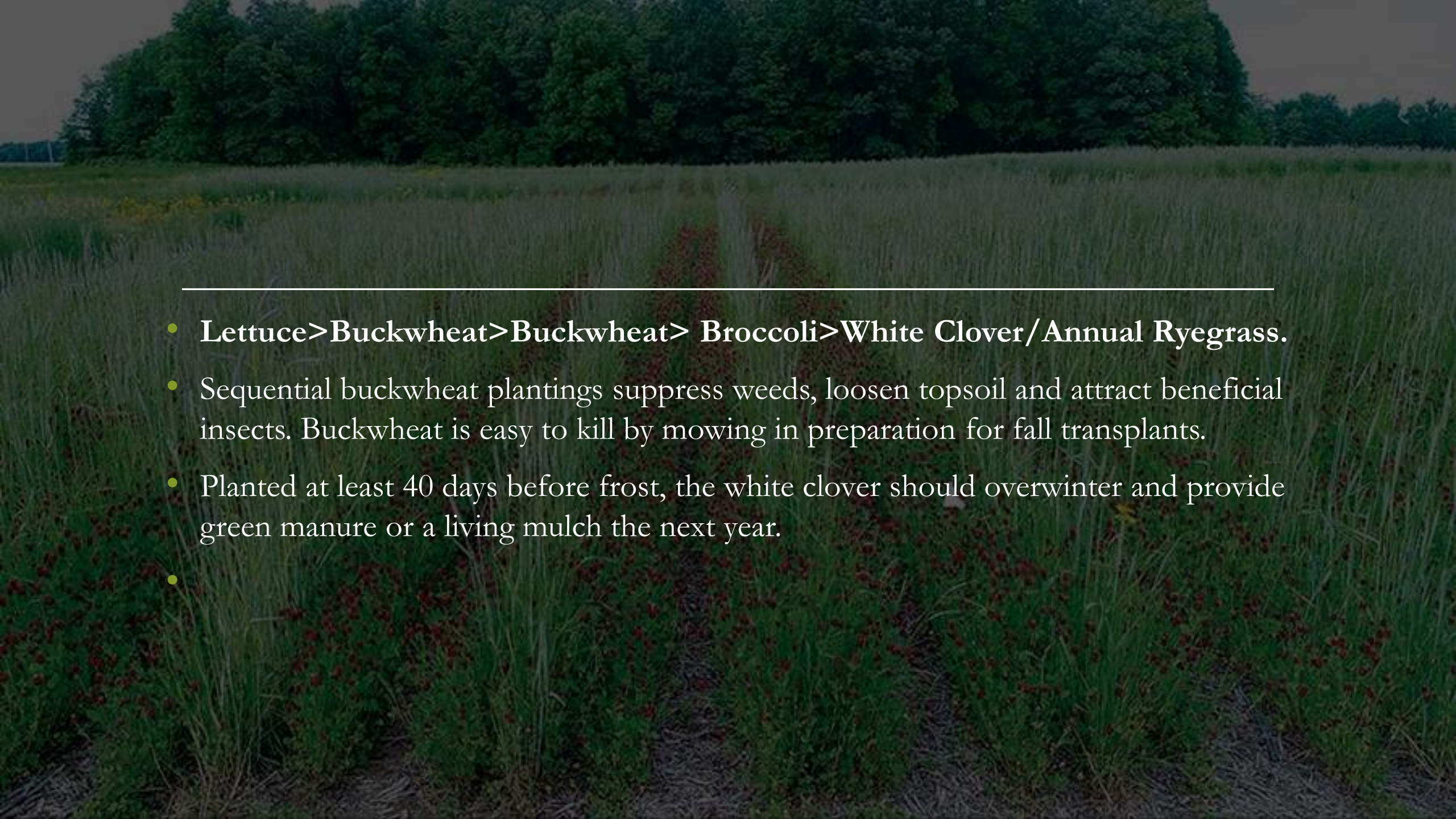
- AustrianWinterPeas – $50-75/A
- – Nproducer90-150lbsN
  – Weedsuppression
  – Quickgrowth
  – Winterkills(dependsontemperatureandsnowcover)
- • Wheat
  – $20-30/A
- – Nscavenger
  – Potentialascashcrop/forage – WeedSuppression
  – SoilBuilder



- In Zone 5 and cooler, plant rye, oats (in August) after snap bean or sweet corn harvest for organic matter production and erosion control, especially on sandy soils. Spray or incorporate the following spring, or leave unkilled strips for continued control of wind erosion.
- You can sow annual ryegrass right after harvesting an early-spring vegetable crop, allow it to grow for a month or two, then kill, incorporate and plant a fall vegetable.

Examples of Covers Included in crop Rotations

- **Winter Wheat/Legume Interseed> Legume>Potatoes**
- This rotation conditions soil, helps fight soil disease and provides N. Sufficient N for standard potatoes depends on rainfall being average or lower to prevent leaching that would put the soil N below the shallow-rooted cash crop.



- **Lettuce>Buckwheat>Buckwheat> Broccoli>White Clover/Annual Ryegrass.**
- Sequential buckwheat plantings suppress weeds, loosen topsoil and attract beneficial insects. Buckwheat is easy to kill by mowing in preparation for fall transplants.
- Planted at least 40 days before frost, the white clover should overwinter and provide green manure or a living mulch the next year.
-

Cover crops based on the seasons

- When doing a multispecies cover crop blend you want at least 2 species, a legume and a grass. These two will provide most of the nutrients your following crop will need.
- This last fall I put down, peas, radish, rye, turnip, and wheat in a blend on my fields.
- I wanted the biomas, weed suppression that wheat and rye would give me, I needed the nitrogen that the peas give and the radishes ability to hold the N, and the compaction breaking abilities of the radish, turnip and rye.

Biofumigation

- **Biofumigation** is based on the incorporation of fresh plant mass into the soil, which will release several substances able to suppress soil-borne pests/weeds
- Mustard plants contain chemicals called glucosinolates. When the tissue of a mustard plant is destroyed, these compounds are broken up into a variety of chemicals, including some that form gases with activity against various soil borne pests.
- Biofumigation reduces weed competition and soil-borne pathogens and is a suitable tool for soil disinfection.

Cation Exchange Capacity(CEC)

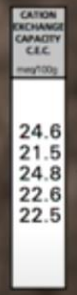
- Cation exchange capacity (CEC) is a measure of the soil's ability to hold positively charged ions. It is a very important soil property influencing soil structure stability, nutrient availability, soil pH and the soil's reaction to ~~fertilizers and other amendments.~~
- CEC refers to how many charged 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.

Terminating Covers

- What is your end goal with the cover crop?
- Termination methods:
- Chemical Burn down
- Mowing
- Tillage
- Crimping


7330

Terminating a cover crop

- Crimpers can be front or PTO mounted on the tractor
- The roller kills the cover crop by breaking (crimping) the stems. The crimping action aids in cover crop desiccation.
- Blunt blades are used to crimp the cover crop. This is preferable to sharp blades that would cut the cover crop and dislodge residue that might interfere with seed soil contact at planting.
- The cover crop is rolled down parallel to the direction of planting to form a dense mat on the soil surface, facilitating planter operation and aiding in early season weed control.
- When using a roller alone for cover crop termination, best results are obtained when rolling is delayed until flowering stage or later.

Questions?

- The handout has links to my references which go into much greater detail then I could in 1 hour today.