Soil-health benefits of cover cropping during summer

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Lettuce Advisory Committee

@UFSustainableAg

Acknowledgements

Personnel

- Nathan Lowder, USDA NRCS
- Dennis Chessman, USDA NRCS
- Raju Khatiwada, UF chemist
- Nan Xu, UF graduate student
- Sarah Strauss, UF faculty
- Kelly Morgan, UF faculty
- Chris Miller, UF extension
- Stewart Swanson, UF extension
- Patrick Troy, UF extension

Grower Collaboration

- Tripp Whidden – R.C. Hatton
- Margaret Duriez – Lox Farms
- Derek Orsinego – Growers Management Inc.
- Noah Shitama – Swallowtail Farm
- Sam Glucksman – Hundley Farms
- Kim Yates

What is Soil Health?

It is the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.

- Nutrient Cycling
- Water (infiltration and retention)
- Filtering and Buffering
- Physical Stability and Support
- Habitat for Biodiversity

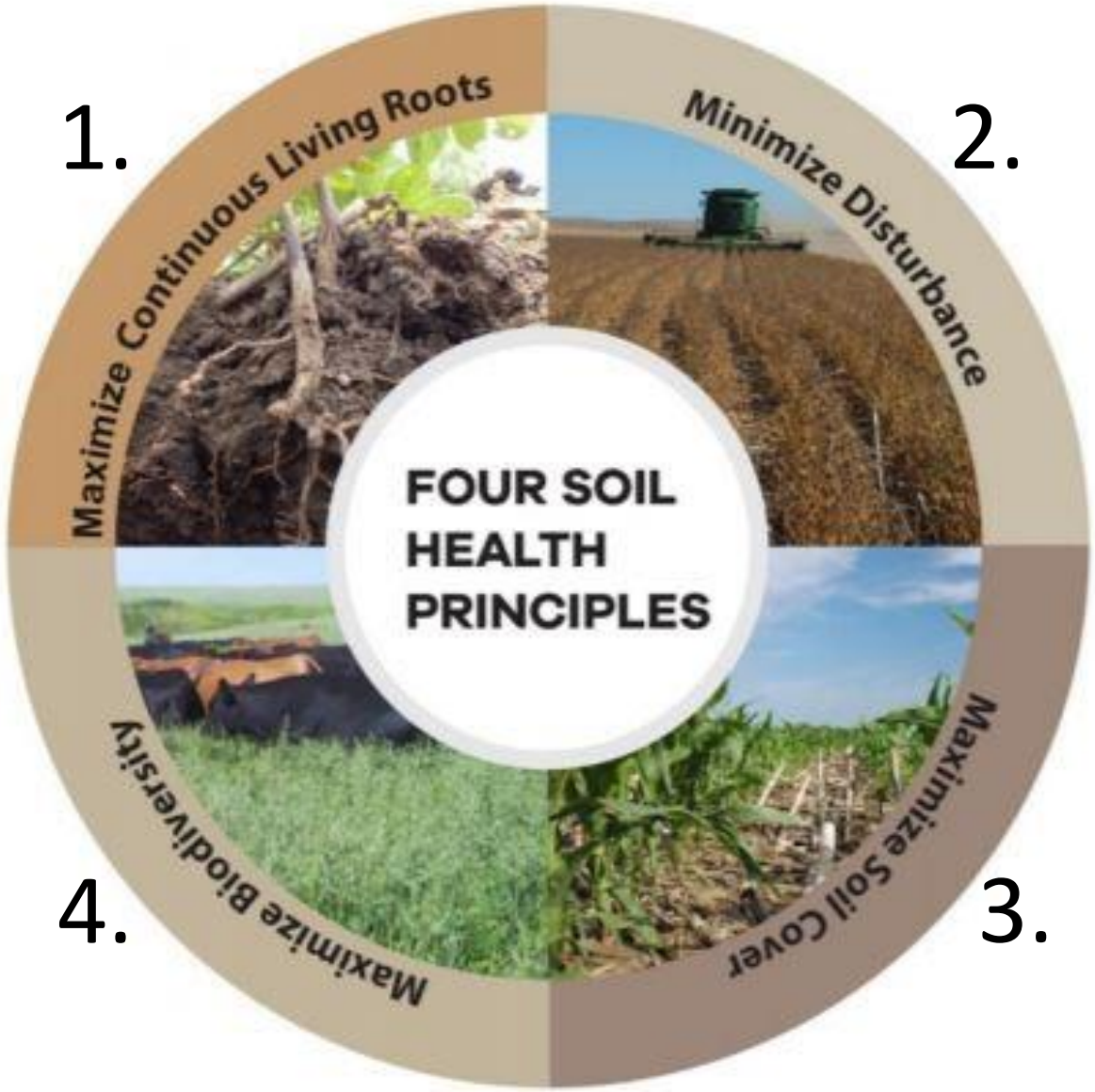


Image courtesy: USDA NRCS

We must view the soils as a house for living organisms. The goal should be to create the most favorable habitat possible for the soil food web.

Soil Health Principle 3.

Keep it covered as much as possible…

Benefits:

1. Controls erosion
2. Protects soil aggregates
3. Suppresses weeds
4. Provides habitat for soil organisms
5. Cools the soils
6. Conserves soil moisture

Enduring Heath Stress

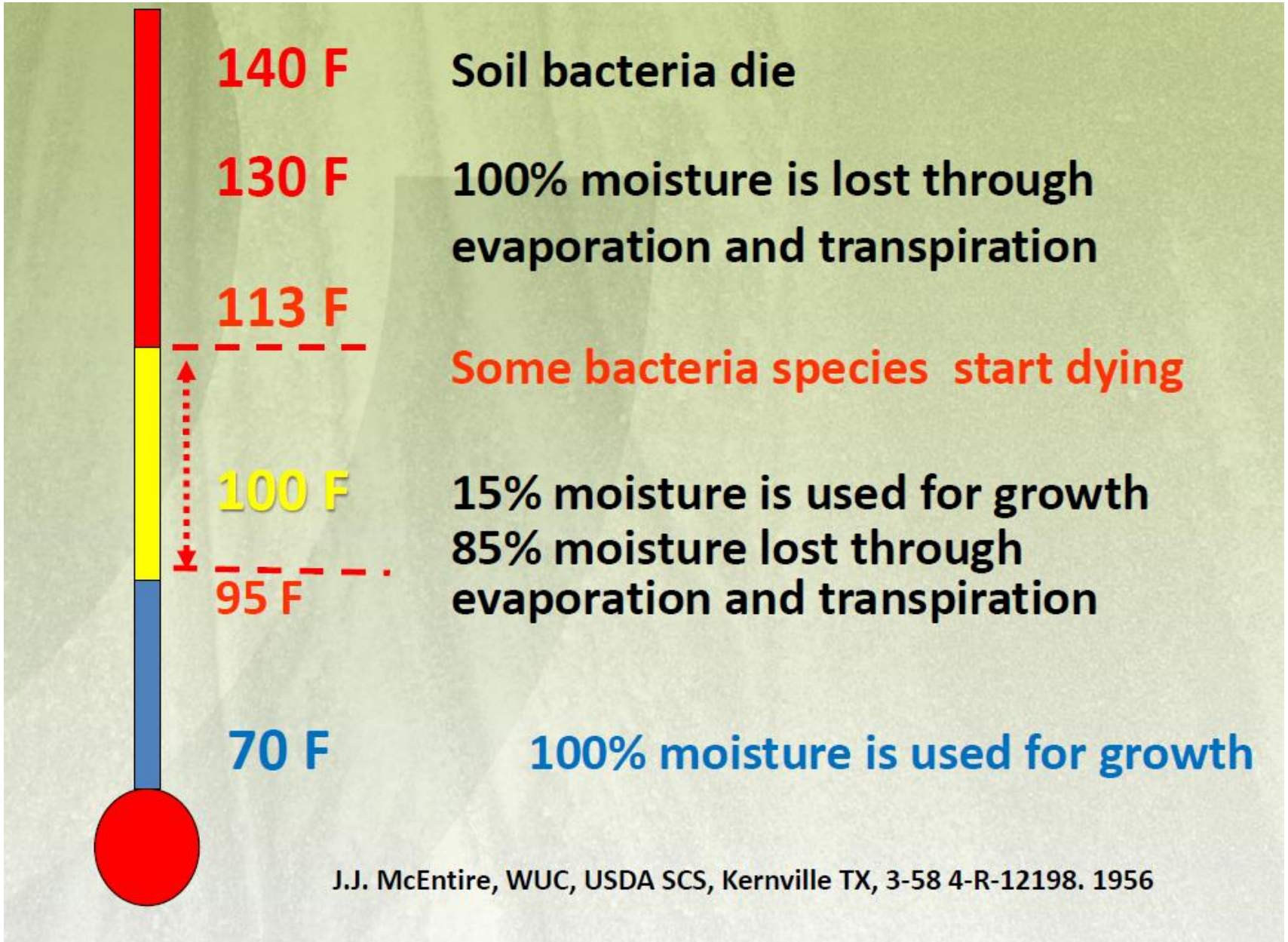


Image Courtesy: Nathan Lowder, USDA NRCS

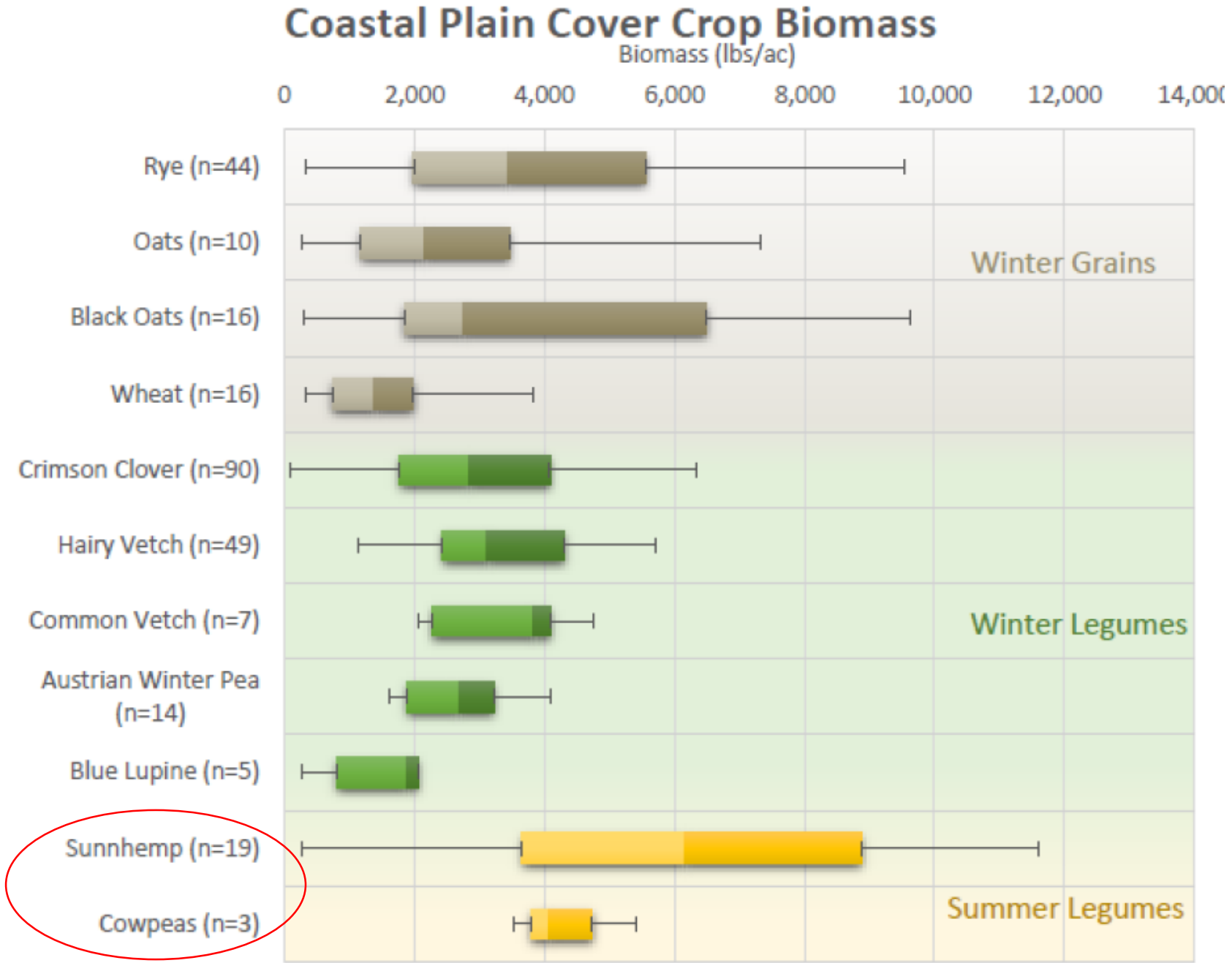
- Reduce temperatures conserve moisture
- Crop yields are limited more often by hot and dry, than cool and wet

Species adapted to Florida

Winter varieties	Summer varieties
Cereals: rye, oat, triticale, ryegrass, wheat	Cereals: Sudan sorghum, Pearl Millet
Legumes: clover, field pea, vetch, lupin	Legumes: Cowpea (clay/iron), Sunnhemp, lupin, vetch, clover, alfalfa
Others: radish, kale, turnip, canola, flax	Others: buckwheat, sunflower, sesame

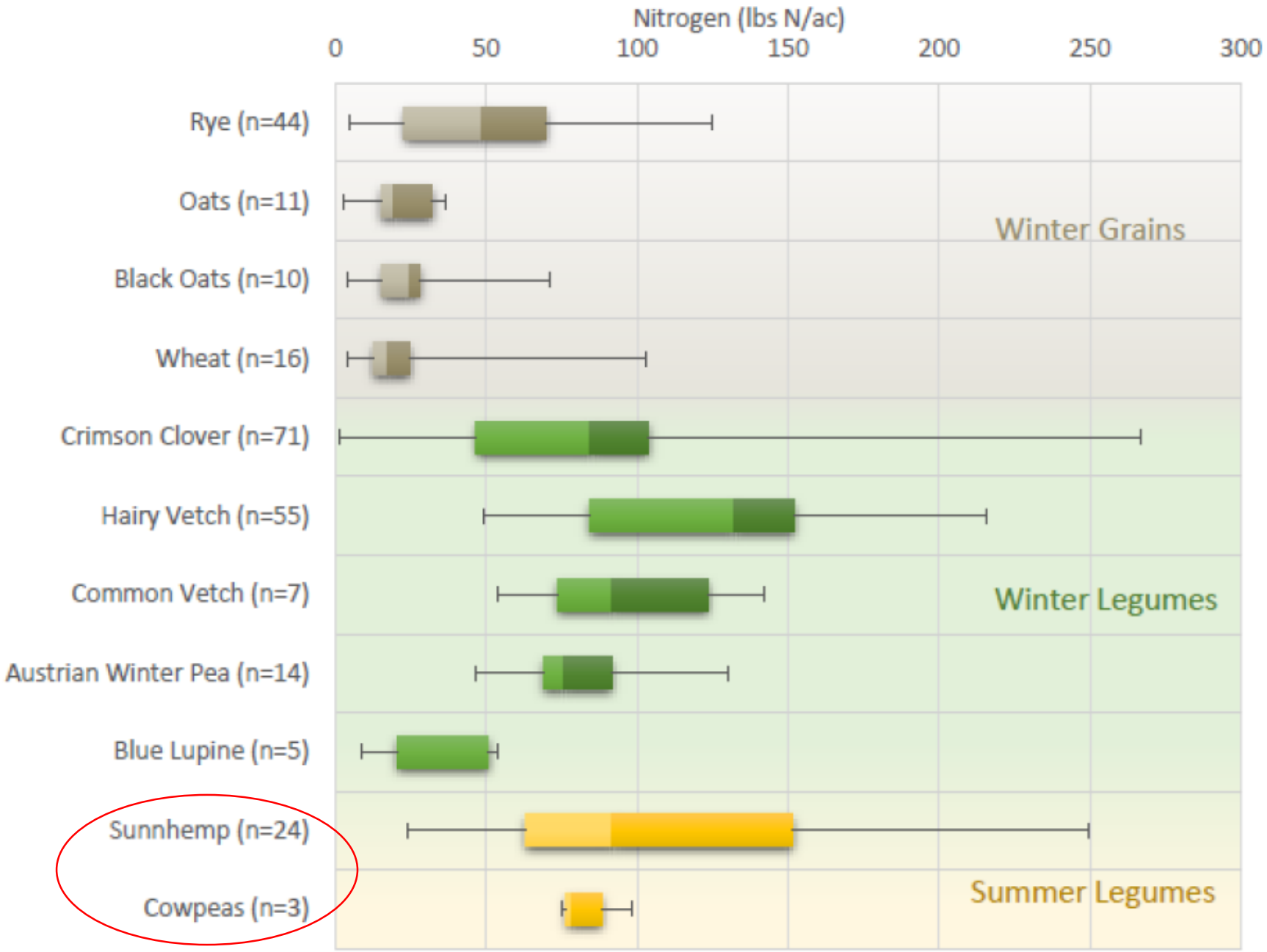
Patrick Troy, 2018

For more information on winter varieties refer EDIS Publication #SS-AGR-84



UGA extension

Coastal Plain Cover Crop Nitrogen (lbs/ac)



Cowpea (*Vigna unguiculata*)

Nitrogen fixing nodules

Farming in the EAA

Year 1

Planting →

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

(Plant cane)

Year 2

Harvest

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

(First ratoon)

Year 3

Harvest

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

(Second ratoon)

Year 4

Harvest

Fallow →

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

Plant sweet corn, leafy greens, beans, radishes

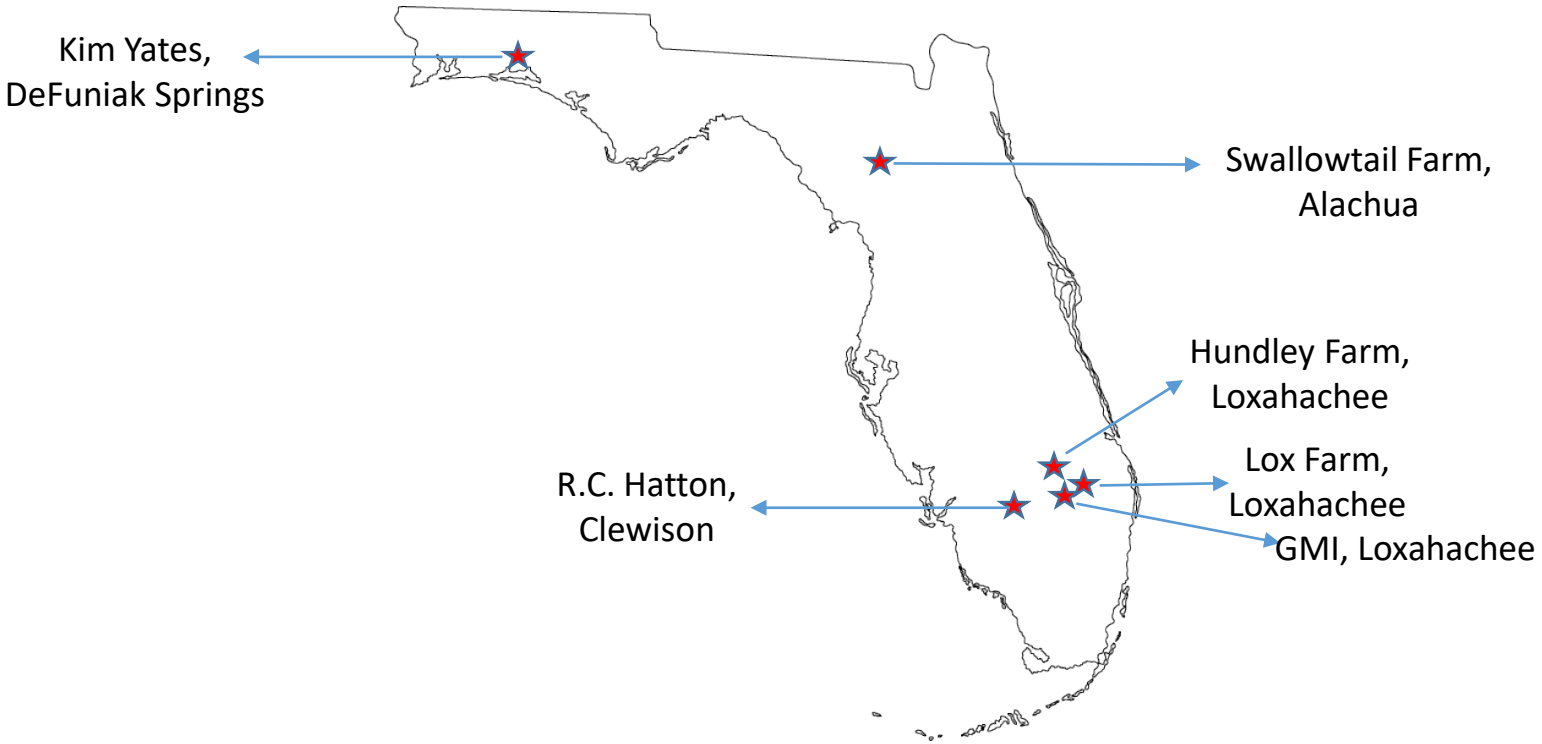
Plant rice

Lettuce
cabbage
celery

On-farm Research Grant through Southern SARE

Title: 'Assisting vegetable growers in Florida with soil health evaluation associated with cover cropping/green manure practice during summer.'

- Six collaborative growers (R.C. Hatton, GMI, Hundley Farms, Swallowtail Farm, Lox Farms, Kim Yates)



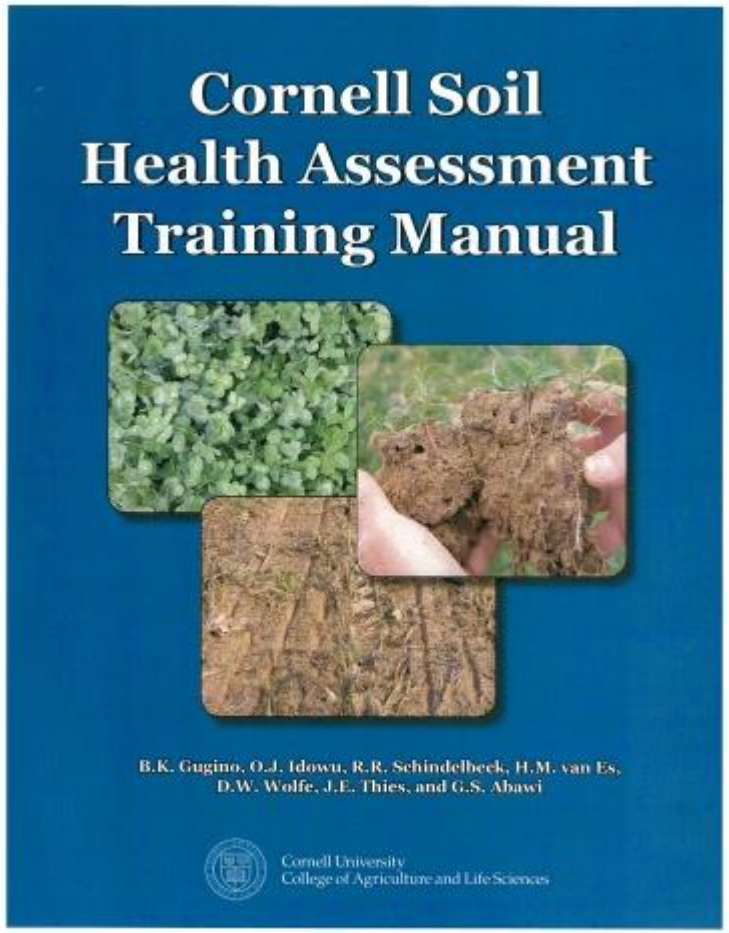
Method

- Our plan is to collect multiple soil samples (0-6 in) from minimum six locations before and after summer cover crop.
- Up to ten soil health indicators will be tested to evaluate percent change in properties.
- Information will discussed with the growers individually, and later summarized and presented to all.

In 2017, the Soil Health Institute endorsed 19 soil health measurements that would help accelerate agricultural transformation:

- organic carbon √
- pH √
- water-stable aggregation
- crop yield
- texture
- penetration resistance
- cation exchange capacity √
- electrical conductivity
- nitrogen √
- phosphorus √
- potassium √
- carbon mineralization √
- nitrogen mineralization
- erosion rating
- base saturation
- bulk density √
- available water holding capacity √
- infiltration rate
- micronutrients

SOIL HEALTH INSTITUTE



SOIL HEALTH INDEX

Scoring function between 0 to 100 by estimating the cumulative normal distribution (CND) function.
Overall scores were calculated in two ways – first based on average of all the scores; and alternatively excluding nutrient scores (M3P, M3K, TKN and TP).

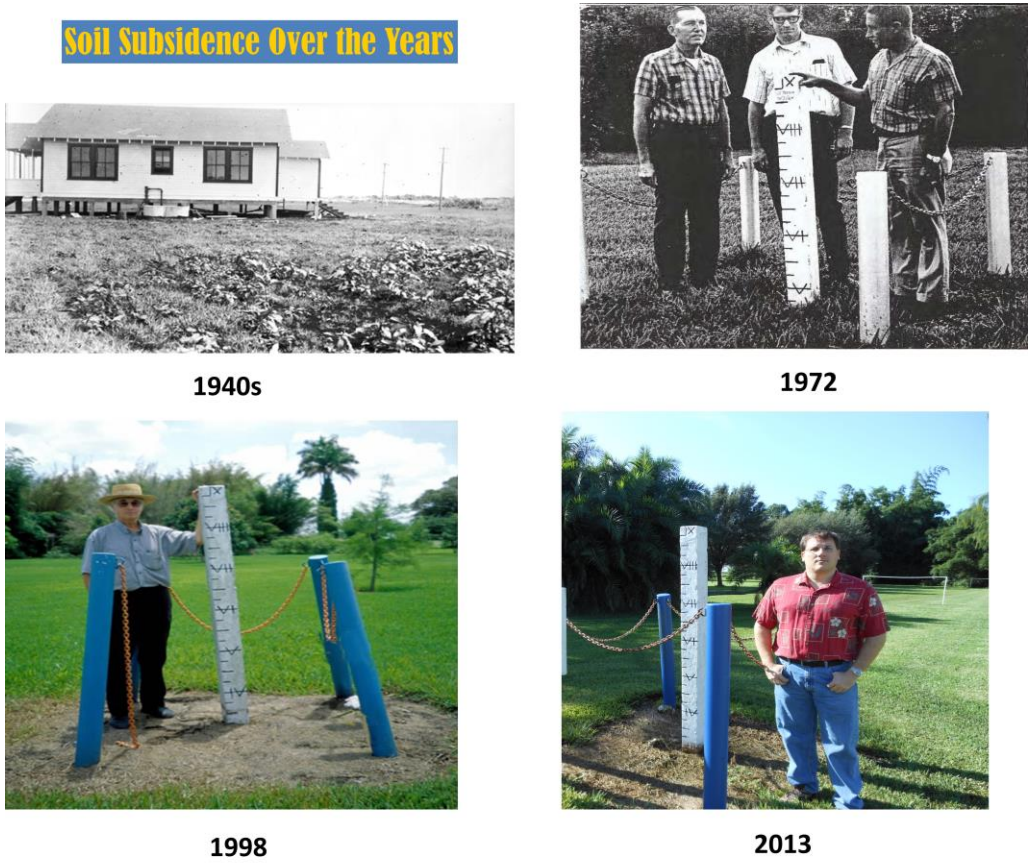
Soil Testing and Analyses

Soil tests will be conducted at the University of Florida- Soil, Water, Nutrient Management Laboratory located in Belle Glade, Florida. Up to nine different soil health indicators will be evaluated. These include:

1. **pH** which will be determined using 1:10 soil/water extract using Accumet AB250 pH meter.
2. **Bulk Density** which will be determined by measuring soil mass in the known core volume.
3. **Maximum Water Holding Capacity** which will be determined using modified method described by Jenikson and Powlson (1976) measuring amount of water retained in soil after saturation.
4. **Cation Exchange Capacity** which will be based on exchangeable ammonium using neutral ammonium acetate exchange method (Chapman, 1965)
5. **Organic Matter Content** which will be determined based on loss on ignition (LOI) at 550 °C.
6. **Active Carbon** which will be determined based on potassium permanganate oxidizable carbon.
7. **Total P** which will be determined by ashing technique followed by extraction with 6 M HCl and analyzed with ICP.
8. **Extractable P and K** which will be determined based on Mehlich-3 extraction technique analyzed using ICP.
9. **Total Kjeldahl N** which will be determined by digestion followed by colorimetric determination (EPA method 351.2).
10. **Protein** which will be determined using sodium citrate extraction followed by colorimetric BCA method

Relevance of ‘soil health’ to the region

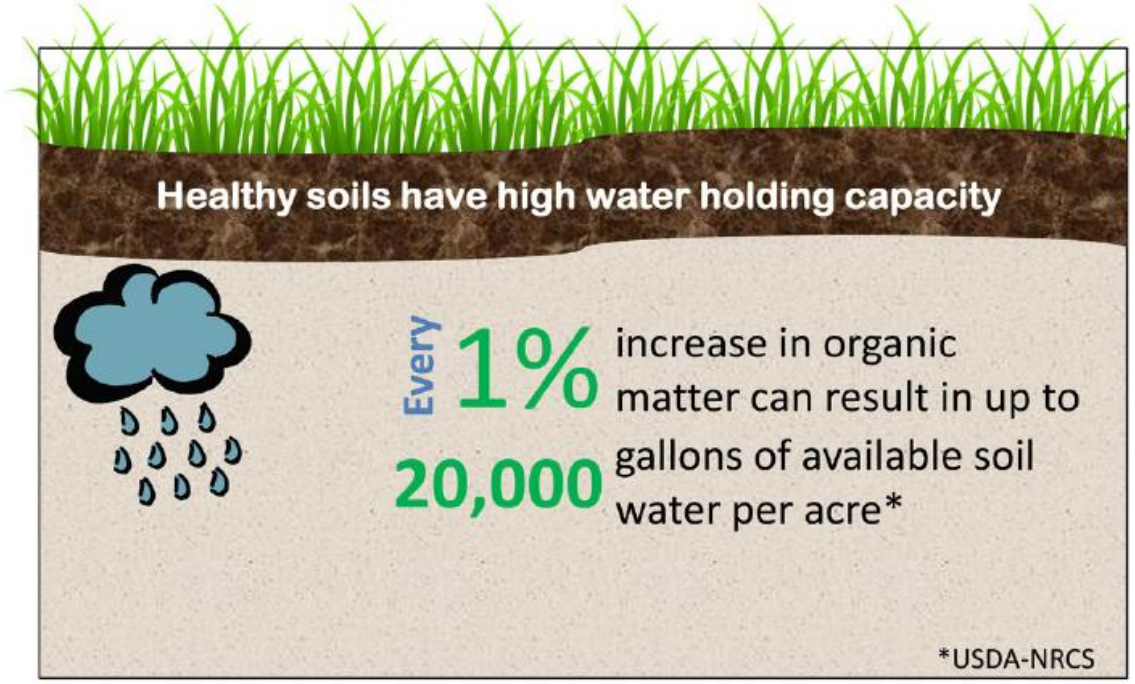
Muck/Organic Soil



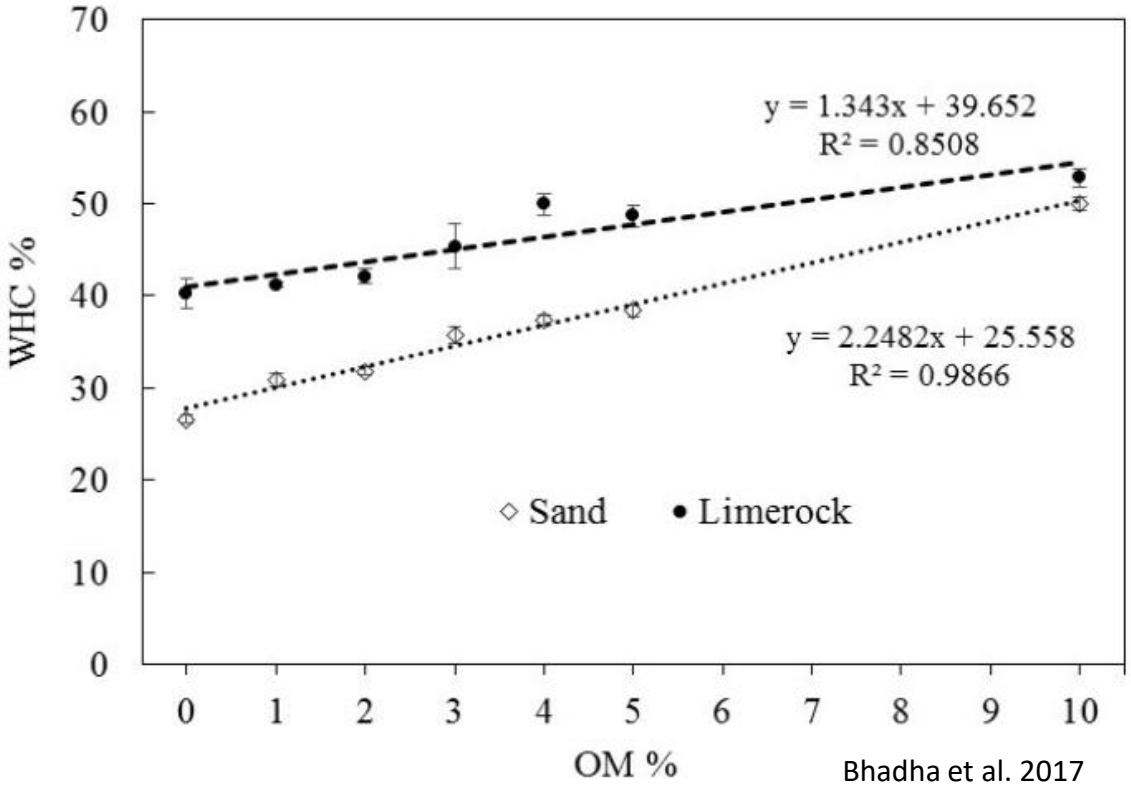
Mineral/Sandy Soil

Less than 3% OM
Low in micro nutrients
Low water holding capacity

Raising Soil Organic Matter Content to Improve Water Holding Capacity



Healthy soils with high OM will equate to higher water holding capacity



Bhadha et al. 2017

Changes in maximum water holding capacity of sand and limerock with percent increase in soil OM

Thank you!

Request – Please reach out to me if your summer program involves **cover crops** OR application of **organic soil amendments**, glad to discuss and evaluate it for you.

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