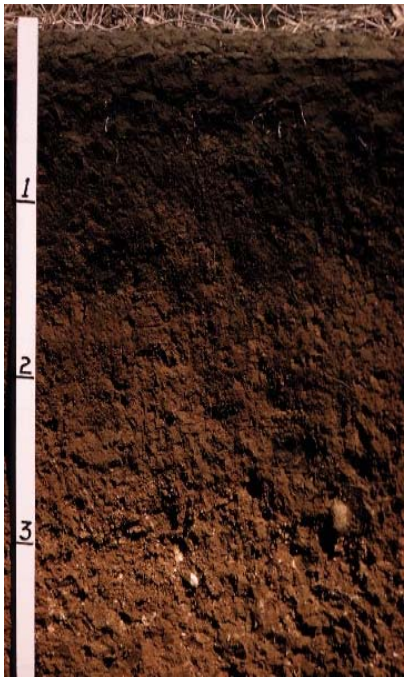
Benefits of Integrated Crop-Livestock Systems on Soil Health



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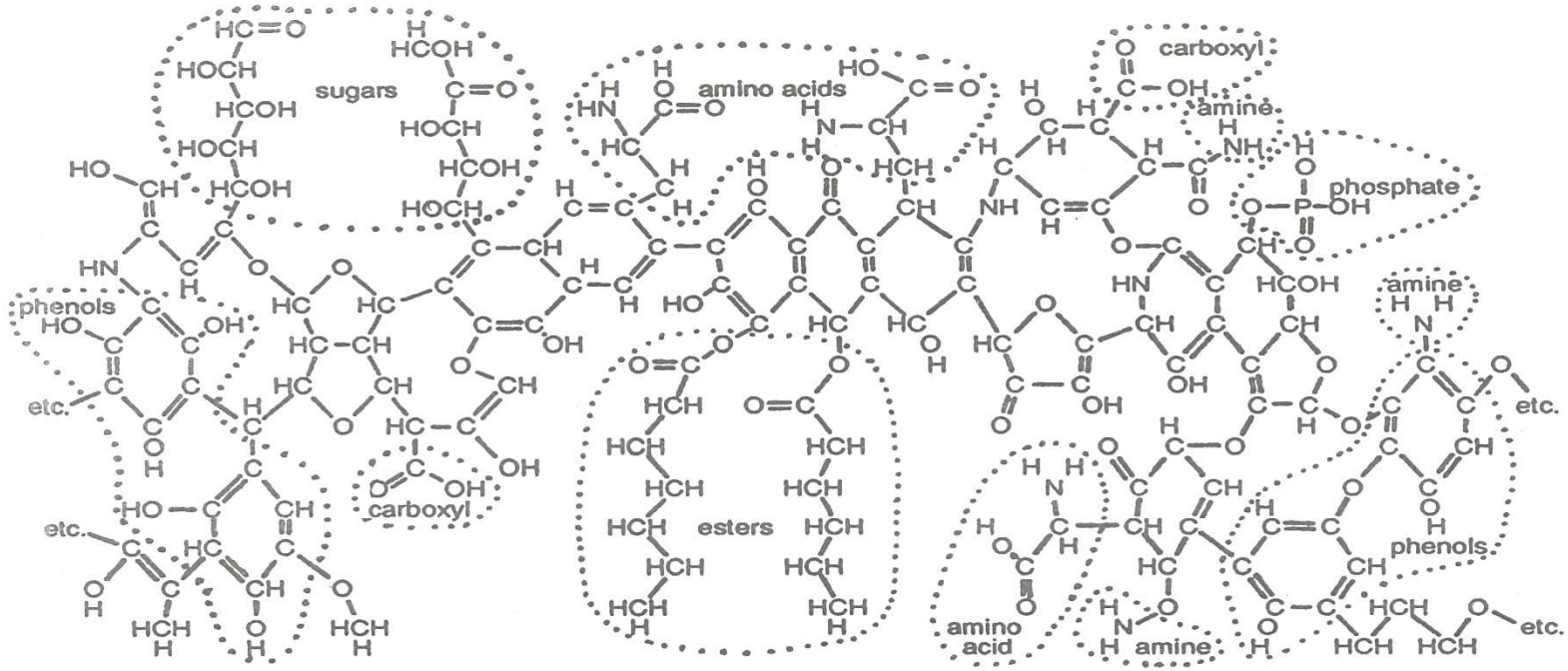
Functions of Soil Health

- Key functions
  - Productivity
  - Nutrient cycling
  - Holding water for plant use
  - Filtering soil contaminants
  - Withstanding erosion

What is Organic Matter?

- Decomposed plant and animal residues.
- Organic compounds manufactured by soil microorganisms.
- Stuff that leaks out of plant roots.

Organic Matter Structure



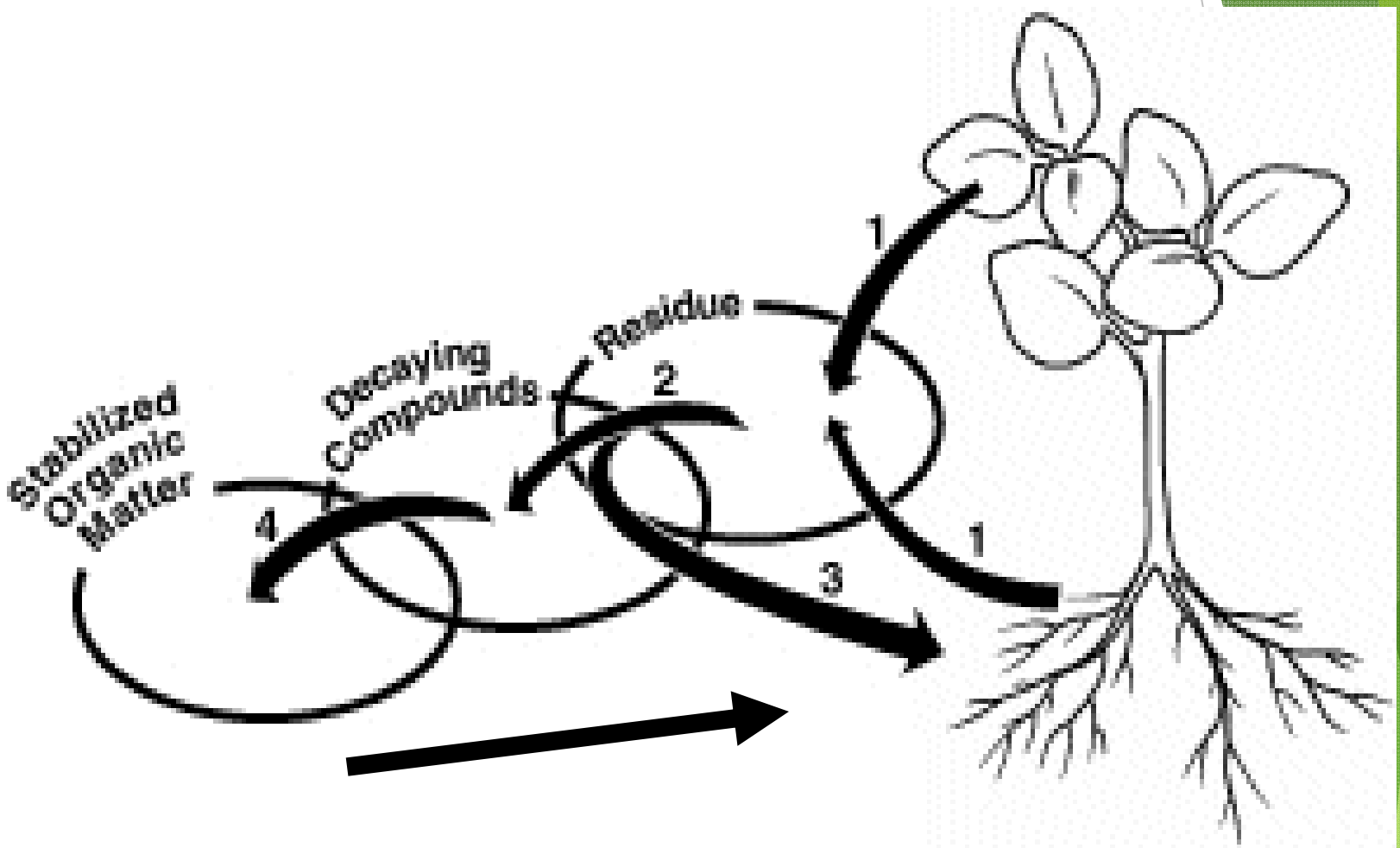
What Does Organic Matter Do?

- Reservoir for plant nutrients (nutrient source).
- Glue to hold soil mineral particles together (aggregation).
- Sponge for nutrients passing in soil water (absorbant).

Organic Matter as a Nutrient Reservoir

- "Revolving Bank Account"
  - Contains all essential plant nutrients
  - Storehouse for plant nutrients
  - Releases plant-available nutrients upon decomposition
  - Absorbs and holds plant available nutrients.

The “Bank Account”



Nutrient Source

- Nitrogen (N), phosphorus (P) and sulfur (S) are part of soil organic matter compounds.
- All are required by both plants and soil microbes.
- Microbes also need carbon (C) compounds as energy sources to survive (sugars, starches, cellulose, etc.)

Nutrient Source

- As the microbes go through the life cycle they may excrete plant available mineral nutrients.
- Or, when they die they decompose and release the N, P, K.

Nutrient Mineralization

- Microbial activity is primarily influenced by N content of residues.
- Microbes need N to build cellular protein.
- Microbes will utilize soil mineral N before plants can.
- Crop yellowing after incorporation of heavy residues – N deficiency.

How Can We Increase Soil Organic Matter?

- Increasing C inputs into soil.
- Decreasing C losses from soil

Decreasing C Losses (or Increasing C inputs)

- Growing High Residue Crops
- Reducing Tillage
- No-Till
- Continuous Cropping
- Cover Crops

Recent Studies at DREC

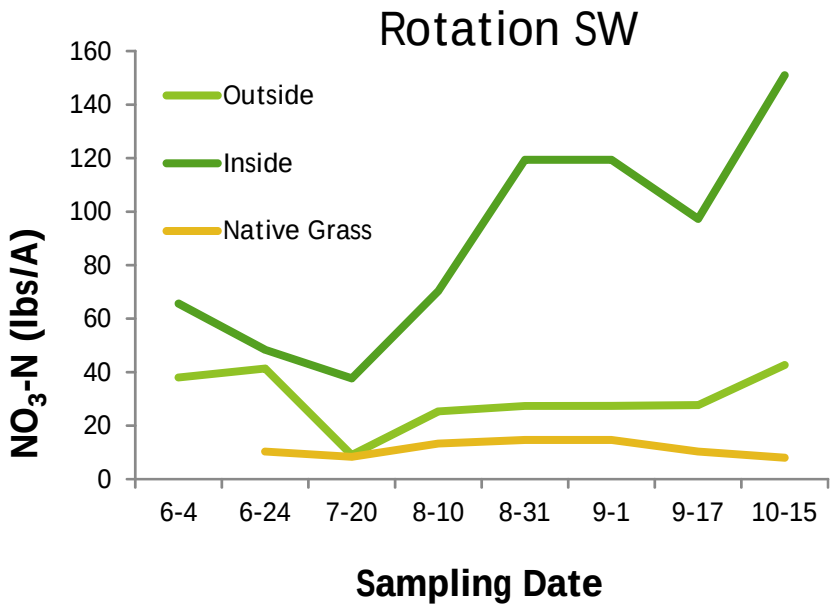
- Crop sequence:
  - Spring wheat (continuous)
  - Spring wheat (Rotation)
  - Triticale/hairy vetch cover crop (grazed or hayed)
  - Field pea/ barley (hayed/grazed)
  - Corn (grazed in field)
  - Sunflower (grain)

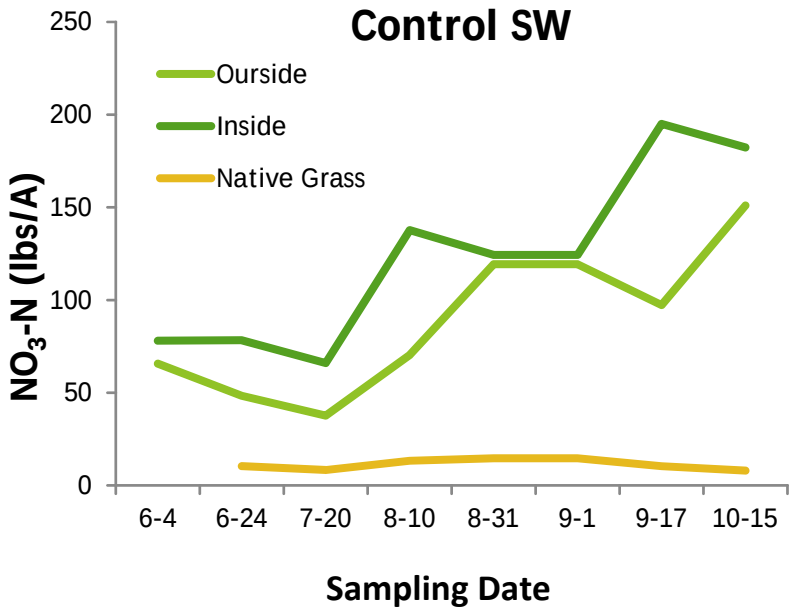
Recent Studies at DREC

- Integrated cropping system with grazing study.
- Comparison of continuous hard red spring wheat with spring wheat in a diverse system.

Recent Studies at DREC

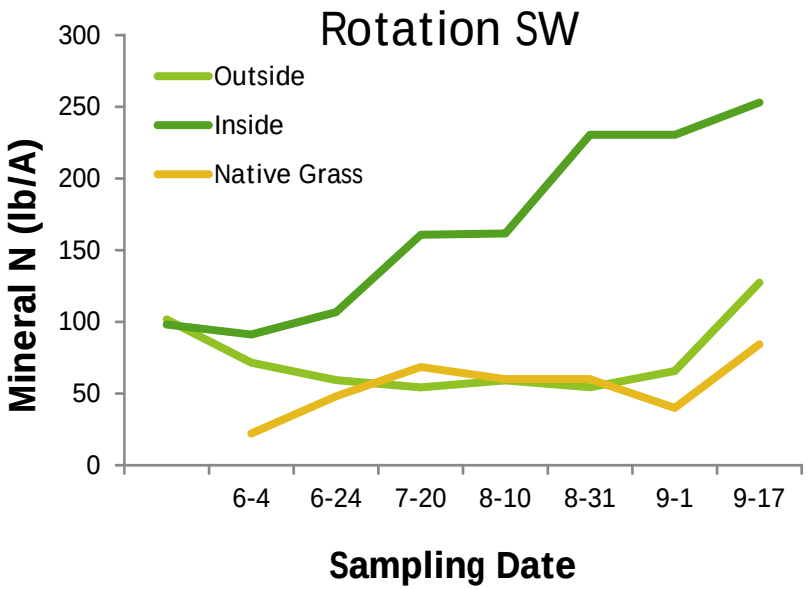
2015 Seasonal NO_3-N

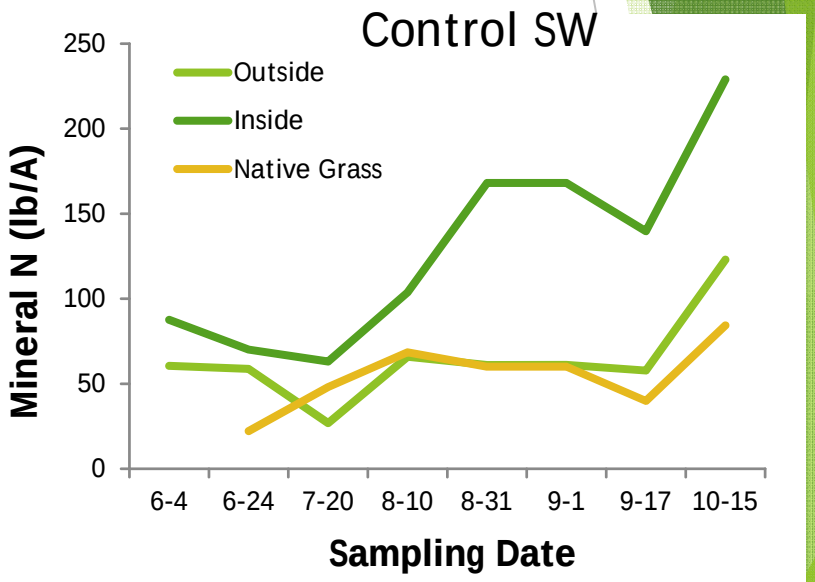




* 30 lb N/A applied to all wheat in 2015.

2015 Total Mineral N





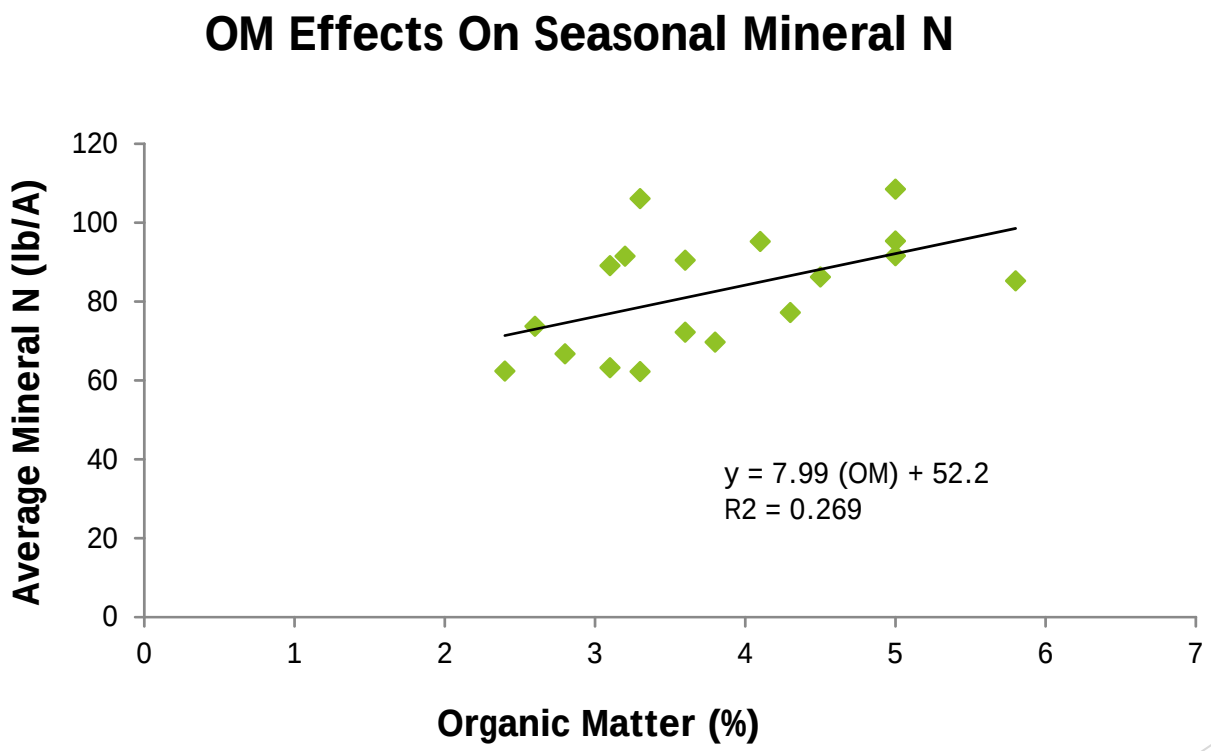
2105 N Status

- Mineral N tending to be higher throughout the growing season in the rotation spring wheat than in the continuous spring wheat.
- Soil test based N requirements are decreasing with time for both systems.
- Wheat yields are increasing in the rotation system.

2105 N Status

- At this point:
  - N cycling in the rotation system appears to be increasing over the continuous wheat (enhanced microbial activity).
  - Crop diversity appears to be enhancing soil health and soil productivity.

OM and Soil Productivity



OM and Soil Productivity

- This shows that 1% OM is equivalent to 8 lbs mineral N/A under dryland conditions.


Questions?