

Winter Ag School Notes, CIG class – March 1, 2016
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Reason everything works in soil is from living organisms. Soil is impacted by physical environment and also by how we treat it.

Biogeochemical: biological and chemical aspects are dynamic and constantly changing. Geologic is a constant and a link to biology and chemistry and how it is going to react over time. Biology needs the trace minerals to do their work to cycle through the big nutrients that make soil work for the crop.

Soil organic matter is really about soil organic carbon and is what feeds the biology. Carbon cycle is the important cycle since the organic carbon is the food for the organisms and helps buffer applied nutrients. Also helps in times of soil stress. Not about amount of carbon – soils will always respond better when they are always accumulating carbon from atmosphere. That accumulating carbon is driving the microbial systems.

Soil tests: RJ likes to use respiration tests as they give him an idea of microbial biomass. Bigger biomass, the more it is going to drive nutrient cycling.

Achieving carbon in soils:

Crop rotation and cover crops: Bar none, most important.

Biomass carbon are things like compost, crop residue, manure. All these act as quick immediate food to the soil and really act to stimulate organisms. Root-driven carbon is the key driver to enhancing soil. They break biology into simple sugars. 60-80% goes off as CO₂ but it also creates food for microbes that cause respiration that is available for the crop. In a lot of systems, CO₂ is yield limiting. If a green living plant is right behind harvested crop to catch that carbon then there are a whole second set of organisms that act as builders and use those simple sugars to build the soil by linking chains of carbon.

“Plants grow soil.” All new research is heading in that direction.

Difference between rotation crops and cover crops: length of time changes the microbial dynamic. Used the example of rye planted in September to April. By “time” RJ means actively growing periods. In this example, rye is not in long enough to have the same “bump” for microbial dynamics as a rotation would. Multi-species mixes can simulate a 5-6 year rotation in 1 year. The diversity within multi-species has a way of battling bad guys in the soil. Combo example of oats, rape seed, sorghum sudan grass mix is good at suppressing verticillium.

Biological profiles in soil get narrow and they need to be woken up. Can do that with plants. The organisms are there but they lay dormant until soil has the source for them to go to work. Usually takes a season or two.

Cover crops really help with soil structure. Lots of testing to try and put numbers to soil health and it is still a learning process. Aggregate stability tests (Cornell has a great test for that). Soil aggregates is where soil structure comes in. Aggregate stability is what changes first after rotations and cover crops. The worse the soil structure is, the worse the potato crop handles stress.

Mychorrhal fungi spread out and help distribute water to plants during drought. Don't need to re-inoculate if you aren't using fungicides. Need a "relay crop" to keep that fungi active.

Integrated Nutrient Management: Currently, this is too crop-driven for RJ's liking. He wants to look at feeding the crop and soil. Everything that is put down is what the microbe touches first. Changes he tries to get his growers to make is the switch to Potassium sulfate. Why? Chloride is really hard on soil organisms. INM needs to be looked at from biological aspect, not just chemical. Fertility is a big decision. Organo-mineral associations link to elements, carbon and the silt, sand and clay. RJ actually tries to go back to older fertilizers when they can as they include those minerals. Producers use yield-driven nutrients but need to be conscious of placement. For example, in furrow application or liquid instead of crystals. Need to be thinking how to do it without hurting soil life?

Balance between crops of sugar and fiber like potatoes and corn. Doesn't really like liquid manure for the fact that it provides nutrients but no fiber. N can drive a lot of our pathogens. Might use Potassium 5 sulfate because it inhibits N from converting and can have a profound effect on disease suppression. Always need to look at it from integrated approach.

Tillage: Effect can be based on how many times and at what depth. Tillage exposes aggregates to air which does the most damage since the carbon is then oxidized. Tillage is cumulative and we can figure out ways to do it less. Tilling in residues slightly is a small negative that turns into a positive. Doesn't have to be a bad thing. One issue in no-till over time is the stratification of nutrients in layers. Mineral incorporation isn't a bad thing.

Amazing to see is the soil changes that happen not only in top layer but down below in B horizon. That's when you know things are really happening. See carbon accumulation and respiration and aggregate stability all happening.

Questions

Is there a certain C:N ratio to shoot for on multi-species mixes? Still learning about that. Ask yourself what kind of management are you looking at for a mix. Nematode control? Building soil? Something to winter kill for spring tillage? Rye/radish after a lot of fall crops because it will sop up excess nitrates and keep them there for next crop. Always have a grain and a grass. Brassicas will dominate so keep rates low – to 2# at most. 1-2% Dwarf Essex Rape benefits a lot of soil life with intermediate root height. Rye has all surface roots. Radish grows straight down with deep roots. Legumes for nitrogen fixing.

If rye is allowed to grow all the way to seed it can provide 400# sugar for next crop. Wheat can help suppress pathogens. Balanza clover with alfalfa has shown great results for forage and building soil. Multispecies example of 1 year multi-species, next year potato, another rotation and multi-species mix in year 4 or 5. The benefits from 1 year of multi-species mix can really last.

Manure in a wheat year – don't need to manure until wheat again but potato year will still see benefits from that application. Some guys plant winter wheat as a cover crop and underseed it with 1# radish. They also frost seed clovers into wheat = relay crop. Can harvest wheat or treat as cover crop. Oats provide an uptake in Phosphorus availability. Oats/radish combo after wheat harvest is having a positive impact on soil.

Mowing cover crop? Great as roots continue to grow. The plant where they've found it doesn't benefit from mowing is Sudan grass. Root structure changes somehow and suddenly root lesion nematode numbers increase (a problem in MI). Cover crop varieties make a difference with what soil organisms light up.

Cover crop to help with pink rot? Not an issue in MI. Could make some guesses but doesn't have experience with that.

Wrap-up: You'll see more big macro-aggregates in soil with rotations and multi-species. More diversity in rotation means more food to more organisms and a great ability for the soil to cycle nutrients and buffer against the bad guys. Competition rules in the soil system. Work in inoculants in management but keep it to the seed piece.

Products that RJ uses are biostimulants that can really wake things up in spring and get microbes in action at planting.