Cover Crops: Can Cover Crops Pay, February 18, 2016 Question log
NC-SARE, PFI
Ken Rulon and Lauren Cartwright
Several management questions in this webinar overlap those in the Feb 4 and 18 webinars. Please see those question logs, as well.

Budget

Ken's spreadsheet showing $74/acre benefit seems off or misleading. Could he explain why he included those categories and how some of those numbers (yield) do not overlap and therefore show a higher net benefit than what there actually may be?

We have attempted to capture things fairly. There may be mistakes in our thought process, but I think "misleading" is probably not fair. If you notice, we only give the corn yield credit to the acres of corn having cover crops, same for beans.

The other area that you might be having trouble with is the time horizon. Our budget is attempting to capture the short-term (ie higher yields the year after the cover crop) PLUS the long-term benefits (ie the OM build level and erosion savings). One spreadsheet is not going to be as accurate as Lauren's multipage model, but the model didn't exist when we did this spreadsheet for the first time 8 years ago.

We readily admit that some of our numbers are based on the best science currently available, which in some cases is not much. We have tried to be very conservative.

The ultimate point is that we started this to stop erosion and now are finding numerous economic reasons to continue regardless of cash grain prices.

You did not credit the N contribution from cover crops in your economic budget, but do you credit the N contribution in your N budget for your cash crops?

This is a bit tricky. I initially wrote that we are not. Then I realized that all of our N application Rx's are driven by OM and yield goal. Thus, we clearly do count the increasing mineralization of N from an increasing OM level. The N rate Rx changes with each new test, so yes we are giving that credit.

The other reason that this is a little challenging is that our yield goals keep increasing due to genetics and lots of other things, so the actual N budget might still be higher than 4 years ago even though the OM has increased.

Fertility

When you apply Gypsum or lime do you incorporate?

In an ideal world, we would pick up a farm after wheat and then do the following in order of importance: 1. Pattern Tile 2. Construct and Seed Surface waterways if needed 3. Apply 2 ton of chicken manure 4. Apply Lime and Gypsum Rx 5. Level with a soil conditioner 6. Plant a 7 species mix of cover crop around August 10th. Since ideal never happens, we try to do the above tasks as prudently as possible, sometimes over a few years.

We have not incorporated lime or gypsum for over 20 years. The worms and plants themselves move nutrients up and down in the soil profile, as well as water movement of course. The stratification that everyone worries about has not presented itself at this point.

What rate of gypsum do you use on 10-12 TEC and 15-20 TEC soils for magnesium reduction?

Our approach is normally 1 ton max per acre per application. Wait 2 years and complete the Rx. Then retest in year 4 and get a new Rx. By this time, usage per acre will likely average less than 250#.

What are your predominant soil types? And the range of CEC? It is a big range

Roughly

32% Miami Clay Loam

29% Crosby Clay Loam -

27% Patton Poorly Drained Black Dirt

12% Brookston Well Drained Black Dirt

Also how did you generate you maps for base saturation, 2 acre grid?

1 acre grid, 5 probes per acre, mixed, test every 4th year.

You said you are balancing soils based on base saturation percentages. Were you referring to just Mg and Ca, or do you also fertilize K by base saturation levels?

Yes, we do Ca, Mg, P, K, and a few other things on base saturation to the best of our ability. More accurately stated, we try to get things perfectly balanced. Closer today than yesterday, but not perfect.

What is your nitrogen utilization since using long-term cover crops?

Depending on weather, we average per field .8#N/bu up to 1.1#N/bu. Lots of variables.

Ken, are your fertilizer applications broadcast or banded?

All P/K/Ca/S is broadcast at this time. We will likely shift to injected P/K in the future due to environmental concerns.

Do you fertilize the cover crops to maximize growth?

No, we are using them to capture excess nutrients before they leach away.

Why is anhydrous being used?

1. We apply it with Thiosol under high pressure using an Exactrix system. This creates a TAPPS product in the soil which is stable for a few weeks. Since we sidedress in late May, early June, and IN has lots of rain sometimes in the 3 weeks following application, this results in much nitrification and loss of N. It results in higher yields for us. 28% is a disaster normally. Urea might be better or worse, but we are not equipped to do it. Our Rx varies from 70# up to 190# actual N on the NH3 applicator on almost every pass across the field (yield goal of 90 up to 300 based upon OM content). The Exactrix can make those adjustments fast enough to work. We also have not seen any negative effects of the NH3 on our soils biology as it continues to improve. Nothing is perfect, just trying our best.

How did you map the organic matter levels within the field? Grid sampling or using sensors of some kind? 1 acre grid as outlined above. Other sensors have not been as accurate as the simple grid for us.

Are you using the Haney or Solvita soil test, and if so, to what extent?

We continue to experiment each year with both. No real opinion as the data seems to contradict some of our other findings. It seems we have a lot to learn.

Model/Tool

Where can we find the cover crop economics tool?

http://www.nrcs.usda.gov/wps/portal/nrcs/main/mo/soils/health/

Is there any study which can model cover crops benefits on soil compaction?

LC: One way to model the benefits of cover crops on soil compaction is to tie that to the water infiltration benefits. The less compacted a soil is the more pore spaces are available to allow water to infiltrate during either irrigation events or rain events.

In regards to the model: is there a way to measure inputs of beneficial insects, such as natural enemies of crop pests or pollinators (for pollinator-dependant crops, obviously not applicable to corn or soy)?

LC: If the use of cover crops will reduce the need for insecticides due to habitat for beneficial insects that can be modeled in the short term benefits section of the model where we look at any potential reductions in herbicide, insecticide, fungicide inputs.

Manure

Ken, do you utilize any manure on your operation?

500 sow farm farrow to finish. We mix barns and apply around 10,000/acre over around 220 acres each year. Our goal is to apply manure once every 5 to 6 years on a field. We have more than enough acres, really just need more hogs but refuse to lose any more money raising the things ☺

If applying liquid manure, what system is best to apply in no-till?

We have a contractor use a dragline system. I'd never let a tanker in the field ever again. They have a 9 shank no-till injector bar. Cutters in front and then a narrow shank with a flat shovel running 3" deep. Very little leakage.

How do integrate this into your no-till system?

Dragline runs at a 45 angle to the field direction. Then we just plant across the applied area. Raise the population about 3000 to account for the 3000 seeds that end up directly in the manure and die. With limited compaction, we see little to no yield drag planting into the injected areas. Plus it is only 1 out of 6 years on the field. Again, not perfect, but workable. The fall manure is into cover crops and by spring, the fall manure areas you cannot even see the injection slits.

Is there any experience shank vs. an air-way or tine type system?

Aer-way would be an environmental disaster in IN. We farm 4 miles from the water that Indy drinks. No way I'd risk no incorporation. Just my opinion. We don't allow tines on the farm anymore ☺

Have you tried to sidedress manure in corn? There have been a few who have in Ohio and it's working out well.

I think it could work very well if the hose wouldn't break off the corn, so timing is key. Or, if you had a tank on tracks that might work, but is expensive. We are not set up for that at this time.

Caution for long-term use of animal manure: Monitor soil phosphorus levels, particularly dissolved phosphorus. As soil phosphorus test levels increase, so does dissolved phosphorus. Dissolved phosphorus can move with runoff into surface waters. Phosphorus moves to surface waters with eroded soil. Surface water quality problems occur: eutrophication, algal blooms, and green water.

What is the value of the Hog manure/acre?

I use 12 bu of corn and 5 bu of beans per year for 5 years. SO, 3 of corn = 36 bu of corn, and 2 of beans = 10 bu of beans. (36x$5)+(10x$10)= $280. But that is before costs.

What is the ground temperature when applying the hog manure?

Extremely dependent on the weather that year. We have done it at 34 degrees, or at 75 degrees.

Purdue has a manure management planning tool at http://www.purdue.edu/agsoftware/mmp/

Compaction/grazing

Does grazing minimize cover crop benefits?

LC: Poorly managed grazing could certainly reduce or eliminate the benefits of cover crops. The key to grazing cover crops in systems where the farmer is also wanting to maximize the soil health benefits of the cover crops is to not "maximize" the forage value of the cover crops. Rather, balance the forage value with leaving adequate cover crop growth to still achieve the benefits to the soil and following cash crop.

How much do you think grazing cover crops before beans or corn will diminish the effects on the following crop?

LC: this is totally dependent on how the grazing is managed. See above answer.

Even when I graze the cover and delay planting my yield has increased on soybeans, possibly caused by extra boost from hoof traffic?

Or possibly from planting into warmer soils.

May hoof traffic mix manure nutrients into topsoil without loss when tillage might result in loss?

Certainly tillage might result in nutrient loss through erosion, and possibly increased runoff. Cover crops decrease the potential for nutrient loss by decreasing runoff and erosion, and by nutrient uptake from the soil. Unless high stocking rates are used, it is unlikely hoof traffic will have much effect on mixing manure and nutrients into the topsoil.

Planting/Types

Have you experienced any delay in planting or emergence caused by cooler soil temperature in spring from cover crops?

Yes, as outlined in the presentation, but that was caused by inability to kill the rye on time. In 98% of the cases we have not experienced any delays or problems.

Do you plant oats and radish in the fall? Yes, until Oct 1st, not after.
In northern Indiana, if cover crop planting were not done in the fall, would it be too late to seed the Annual Rye/Radish mix in March/April prior to sweet corn planting in May or June?

Never done it, but I think it is an excellent idea. Radish oats might work better depends on the goal.

Are you using variable rate seeding for any cover crops?

No, but maybe we should be. We have discussed and can't decide.

For the following questions, those in the United States should consult with the local NRCS office, the local extension agronomist, and with reputable, local seed companies. These will have information on the best-adapted crops to the location and soil conditions. They may also have recommendations on cover crop cocktails.

How many species do you recommend in a cover crop?

This is a relatively new area of agronomic research with no clear answers on the results of using one or two species versus using six or eight in a mix.

Do you have any recommendations for cover crops for heavy, clay type soils that hold a LOT of water?

If you have 0 percent organic matter content. In an iron-rich oxide soil. What kind of cover crop would you recommend?

Such a soil also is likely strongly acidic. Regional climatic conditions will affect choices as well: length of growing season, mean summer and winter temperature, in-season precipitation, etc.
There are lists available of cover crop adaptations for various climatic conditions, and tolerances to soil pH. Many seed companies have these available, as do many research and extension organizations.

Termination

Do you typically terminate your cover crops through mowing, or another technique?

Oats/Radishes freeze out, Cereal Rye is killed with burndown application.

If cereal rye is planted before going to corn, how many days before planting corn does the cereal rye need to be terminated? Probably as soon as you can get across the field with the sprayer in the spring. The other option is to plant into the rye that is 2' tall. We do very little of either because the oats/radish/clover mix produces a higher corn yield. Dan DeSutter would be a good contact for more on this area.

How large is the Rye when it is terminated prior to planting corn or beans, and how far ahead of planting do you terminate? Time before planting is not that important in my view, far more important to not let the cover crop get to large. 4" tall or less seems ideal for not affecting the following cash crop. For the first planted beans in April, we might even spray the rye after planting. Lots of variables due to the weather wildcard.

Organic matter/soil biota

Is the moisture benefit from using cover crops due to additions of soil organic matter, or is there an immediate "mulching" effect from use of cover crops like cereal rye? I think the real effect comes from lowering soil temps while increasing water infiltration due to the mass of root channels created. The scientist are better equipped to answer this one I guess.

Ken said that cover crops are crucial for microbial activity. Do you see some cover crops being more successful with microbe activity than others? If so, can you share some of those with us?

Diversity is important I think. Thus, we like cereal rye after corn ahead of beans. After beans ahead of corn we now plant oats/radishes/clover/rapeseed mixes to create more diversity. Also, the some of the clover and rape will survive and be great and growing in the spring.

Why is anhydrous being used? Does it not hurt soil bio life, nukes all earthworms, for example? Have you seen any deceases in soil biology by using anhydrous?

Anhydrous ammonia is a caustic nitrogen source. All soil biota (from earthworms to fungi, bacteria, and plant roots) within a few inches of the injection knife are hydrolyzed as ammonia reacts with the water in the soil and in those organisms to form ammonium. This results in a short term increase in soil pH to about 10 in the affected zone. In the long-term, nitrification of the ammonium contributes to soil acidity. Once the initial effects dissipate and the zone is recolonized, all the dead organisms become food for other microorganisms. In sandy loam and coarser soils in subhumid and semiarid regions, some have noticed soil structure degradation after long-term anhydrous use in association with conventional tillage (with inversion plowing).

There have been reports of diapause corn root worms in Nebraska. Can cover crops help against these root worms?

See the Feb 4 webinar and question log for more discussion on herbicides in cover crops.
The Feb 11 question log has some discussion on herbicides.

General management/conservation

Mr. Rulon mentioned shorter season crops and that it was beneficial and important. Could he comment further?

In general, for soybeans, we use to average a 3.7 maturity, ranging from 2.9 to 4.2. Now we average around a 3.2 maturity, with 25% at 2.4, 25% at 2.8, and the latest being a 3.7.

For corn we plant a lot more 105/108 day corns, Beck 5140 is fantastic in no-till. Never over 110, while 20 years ago we planted a lot of 112 day corns.

If a grower is on a short-term lease, how would you go about trying to convince them of the value of cover crops on a short-term basis? Do you find that kind of conversation difficult, particularly if it means a shift in the type of machinery/tillage operation?

Great question, we have zero short term relationships. We do not chase ground by paying high cash rent. Our approach is to find landowners who care about their legacy and educate them on the science of crop production. If no such owners exist in your area, you might have to shift your geographic focus. As more and more of owners become off farm well educated professionals by inheritance (2 or 3 generations off the farm) we find they are extremely receptive to a soil health approach. IF the Landowner is not of this mindset, we won't rent the farm. We are at capacity and have turned down a number of farms over the years. We are willing to travel up to 20 miles to work with the right landowner.

To be fair most of our leases are profit share leases. Thus the higher our profits, the higher the net rent to the owner. These used to be called crop share leases, but we manage everything for them including storage, selling price, and time of sale. Many sold some of this year's crop back in 2014. So, we are providing an entirely different level of management at basically no charge. The approach is not for everyone, but we attempt to deliver higher net rents and increasing organic matter to the landlord. Some care, some don't.

LC: For growers farming on a short term lease I focus on the potential short term benefits they may be able to get from cover crops and see if they can cash flow that. Being able to work with the land owner is key to working towards those long run soil health benefits perhaps through lease arrangements with operators.

Do you use any shallow vertical tillage?

1 pass destroys about 12 years of soil structure. Vertical tillage is tillage after all. No, we have trouble meeting residue coverage requirements as it is. The residue is all digested well before mid-June. Erosion losses following vertical tillage skyrocket. I can't think of any good reason to do even one pass. Dryout? Buy a tile plow and fix it permanently rather than run equipment over it every year forever. Or, just wait for the soil to dry out.

We are always battling the comment that I can't do this (no-till & cc) on my heavy clay soils because the seed slit will not stay closed. I have told them with time the soil structure will change and it will stay closed. What has been your experience on heavy soils?

There has been much research on the Blackland heavy clay soils of North and Central Texas on seedbed preparation and planting technologies to optimize germination under adverse conditions including both too wet and too dry conditions. It would be worth considering their findings to see if any are applicable to your conditions.

Have you found useful resources that help you make herbicide decisions based on the cover crop you plan to plant behind your corn or soybeans?

See also Feb 11 webinar question log.