April 17, 2021

Brief answers to questions from cover crop webinar not covered in Q and A session

Attendee: Italian Ryegrass has become a very noxious weed in N Idaho. It has also become resistant to some chemicals.

Point well taken. All cover crop choices need to be region- and site-appropriate. I had heard that Italian (annual) ryegrass can become a noxious weed in some circumstances. Of course I would definitely not recommend Italian ryegrass anywhere it is on a state noxious weed list or anywhere else that the farmer has observed it to be a problem.

Same goes for any cover crop. For example I have heard that Japanese millet can become a serious weed – it was a major nuisance for one Virginia farmer who ordered pearl millet seed to plant (on my recommendation as part of a consultation I did with him) and received Japanese millet seed instead.

Attendee: What is good to plant along a creek bank or pond levy?

This sounds like a place for a diverse perennial mix, not annual cover crops which were the main focus of my presentation. I am not as informed on perennial conservation plantings – and I would suggest she ask her local district NRCS office or state conservation agencies.

Attendee: Could you discuss some of the work by Dr Christine Jones about having at least four functional types for the best covercrop mixes?

Covered briefly in our Q and A session. As I mentioned earlier, I have heard of her excellent work (I believe in Australia) and I need to learn more.

Attendee: Previous question/to mitigate erosion

Perennial planting should include but not be limited to locally adapted non-noxious grasses, preferably native species that will enhance the local soil microbiome and not cause any upset to local soil or aboveground ecology. Depending on the local ecosystem and climate, riparian buffer plantings can include shrubs or trees (e.g. riparian forest buffer). For a pond levy, this sounds like a smaller area that one would not want to be tree covered, so native perennial grass-forb mix might be best.

Attendee: Could you discuss the benefits of spreading the covercrop seeds with a small amount of worm castings... like 5 pounds per acre.... to help jumpstart the soil microbiome.

Covered briefly in our Q and A session. As I mentioned, there is no harm in trying this – and for very fine seed sown at very low rates, the worm castings might be a good diluent – even 25 – 50 lb/ac of castings might be quite affordable for small acreages of high value crops like vegetables. Inoculant benefits may or may not accrue, but no harm will be done.

Attendee: I've never heard the term "perennial sod" before. Where do i find out more info on what perennial sod is ?

This is a general term for perennial cover crops, which are essentially perennial forages that can be grown in rotation with annual crops. It can be exactly the same mix that one might plant for permanent pasture – e.g., for my area (Virginia) perhaps orchard grass, timothy, and perennial clovers. One way to restore soil health and fertility and reduce annual weed pressure

after a few years of intensive annual cropping – either vegetable or field crops – is to plant an adapted grass-legume mix and (optionally) rotational-graze it (best for soil health) or cut it for hay or silage. Then rotate back to annual cropping.

Attendee: Could you discuss some of the work by Dr. Erin Silva at University of Wisconsin, and then folks like Rick Clark in Indiana who is doing organic No-Till on about 14,000 acres with zero off-farm inputs at all (except for Diesel and seeds). https://www.youtube.com/watch?v=YuvSbmumgcI

This demonstrates the kind of success that organic farmers have had in many locations throughout the eastern half of the US with soybean no-till planted after cereal rye. This sequence is so successful because the rye ties up N which slows N responder weeds like pigweed (including the dreaded herbicide-resistant Palmer Amaranth) and many other summer annual weeds, but does not hinder the soybean which fixes its own N. Note that for a non-legume cash crop one would want a rye-legume mix so that it does not tie up N.

In this case, Dr. Silva has successfully used the "planting green" technique – sowing the soybean a couple weeks before roll-crimping the rye.

Attendee: No-till row crops - How do we eliminate control perennial grass without tillage?

I am afraid that, at this point, there is no reliable organic method to eliminate perennial grasses without tillage – except for tarping. If the operation is small enough in scale to make tarping practical, I would start by growing an aggressively weed-competitive cover crop, flail mow it at mid to late flowering (along with any perennial grass weed that has come up in the cover) and immediately tarp for four weeks. The combination of cover crop competition and tarping should set the perennial weeds back considerably.

Without tarps, some tillage, possibly multiple passes, will be needed to bring perennial grass weeds under control.

Attendee: Can you discuss the infiltration benefits that come from cover-crops and Climate-Smart Regenerative Agriculture. Could you discuss the Army Corps of Engineers studies that highlight that covercrops and soil health can significantly mitigate flooding. https://conservationwebinars.net/webinars/watershed-wide-infiltration-and-flood-benefits-from-the-fields

As I mentioned during the Q and A session, living cover, especially cover crops that form deep, extensive root systems, are good at improving soil structure and retaining moisture – so, yes, whenever a soil- and climate-friendly practice such as cover cropping is widely implemented throughout a region, it could provide significant flood-mitigation benefits, as well as reducing nutrient loads into surface waters. I did not have time to do more than look at the home page of this website; however, I got the idea that it was all about region-wide adoption of practices.

Attendee: Could you discuss Peter Andrews and Natural Sequence farming in Australia that actually uses the existing weeds as the covercrop, and terminates the aggressive weeds just before seeding.

Many years ago, I met one organic farmer in Texas who uses and manages weeds as cover crops – mainly summer annuals whose dates of flowering and seed set are fairly predictable and manageable. I am not familiar with the Australian example, and again it is something worth learning more about.

Attendee: W/o access to a no-till drill how best to plant, e.g., sorghum-sudan cocktail mixes?

You would probably have to do some tillage to ensure sufficient seed-soil contact. Depending on weed levels and soil conditions at planting, you might be able to broadcast and till shallowly; otherwise it may be necessary to prepare a seedbed and then drill with a conventional drill or broadcast and do a second pass to work the seed into about an inch deep.

Attendee: Sorghum has allelopathic effect! do you encounter any issue?

This question was raised during the Q and A, and frankly I do not recall any specific issues, though I know it is a possible risk for crop establishment.

Attendee: Dr. Christine Jones has demonstrated as much as 200 pounds of nitrogen per acre from covercrop blends with Zero Legumes... Could you discuss this observation. See her "Nitrogen Solution" webinar...https://greencover.com/webinars/

I looked at part of this webinar – need to investigate it in more depth. I think what she said was that growing a diverse mix with the four functional groups (grass, legume, tall herbs, short herbs) and no soluble N promotes plant biomass production that exceeds that of a monoculture fertilized with 200 lb N/ac.

Attendee: Could you discuss the data coming out about covercrops for drought mitigation because they make the soil much better at infiltrating the rains when they do come...

I don't have the quantitative data at my fingertips, but I do know that, as discussed in the Q and A, that the improved soil structure and permeability left by high biomass cover crops with robust root systems does lead to greater moisture storage, better infiltration, and hence less flooding and greater drought resilience when the weather turns dry.

This is especially important during the era of climate change, as the erratic rainfall patterns created "flash droughts" when a period of excessive rainfall is followed by a sudden cessation of rain. If the soil became waterlogged, crops form much smaller and less healthy root systems, and are much more prone to drought impacts. If the soil has enhanced structure due to cover cropping and absorbs moisture and stores it, yet remains aerated, the impact of a "flash drought" on the crop is less severe as the crop has more roots and the subsoil has more stored moisture.

Attendee: any cover crop suggestions for high tunnels in midwest?

We touched on this during the Q and A. I do not have specifics, though I definitely advocate for cover cropping in high tunnels, including legumes for adding N without the risk of excess P and other nutrients from heavy use of compost. The following linked OREI project has some research data on cover cropping in high tunnels in the Midwest and midsouth:

A multi-regional approach for sustained soil health in organic high tunnels: nutrient management, economics, and educational programming. Link to project reports.

Attendee: Lentil is grown well in drought

Yes indeed – Doug Crabtree and Anna Jones-Crabtree in Montana include black lentil in their complex rotation – a production crop yet with cover crop benefits, especially legume fixation. I believe it also has a fairly light water demand, and therefor fits well into rotations for low rainfall regions.

Attendee: With Respect to low fertility soils, Could you discuss the benefits to biological inoculants on the seeds or mixing the covercrop seeds with s small volume of worm castings.

Covered above. In general, biological inoculants are most likely to be beneficial in soils with limited nutrient availability yet overall fairly good health. If the soil is really depleted and degraded and low in organic matter, the microbes have nothing to eat. But if there is a decent amount of plant root exudate and/or residue, and levels of readily plant-available nutrients are limiting to crop production, the inoculants are most likely to have a beneficial effect.

Attendee: When scaled down to the no -till backyard garden, are these cover crop strategies worthwhile to implement, or does it make more sense to compost the cover crop material and incorporate it into beds that way?

Covered in the Q and A. Cover crops are valuable at all scales from backyard garden to 10,000+ acres dryland grains and everything in between.

Attendee: The approaches elements of regenerative agriculture. Any thoughts?

Organic agriculture, when well done, is regenerative agriculture. Organic eliminates synthetic fertilizers and crop protection chemicals and is regenerative when tillage is done with sufficient care not to seriously undermine soil health. Other forms of regenerative agriculture eliminate tillage altogether and use agrochemicals judiciously and as little as possible.

Attendee: If rye to sweet corn, there is a possibility of rust may carry from rye to corn! please take a closer look.

Yes, when the cover and cash crop are in the same plant family there is always the risk of one disease or pest or another building up from crop to crop. I gave the example that includes rye to sweet corn because this is the rotation that the Vermont organic vegetable farmer – Justin Rich – has used successfully. Apparently, this rust does not occur there, or his soil is suppressive toward this pathogen. I would not recommend the rye-corn sequence widely.

Attendee: Great...Bison Biomimicry animal impact!

Yes, bison are the inspiration for mob grazing, adaptive multipaddock grazing, rotational grazing, etc.

Attendee: What equipment use to interplant cover crops in vegetables

I am not an ag engineer and know little about equipment, being a home gardener who uses a hoe and a week whacker to manage weeds. Note the example of the multirow push seeder rigged up by Eliot Coleman, and larger farm scale equivalents used by Cornell and other research teams as well as innovative farmers.

Attendee: Warm season grass, cool season grass, warm season broadleaf, cool season broadleaf is one way of looking at four functional groups

This is the NRCS way of looking at crop types – when I looked at part of one of Christine Jones' webinars, I learned that it is grass, legume, tall herb, short herb (by which I gather she means non-leguminous forbs, for example sunflower for tall and alyssum for short).

Attendee: Do you have experience with sequential planting of flowering cover crops for pollinators?

Addressed in Q and A – and the possibilities are almost infinite. It is a matter of the farmer experimenting with different mixes and finding what works best for her/his location and farming system.

Attendee: What is a cruxifier???

Same as brassica or mustard family – in cover crops it includes tillage radish, mustards, canola, etc.

Attendee: What are your thoughts about cherries and poppy and asparagus as companion plants? and Do you know what grows well with asparagus as a cover crop? Thank you

Cover crops for asparagus were addressed briefly in Q and A. Buckwheat, soybeans work well in mid Atlantic – others may work better in other locales.

As for companion planting, this is another term for functional crop biodiversity – sometimes the companion plants attract natural enemies of each others' pests, other times it is a matter of complementary soil nutrient demands, root architectures, or microbiomes that make the combination better than either alone. If cherries, poppies, and asparagus thrive well together in your locale, go for it! It may or may not work well in Virginia, for example. Each farmer and gardener builds a functionally diverse system partly through trial and error and partly through use of regionally appropriate information.

Attendee: Dr. Jones prefers using a borage like Phacelia as a covercrop functional group instead of a legume... ...by avoiding using legumes, your soils start building-up the free living nitrogen fixing bacteria instead of the rhizobium that only live in the root nodules.

Most sources say that the free living N fixers can provide only a fraction of the N needed for crop production, yet there is a distinct grain of truth here, as relying too heavily on legumes and growing all-legume cover crops can indeed create a N saturated, unbalanced soil condition. I would tend to use legumes in combination with grasses and non-legume forbs/herbs and also encourage free living / rhizosphere N fixers through high diversity and perhaps by planting grasses like millets and older land races of corn that host N fixers in their rhizosphere.

Attendee: What kind of research is on-going to determine exactly how much Nitrogen is being contributed by legume cover crops to the subsequent commodity crop. This seems to be a bit of a moving target.

Addressed in Q and A. In short, I think more and more in terms of total N in and total N out, rather than plant available N and worrying too much about how much N moves directly from the legume to the cash crop. If the soil provides N from organic matter, it is only necessary to replenish soil organic N, not feed the crop directly from the legume cover.

Attendee: The Rodale Institute the East Coast has pioneered using the Roller Crimper with a no till drill on the back to "Plant Green". This Terminates and sow seeds all in one pass. This is very Similar to Dr. Christine Jones work and Nicole Masters.

Yes, this is a great system when it works – there are challenges with timing of N mineralization as well as seed-soil contact and the crop's ability to emerge through the cover crop residue. This is an area where plant breeding efforts are needed, to select crop cultivars that

can emerge vigorously in a no-till, no-herbicide rolled cover crop system, and that can partner effectively with soil microbes to enhance nutrient uptake efficiency and even rhizosphere N fixation. More on this in the next webinar on plant genetics!

Attendee: Love Masanobu... "Mr. Fukuoka is perhaps most known for his bestselling book The One-Straw Revolution (1978), a manifesto on the importance of no-till agriculture, which was at the time of publication a radical challenge to the global systems that supply the world's food, and still inspires readers today."

Yes he is a leader in non-chemical-dependent no-till. As mentioned during the Q and A., even Mr. Fukuoka was challenged by quackgrass, an invasive creeping perennial, but not one of the worst (Field bindweed, Canada thistle, Bermudagrass, Johnson grass, and purple and yellow nutsedge lead the rogue's gallery of this type of weed in my book).

Attendee: Suggestions for cover crop mixes for weed control in intensive small-scale vegetable/cut flower operations on silt-loam soils with a compacted plow pan where weeds with taproots (dandelions, mallow, etc.) are thriving?

Addressed briefly in the Q and A. I call the use of cover cropping "putting the weeds out of work" – so if these weeds are doing the job of breaking through a plow pan, I would use deep rooted cover crops – both the taproot type like radish, canola, sunnhemp, biennial sweetclover, etc, and the fibrous rooted type – sorghum-sudangrass, pearl millet, winter cereal rye – to do this job and crowd out the dandelions and mallows. Since these weeds are robust perennials, some tillage may be needed at first to set them back.

Attendee: Does Mark think that increasing soil health and improving soil infiltration across an entire watershed can improve water quality or mitigate flooding downstream??

No kidding! See above. Also mentioned briefly in the Q and A. I daresay that, in the example from my home community in Floyd, VA, that if most farmers who had fields within reach of that flood (perhaps the 100 year flood plain) had robust cover crops or cash crops (a good stand of corn or soybean nearing full height may suffice), both the force and the muddiness of the flood may have been significantly diminished, and vulnerable fields, properties, roads, or structures in the flood's path may have experienced less damage.

Attendee: I just got a text from a grower who let their overwintered brassicas go to flower in their high tunnel and by spring (now) there are lots of flowers for early emerging bees and other pollinators.

Yes – and I have heard of several farmers who let a few brassicas go to flower in their fields to attract beneficial insects – including several natural enemies of the very pests that each young, succulent brassica vegetables and thereby cause crop losses!

Attendee: Is there a risk of including brassicas in a mixed cover crop if the main crop includes brassicas RE: risk of blackleg pathogen?

Addressed briefly in Q and A. I am not familiar enough with blackleg to know how much risk there would be in including some radish in a winter cereal-legume cover crop, for example. In general, risk is greatest for an all-brassica cover crop immediately before a brassica vegetable or forage, least when brassica cover crops are avoided altogether, moderate for a cover crop mix with radish or other brassica before a brassica production crop, and minimal if the brassica-

containing cover crop is separated from the next brassica production crop by at least one full year of non-brassicas (cover and/or production crops).

Attendee: Any thoughts about the use of wood chips and compost tea?

Fresh wood chips will initially tie up N (especially if incorporated, less so if as a surface mulch), may acidify the soil, and may release strong allelopathic compound for a few weeks or months, but will eventually become highly beneficial to desirable soil fungi. Aged or partially decomposed wood chips will already be well colonized by mostly beneficial fungi and no longer acidifying or allelopathic, and less apt to tie up N. Use fresh wood chips as a weed suppressive mulch around well-established crops especially woody perennials (be sure the chips do not carry pathogens of the crop!), and as they age and decompose, the other benefits will kick in.

Compost tea making is an art and science, and results can vary all over the map from quite beneficial to harmful – if the brewing is not precisely managed you can end up with a strong inoculum of detrimental microbes, plant pathogens, or even human pathogens.

Attendee: Assistant Administrator of the EPA says that Soil health= Water Quality. ... https://mobile.twitter.com/radhikafox/status/1463291518807117824

Absolutely right! Healthy soils leach less N, have less runoff and hence less sediment, N, P, and (in conventional fields) agrochemicals to surface waters.

Attendee: They suggested that they might try interplanting with tomatoes for early pollination support instead of commercial bumble bees

Sure – flowering cover crops that support pollinators can help – however there have also been reports of a flowering cover crop competing with fruit trees for pollinators – i.e. diverting pollinators from the trees when the producer most needs them in the trees. Another trick y management challenge on which I am not highly informed.

Attendee: USDA FSA Chief Zach Ducheneaux says that "the Regenerative agriculture movement is the solution to climate change.....Period". The practices that Mark is discussing is they key to regenerative agriculture.... starting from minute 48 to 50...https://www.youtube.com/watch?v=FlSmTFStf4g

Indeed – well managed organic agriculture is a form of regenerative agriculture that addresses all five principles of soil health, and keeps chemical soil disturbance to an absolute minimum while allowing a bit more physical disturbance (tillage) than other regenerative ag approaches that abstain from tillage completely and use herbicides, etc. with care. New research over the past 10 years or so has revealed subtle yet substantial negative impacts of most classes of agrochemical on most taxonomic categories of soil life from bacteria to earthworms.

Attendee: After growing a high biomass cover crop such as millet or sorghum sudan what seeders or planters are able to cut through the biomass?

Most no till planters developed for rolled or flail mowed cover crops include a leading coulter to slice or part residues, followed by a narrow shank to work a ~2 inch wide band of soil (for transplanting) or by a no till seeder or drill unit, and press wheels designed to ensure good seed-soil contact in a no till situation with heavy cover crop residue.

Attendee: There were interplanter units built for horses to pull through corn and seed wheat or other crops a 100 years ago.

Cool – sometimes the best technology for today's sustainability challenges were developed decades to centuries ago.

Attendee: Regarding pollinators, Iowa has a conservation strips program. Any thoughts??

Excellent practice. Not only will these strips support pollinators, but also intercept wind (reducing wind erosion losses), support other beneficials (natural enemies of pests), and maintain zones of permanent root biomass in the soil for carbon sequestration and soil health improvements that can even benefit adjacent crop rows.

Attendee: What about no till drills to plant in crimped cover crops with all rolling/moving parts...

I believe that at least some of these drills include a leading coulter to slice through the residues to allow successful drilling of seed. Note that the big advantage of the roller-crimper is that it lays the crop down all in one direction, making it easier to open a narrow slot of plantable soil with the coulter – it only has to part the oriented cover crop stems, rather than actually slicing through them.

Attendee: "Perennial sod" as it relates to organic overcrops, then how to terminate for a no-till cash crop corn or soybeans?

Sorry – the one disadvantage of perennial sod phase in crop rotations is that it does need to be broken, usually by tillage, often by moldboard plow. However, some innovative farmers and researchers are experimenting with terminating the sod with intensive grazing (leaving the animals on it long enough to set it back severely rather than a brief flash grazing that allows or even stimulates regrowth), with shallow noninversion tillage, or a combination of both.

This is an important cutting edge of research for organic soil health systems.

Attendee: Thank you for asking so many of my questions... I would love to connect with Mark and the folks who run these webinars to discuss future presentations that help meet the strategic goals of multiple agencies at enhanced agricultural profit. Hummel.Bryan@epa.gov

Sure – let me know how I or others at OFRF can be of assistance here!

Attendee: In the California Delta planting Dicon-Radish is discouraged because it is highly prolific and and becomes a weedy species..

Oh, I did not know that daikon could become a weed – and as I mentioned earlier, if a cover crop is a weed in a certain location, then use another cover crop that won't pose a weed risk – or be sure to mow, roll-crimp, or till the cover crop before it sets seed.