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Jigsaw report #2: Cover crops and healthy soil

Field-day farm, researcher and agribusiness visitors listen, share insights on how cover crops and soil management connect with organic no-till planting systems.

SLIDESHOW: Organic No-till field day, Part 2

Following up on **the first half of our report** on the Rodale Institute 2008 field day is this summary of findings recorded during small-group “Jigsaw” sessions.

Recap: More than 100 people joined Rodale Institute staff to interact with agricultural specialists from Penn State, Virginia Tech and the USDA Agricultural Research Service Beltsville facility. They ended their day at the Institute with an interactive exercise in which small groups rotated between four wagons to share information on weed management and pest management (in Part I), as well as soil fertility and cover crop information here.

Cover crop sessions

We asked field-day participants what their experiences and challenges were with cover crops. Here's some of what they had to say:

- A researcher in Hawaii reported using Sudangrass and sunhemp in Maui, where, he reports, all the biomass is aboveground, and labor and input costs remain high.
- A small-scale farmer with just a few acres who produces for her local farmers' market reported that she has yet to try cover crops. She currently uses composted leaf mulch for weed suppression at the beginning of the growing season and applies it again two to three months into the season when the first application begins to disintegrate. (What few weeds do make it through, she said, diligently get pulled. She also makes her own compost with “kitchen scraps and chicken manure.”)
- Another researcher reported two major challenges in working with hairy vetch and rye: fitting the cover crop into the rotation, and weed-management issues.
- One farmer reminded the group of another great benefit of having a rich microbial community in your soil from good cover-cropping. As microbes complete their life cycle, the exoskeletons they leave behind yield 10-percent nitrogen as they decompose. (Speaking of nitrogen, another farmer counseled, you have to make sure it's available to your crop plants at the time that they need it.)
- Another farmer reported using Sudangrass to effectively squelch a thistle problem. The fast-growing annual grass also gets cut back (at about 4 feet) and used as a mulch.
- One researcher reported working with grain triticale and vetch in a conventional cropping system. Winter rye, he said, is suitable both as forage and a cover crop. (A West Coast farmer added that rye can come back quickly and become a problem—particularly under irrigation—and that it's a common allergen.
- A representative from the soil conservation district in Maryland's Baltimore County reported that her agency was offering cost-share incentives for growing rye for seed because of shortages in supply. The agency is promoting rye as a cover crop because of its ability to hold soil and protect water quality by keeping excess nutrients and agricultural chemicals out of the Chesapeake Bay. A big challenge, she said, is convincing farmers of the economic, as well as the environmental, benefit. “There are a lot of opportunities out there,” she said, “but people just miss it.” (In response,

one participant reminded the group that farmers are constantly bombarded with messages from chemical companies and major seed businesses, and are “made to feel like total idiots if they don’t embrace all the technologies...while people are starving.”)

- A home gardener reported using crimson clover, an early-blooming winter annual legume. He enjoys the flowers, then pulls the plants up by the roots and uses it to mulch his vegetables.
- Another home gardener reported using wood chips from his local municipality. (To this comment several people cautioned against the allelopathic properties of certain trees such as black walnut, crepe myrtle and even pine needles).
- An extension agent said she encourages her growers to use rye and rye grass as companion crops for vegetables.
- A conventional farmer reported direct-seeding pumpkins into rolled winter rye. He rolls with a cultipacker and either spins on nitrogen fertilizer or runs it through drip lines, then uses herbicides for weed management.
- A Natural Resources Conservation Service (NRCS) agent reported using newspaper and straw mulch at home in the garden and promoting winter annual cover crops to farmers in New Jersey. Obstacles reported included proper synchronization of the cover crop and cash crop, finding the time to get the cover crop in the ground before a hard freeze, and the lack of a family tradition (i.e. “My father and grandfather didn’t do it, so I’m not going to do it.”). With regard to finding the time to plant a cover crop in the fall, he said, “The farmers’ market is open until Thanksgiving, the help goes back to school, and time is very limited. They know they should be doing it, but they just can’t get it done.”)
- One Extension specialist reported a renewed interest in the aerial seeding of cover crops, particularly canola. “It’s a small seed, you don’t need much seed-to-soil contact, and there’s lots of seed per pound,” he said.
- One farmer reported using buckwheat and Sudangrass at various points in the growing season to assure that the soil is always covered. “I don’t like to leave the soil bare or covered in weeds,” he said. “I don’t get any return [from the cover crops], but I sleep better at night.”
- A woman who, with her sister inherited 112 tillable acres, reported that they transitioned the land to organic and rented it out to a farmer as a “way to make money and pay the taxes.”
- Another farmer reported drilling rye, hairy vetch and “sometimes oats” as cover crops. Problems included “the perpetuity of vetch,” thanks to hard seed that germinates years after it falls. (At that there was some debate about whether vetch was toxic to grazing animals, with the general consensus being that most animals avoid it anyway because of the high tannin content.)
- A gardener reported using dried black beans bought in the grocery store. They germinate fast, he said, and are easily winter killed, adding that they form nodules to fix nitrogen without needing purchased inoculants. He said he plants peppers and tomatoes right into the mat they form.
- Another backyard gardener reported using short white clover very densely in the rows between the vegetables.
- Adaptive equipment, and its cost, was cited as another barrier to utilizing cover crops. To move forward, someone offered, adaptation of equipment already in the tool barn could be a necessity.
- One Extension agent reported that conventional no-tillers are beginning to look at cover crops such as rye and crimson clover. Turbo tilling and managing high levels of residue are strategies these farmers are using as a way to get manure incorporated into a no-till system.
- One farmer reported planting pumpkins into rolled rye. He also reported problems with late-season

weeds such as pigweed, which he says he generally lets go.

- An NRCS agent from New Jersey reported farmers there experimenting with planting cover crops between black plastic mulch, which is tough on the soil and can cause erosion problems. The cover both controls this problem and adds organic matter. (To this someone reported a farming operation in the northeast using cereal rye and black plastic. They sickle bar the rye and put it over the plastic, increasing the mulch's use for up to five years.)
- A self-described "conventional guy" said he practices (vertical) turbo tillage through residue. "I think that's part of the answer. It makes it look a lot nicer so, if nothing else, my neighbors don't think I'm a 'garbage farmer.'" He said he plans to get a stalk chopper in order to better incorporate crop residues into the soil. "It's all a matter of how much money you want to throw at it," he said, adding that more intensive management meant more equipment on the road, another significant concern, where time, money and safety are concerned.
- Timing is a huge issue, one farmer suggested, adding that he is looking into aerial seeding. "You have to do that cooperatively," he said. He's found that "it's hard to change hearts and minds," when people are stuck in old paradigms.
- A research agronomist said he put out pans to check the efficacy of aerial seeding and that it was spot-on at a prescribed seeding rate of 14-16 pounds per acre.
- One farmer reported using rye and hairy vetch, and that a customer of his who planted corn into hairy vetch experienced some problems with cutworms.
- Another farmer reported planting wheat into soybeans in the fall. After the wheat comes off, he said, sorghum is planted into the wheat stubble, then that gets tilled in and is followed by either alfalfa or hairy vetch.
- "Most of my cover crop is my crop," said one animal forage and nutrition expert, who described his system as a perennial polyculture. "Sudex is one of the best summer forage crops you can grow around here" to overcome the summer doldrums of low forage productivity.
- Weed management and soil fertility were listed as top cover-crop attractions for one farmer. "You're capturing energy from the sun, and you don't have that bare soil sitting there," he said. "It just seems like the right thing to do."

Soil health sessions

The first thing each of the jigsaw groups identified about soil health is that it is very much a subjective term. The first step in improving soil health is to define your parameters and determine what you want to measure. Attendees stressed that it is also important to know what is possible on your own farm (for example, when looking at yield as an indicator, you can grow many more bushels of corn in the Midwest than you can in Pennsylvania.) Most attendees suggested before doing any measurement, you should know your baseline so you can set appropriate goals to which you can aspire.

One woman suggested the very best soil health plans include some additions and some omissions. She said creating healthy soil is really a process of maintaining the structures that naturally exist in the soil.

Sensory cues are one way to see what is happening to your soil. Some good sensory cues are:

- Yield: Keep a record of which fields do what which years.
- Runoff and water infiltration
- Biological diversity: A high earthworm population that is very active is a good sign you have healthy soil. One attendee had heard that lightning bugs are an indication that you have good levels of nutrients in your soil.

- What weeds are growing: Different weeds prefer different soil. Some grow much better in decimated soils, other thrive in very healthy soil.
- Soil physical properties: A long-time farmer said you just know when you have good soil and there's rarely a need to test when you do. She said it's so spongy you bounce on it and it literally has "tilth". Another said good soil just smells good.
- Plant health: Check for signs of stress in your plants.
- Flavor: One man said his carrots are sweeter where the soil is good.

Testing is another way to begin measuring the health of your soil. Attendees suggested the following tests:

- Soil nutrient test (macro and micro)
- Soil biological tests
- Plant tissue tests
- Refractometer to measure the brix
- Monitor soil organic matter but be aware it takes a long time to see changes and it may fluctuate up and down
- Soil conditioning index (SCI)

Once you have your baseline through tests, observation or both, you can then begin to integrate good practices such as the following for improving soil health.

1. Keep soil covered

- Cover crops (cereal rye, winter rye, Sudan grass, buckwheat-tilled at flower stage)
- Grass clippings/yard waste
- Weeds: One farmer said if your soil is in really bad shape, using weeds as a cover crop can provide soil quality benefits. He had purchased some land where the soil had been very poorly managed. Even the weeds didn't grow in some places. The first year he "grew" weeds and mowed them down. This year he planted oats in the spring and wheat in the fall. They didn't do great, but they did grow and he felt the weeds had helped set his soil on the path toward health.

2. Prevent soil erosion

- Contour farming
- Strip cropping
- Cover crops
- Minimize trips across the field
- Eliminate tillage all together – no till

3. Add fertilizer and maintain pH

- Compost
- Manure
- Organic fertilizer mixes
- Leaf mulch composted with manure (a few farmers warned that this can be a challenge for certified organic farmers as community leaf mulch can be contaminated with pesticides, herbicides and even heavy metals.)
- Composted wood chips
- Wood ash
- Food processing waste (this can also be another income stream)
- Loose hay
- Lime

- Terra preta (charcoal applications)
- Glacial dust

4. Create a diversity or polyculture on your farm

- Use crop rotations
- Plant vegetables and flowers and herbs together
- Boost the soil biological community by increasing complexity—bring in different types of plant species
- Use agroforestry: A black locust will provide nitrogen in the soil and a different type of organic matter than what you'd get with just an annual crop.

One farmer said when you grow 25 different vegetables it's hard to keep track of what each plant needs. She said keeping it simple and cost effective are the easiest ways to build the soil health without driving yourself crazy. Whatever you chose to do, everyone agreed, it has to make economic sense. Spending a lot of money on expensive inputs might get you healthy soil quickly, but it might also put you out of business. Improving the health of your soil the smart way requires patience and long-range planning.

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