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# Tillage and Toxins

## Farmers discover and discuss cover crop-based alternatives at pioneering Berks county organic grain farm.

By Alison Grantham and Rita Seidel

### Tim and Ann Bock: Pioneering Sustainability

When it comes to sustainability, Tim and Anne Bock are no strangers to the opportunities to improve. Together they operate Wills Daal Farm, a 100-acre certified organic farm outside of Kutztown, Pennsylvania, where they've taken sustainability measures beyond their fields to the energy footprint of their operation.

Solar panels, on the south-facing roof of their 1840s barn generate electricity for their entire farm (house and outbuildings). On most days, they even produce more electricity than the farm operation needs and the Bocks are able to sell the excess back to their supplier.

For farmers, whether organic, conventional, or somewhere in between, weeds and what to do about them most often tops their lists of greatest challenges. From great challenges come greater controversies, and the to-till-or-to-spray debate is no different. With both sides claiming their solution is better for the environment, the debate has become one of the biggest divides between organic and conventional producers.

To bridge that divide with dialogue and meld elements of each into a hybrid system that preserves the best of both, the Rodale Institute launched a project aimed at increasing cropping system sustainability with cover crops. To do so, we overhauled our own Farming Systems Trial, implementing **new uses of cover crops and no-till practices**, and launched field trials of the practices on regional farms.

On August 5 we gathered with about thirty attendees: farmers, land managers, and Penn State Cooperative Extension staff at Anne and Tim Bock's Wills Daal Farm in Kutztown, PA to discuss some cover crop-based alternatives and see how they're working for the Bocks. The field day was sponsored by the Rodale Institute and Penn State, receiving support from SARE as well as the Kellogg Foundation and the Towards Sustainability Foundation.

Discussion amongst farmer attendees was rich with practical and philosophical points on the drawbacks of tillage and herbicide use. The group acknowledged that both tillage and herbicides exact their own toll on soil health and the environment. As we trudged and sweated from steep slope to steep slope, a conventional no-tiller noted that tillage leaves the soil bare and vulnerable to erosion, saying it would take just one "gully-washer" when the soil on these slopes lay bare to move all the soil into the streams below.

Host, Tim Bock reminded his fellow farmers of herbicides' less- visible toll, saying that while the water running off conventional no-till farms may look clear, the chemicals that go with it are far from innocuous. Herbicides' toll can be counted in their effects on soil microbial life, as well as the aquatic life in the streams they wash into. Perhaps even more detrimental to human health, is the toll they exact on our own health when they eventually percolate down and contaminate our ground and drinking water.

But, it didn't take long for the conversation to turn from philosophical, esoteric debate to practical comparisons of the bottom-line implications of alternative practices. Many farmers discussed that both herbicides and tillage are costly guzzlers of fuel, inputs, and labor, which all add up to similar bottom-line motivators for the reduction of both. The Bocks' beautiful fields of soybeans planted on 15" rows into a thick mulch of rolled and crimped Aroostook rye offered a glimpse of a welcome alternative, with the rye cover crop replacing the need for tillage or herbicide.

**Northampton and Lehigh County Sustainable Agriculture Educator Tianna Dupont (left) and two field day participants in a field of organic no-till soybeans.**

## Taking a step back

The Bocks were among the more than 100 participants of Rodale Institute's 2008 field day on Organic No-till Technique. In short, this system uses a no-till roller-crimper, which allows you to mechanically kill cover crops without using herbicides, therefore combining two best management practices—organic farming and no-till. The resulting living-mulch mat acts as a barrier against weeds, conserves moisture, protects the soil, and—in the case of leguminous cover crops such as hairy vetch—also provides a source of nitrogen to the cash crop.

Tim was intrigued enough by the presentations at the 2008 field day that he decided to give the roller-crimper a try. Although it may have been the Rodale Institute's 2008 Field Day that inspired the Bocks to try the rolled cover crop system, it was their 2009 success that inspired them to get more formally involved in field trials of the systems.

The Bocks' first attempt at organic no-till included Aroostook rye planted heavy at 3 bushels per acre that they rolled and crimped in late-May, and planted into organic soybeans on 15" rows with their Monosem No-till planter. The soybeans grew well and canopied quickly preventing nearly all weed growth that endeared the systems to the Bocks (and this in a wet year that made traditional organic cultivation methods especially difficult to implement).

In a year when many fields of organic soybeans struggled against rain-induced weed pressures, the Bocks soybeans yielded about 60 bushels per acre, well above the 2009 county average of 53 bushels per acre. Not only that, but they've effectively cut their field operations down from about 10 in the tilled system to 2 in their no-till system.

**Early Success – These soybeans on the Wills Daal farm were planted with a Monosem planter in late-May on 15-inch rows and a seeding rate of 175,000 seeds/acre. On his 100-acre certified organic farm, Tim has tried the roller on more than 20 acres, and, after the last 2 years of success, plans to completely switch to soybean production in rolled rye, instead of cultivated beans.**

## No-till corn

So, when Rodale researchers met with the Bocks late last summer to discuss trialing the no-till system, it was no-till corn, not no-till soybeans that they requested help with. To try to overcome some of the challenges they had experienced with late bloom in the spring, poor cover crop control, and heavy weed break-through, we selected three different legume cover crop treatments that they planted in the fall of 2009 to be rolled for corn in the spring of 2010. The goal was to compare time of blooming, nitrogen contribution and ability to suppress weeds. The three legumes were 1) a combination of crimson clover and Austrian winter peas, 2) early cover vetch and 3) Minnesota vetch.

**A promising field of crimson clover and Austrian winter peas disappointed the Bocks with its poor performance in weed suppression.**

One challenge of the no-till corn system is the time of planting (which is also when the cover crop is rolled down). The cover crop needs to be in full bloom to be terminated, which often causes a delayed planting date for corn. In cool years that might mean not enough growing degree days to harvest a mature, dried down grain crop, even if a short-season corn variety is used. We expected the three legumes used in this trial to bloom about two weeks apart, starting in mid-May and ending in mid-June.

**Vetch flowering stage at rolling / planting.**

Biomass levels of the three legumes looked very promising this spring and corn planting took place on May 15 (clover / pea mix), May 22 (Early cover vetch) and June 3 (Minnesota vetch). Both rolled biomass and N input were at sufficient levels (>5,000 lbs/a dry biomass and approximately 200 lbs/a N) and cover crop kill was successful in all treatments. However there were some challenges:

Corn population was very variable in all three legumes but especially low in the Minnesota vetch. This was mostly due to poor seed placement because the planter did not cut deep enough into the soil and a large number of kernels ended up on the soil surface. Insects or birds might have also reduced the corn

population in the last planted treatment.

Weed suppression was also very variable in all treatments although the amount of weeds did not seem to be related to how heavy the cover crop mat was at roll down or the number of corn plants that emerged.

Several dry spells in June and August put additional stress on the corn crop.

**Excellent cover crop kill but variable corn stand, 6 weeks after planting.**

## Early conclusions

While there's much left to do in terms of assessing the performance of these test plots, we have drawn some early conclusions about the performance of the three mixtures. The clover/pea mix supplied the highest amount of biomass, but the least nitrogen. In addition, this mix seems to break down too quickly, thereby allowing more weeds to break through. The Minnesota vetch had the poorest corn stand and might have reduced corn yields due to the late planting date. All in all, another farmer-partner, Steve Groff, seems to have hit on the best early cover—vetch:

1. It allows for early planting due to early vetch bloom.
2. It supplies high amounts of cover crop biomass and nitrogen.
3. Corn populations are high and amounts of weeds were acceptable.

While the Bocks' challenges demonstrate there is considerable work that remains to be done in terms of developing reliable weed suppression and nitrogen supply of cover crop-based no-till systems for organic growers, their successes reveal the systems' potential. Through on-farm trials and field days such as these more and more farmers are seeing this potential. In fact, the Bocks were not the only farmers who made changes on their farm after participating in Rodale Institute's field day in 2008.

In a follow-up phone survey, about half of the farmers surveyed stated that they have made changes in their operations, either planting cover crops for the first time, trying new cover crops, rolling cover crops instead of plowing them, or by setting up an organic test plot on their farms. These changes are taking place on close to 200 acres of the approximately 4000 acres farmed by the interviewed farmers, and after the discussions on the Bocks' farm this month, we can be sure those changes will grow.

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