A Permanent Cover Cropping System

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I started no tilling in the early '80s on about 15 corn acres because we had some erosion problems and I didn't like having to fill in gullies before harvesting corn and I felt that wasn't right. In 1991 I began using a rye cover crop as another soil-conservation measure. In 1994 we stated no-tilling tomatoes and in 3 years, all of our 175 acres of 15 different crops were no-tilled. This "Permanent Cover Cropping System" is done successfully by using cover crops, intensive crop rotation, and long-term no-tillage. I can't say enough how these 3 components are the foundation to make this system work. No-till is not the "magic bullet". It is an equal partner with cover crops and rotation. I use this system for 3 reasons:

- Increase profits
- Enhance soil quality
- Reduce pesticides.

Increase profits

The economics of this system are positive. Total savings when no-till transplanting tomatoes amounts to $675 per acre. Nearly $500 of the cost reduction is from material, labor, and time savings when eliminating the use of plastic mulch. Bear in mind that plastic mulch would still be needed for early-season tomatoes. I have erected a Haygrove multi-bay high tunnel to get the early plantings off to a good start. A saving in tillage is $50/A and $125/A for pesticides (average over 5 years). Increased costs are $50/A for establishment and seed of a cover crop, and $10/A for controlling the cover crop. It's hard to put a dollar value on the other benefits cover crops give such as erosion control, better soil quality, and increased organic matter, but it has to be factored in at least indirectly. On my farm I've been able grow my own cover crop seed and use a rolling stalk chopper to control the covers. This allows me to further reduce expenses. Our yields have increased the last several years and this adds to the profit.

Enhance Soil Quality

Soil erosion is one of the most detrimental aspects of agriculture. We can't turn our backs on soil erosion and call ourselves sustainable! No-till has some very attractive attributes especially when combined with cover crops and crop rotation. SOIL IS MEANT TO BE COVERED! Soil erosion on Cedar Meadow farm has been cut from 14 tons per acre per year to almost nothing. With the ground covered by plant residues and not loosened by vigorous tillage, the soil stays rather than getting washed away during heavy rainfall. With an average soil loss in Lancaster County of 9 tons per acre per year on the typical farm, you begin to realize the importance of keeping this valuable soil resource in place. The combination of cover crops and no tilling does more than cut erosion -- it improves soil tilth, increases organic matter levels, enhances water infiltration and lessens pest problems. Organic Matter has gone from 2.7% to 4.8%. Soil aggregate stability in fields tilled recently (less than 10 years) is 16% and fields that have not been tilled for over 10 years is 67%. Soil microbial biomass has tripled. These results are proof to me that this system is working. Yields have increased 10% over the last several years.

Reduced Pesticides

A good thick mulch helps control weeds and has really cut down on my herbicide bill. It's very important to have a consistent cover crop to make this work. Total pesticide use on tomatoes has dropped from $200/A to $75/A. This is mainly due to fewer fungicides for early blight and insecticides for Colorado Potato Beetle. Consistent with what Dr. Aref Abdul-Baki (USDA Researcher) and Dr. Ron Morse have found, as well as others who have tried no-till tomatoes, the onset of early blight has been delayed. Penn State has a weather station (FAST system) near Cedar Meadow Farm that forecasts favorable early blight susceptibility. I usually am able to wait 3-7 weeks to spray after the FAST system recommended a protective fungicide although this year with constant moisture it didn't make much difference. We've experienced years of extremely different weather conditions -wet, dry, and near normal. In every year, early blight has been delayed with this system. I've also noticed healthier plants even to the end of the season. I've planted a cumulative total of 175 acres of no-till tomatoes the past 9 years and have yet to spray for Colorado Potato Beetles! I haven't used Admire at transplanting. A good thick mulch helps control weeds as well and has really cut down on my herbicide bill**. It's very important to have a consistent cover crop to make this work**. Herbicide use for corn and beans has dropped from $25/A to$18/A. Total pesticide usage on the whole farm has decreased 30%. Beneficial insects have increased.

How the System Works

The foundation of this system is the establishment of a cover crop in the fall. My favorite for transplanted vegetables right now is a mix of hairy vetch (25 lbs.) and rye (30 lbs.). I have successfully no-tilled vegetables into corn and soybean residue with excellent results, however more herbicides, fungicides and fertilizers are needed to control weeds and diseases. I credit rye/vetch giving #50lb. of N and straight vetch #75lb. of N. Vetch seed is expensive so I grow my own with rye. I also have seed to sell.

I wanted to control covers mechanically and in a way that flattens them near the soil to help their decomposition. I ended up buying a 10-foot Buffalo Rolling Stalk Chopper in 1996. It's designed to flatten and chop cornstalks, on a scale between a flail mower and a disk. The machine has two rows of rollers, four in front and four in back, with eight 23-inch blades per roller. The turning rollers crimp up the cover and push it right down. It can be run at 8-10 miles per hour, so it's fast and economical. I added parallel linkage so each roller floats independently. The versatile machine has been used on over 1,000 acres in 8 years. I roll the covers with it, and get good control of hairy vetch and rye if it has flowered. Vetch that hasn't bloomed yet will give some regrowth and needs a low rate of post emergent spray. **It is important to roll the cover before wind blows it in various directions so it is laid parallel to the direction of planting.** I always roll soon after the rye is 4 feet tall, which is around May 10th unless the cover is thin, and will not blow down. If I need to plant before the cover is 2 ft tall I will spray with Roundup 3 days before planting instead of rolling. A cover that is rolled before or during flowering will regrow somewhat and then I spray with 3 ounces of Sencor and 1/2 ounce of Matrix at least 10 days after transplanting tomatoes. Occasionally I will need to do a follow-up spot spray with this same rate. If grasses break though Poast is used to control them. I've successfully eliminated all herbicides when I have a good thick mulch cover and it is fully matured when rolled. This system does have potential for organic growers when a heavy cover is achieved. After harvest, I use the rolling stalk chopper to roll the plant residues and then immediately plant another cover crop.

I've customized an RJ Equipment carousel no-till transplanter for no-till transplanting of tomatoes into killed cover crops. This transplanter has a spring-loaded 20-inch, turbo coulter, followed by a double disk opener and a short shoe to place the transplant in. Angled press wheels tuck the soil firmly around the plant. The package leaves virtually no soil showing after the crop is planted, giving good full coverage mulch for the whole season. RJ Equipment is now manufacturing no-till transplanters on custom order basis. Phone: 519-676-4110

Fertilizer management evolves, as you have become more committed to the use of no-till, cover crops and the overall concept of sustainable ag. Any synthetic N I use is mainly ammonium sulfate as I need the sulfur it supplies, as well as its low volatility. A 30% N blend of ammonium sulfate and Super U is used in side-dressing by broadcasting 40 - 80 lbs. of dry N (depending on contribution of cover). I've found that you need to get N on earlier with the no-till system. I credit my higher organic matter soils of giving me 25lb of N or so from release of additional N and do some foliar feeding as well.

Soil Compaction is to be avoided at all costs! However, once you've no-tilled for several years the soil becomes noticeably less susceptible to compaction. Cover crops are key to this in building soil structure. I'm real fussy about when lime and manure trucks can get on my fields. If you ever need to alleviate compaction, do so with as little surface disturbance as possible. I have a customized 2 shank Unverferth ripper/stripper to go through my field driveways after harvest. This tool has a 3/4" narrow shank that penetrates 12 inches deep and has a 2-inch wide wavy coulter on either side of the shank. This keeps soil from being thrown away from the shank and chops it up a bit. A 12-inch wide rolling basket follows to further break up clods. I am able to plant behind this without needing to disk.

Controlling perennial weeds can be a challenge in no till but I have found that with intensive crop rotation and occasional spot spraying, weeds can be managed effectively. Perennial weeds are not a problem on our farm.

In wet years, you might notice more slugs, but they haven't chewed our fresh-market tomatoes unless the crop is in contact with the soil. I am concerned though with the potential of slug damage and have begun to collaborate with researchers in establishing biological and chemical controls of this pest. Deadline MP has been effective in reducing slugs as well as applying liquid N when they are exposed. Aphid pressure has remained the same.

Video and Web Site

We have produced a video titled, "Cedar Meadow Farm, A Model for Clean Water and Healthy Soil". It shows how our farm handled hurricane Floyd which dumped over 8 inches of rain in 12 hours. Cost is $21.95 each plus $3.00 S/H. To order call (717) 284-5152, e-mail: sgroff@epix.net, or web site: www.cedarmeadowfarm.com. The website also has more information about our farm and the research results that were conducted there.

These examples of the use of cover crops, crop rotation, and long-term no-till are what sustainable agriculture is all about. Don't try and adopt exactly what I have done. You need to adapt these principles to your operation in accordance to the resources, equipment, and experience you've attained. Start small. Learn as you go. Network with researchers, extension agents, and other growers who have been successful. Go to field days or research tours. At the very least, think of one idea you can implement on your farm to make it more environmentally friendly, yet still maintain profitability.