

Low-Till Vegetable Production

Doug Walton, Market Grower, Muskogee, OK

I've been working on a low-tillage production system. What I'm basically doing is growing a cover crop on a raised bed, killing it mechanically or letting nature take care of it by freezing, and then planting vegetables or herbs, with little if any tillage, into the mulch-covered soil.

We have a small farm of eight acres on the edge of Muskogee, with between one-fourth and one-half acre in production. With such a small operation, we've tried to focus on some higher value crops such as salad mix, herbs, and a few cut flowers. We've taken these items as well as standard garden veggies to the Muskogee Farmers' Market and to a local restaurant. Everything is grown according to the organic standards of the State of Oklahoma, yet we are not certified. I've been playing with cover crops for about eight years now and really enjoy growing them, as well as talking about them.

I want to briefly hit on some of the many benefits of cover crop usage. For those of you more familiar with the subject, just consider the following something of a rally session. First, I consider a cover crop any plant crop grown to provide cover and protection of the soil. Some folks, including myself, use the term "green manure" interchangeably with "cover crop," but technically a green manure would be a cover crop whose purpose is shifted from merely protection of the soil to the provision of nutrients and organic matter, usually through incorporation into the soil. Without tillage, the nutrients and organic matter will still become available, yet through a slower release process. The practice of using cover crops, or green manures, is not at all new, but has been used for at least 3,000 years, with its origins in China.

As far as benefits go:

- By sheltering the soil, cover crops reduce erosion and

help to preserve the surface structure of the soil.

- The rooting action of cover crops can improve drainage by helping to aerate and loosen hardpans.
- They also provide nutrients for soil life and for future crops through nitrogen fixation and the gathering, or mining, of other nutrients such as potassium, phosphorus, and calcium.
- Many cover crops also provide habitat for beneficial, predatory insects.
- The addition of organic matter from green manures can improve soil structure, or tilth, and when left as a surface residue, or mulch, soil moisture is conserved and weed growth suppressed.

Now keep in mind, there are some potential downsides of using cover crops:

- They take work to plant and manage.
- In a dry season, cover crops may use up limited soil moisture.
- In a wet season, access for incorporation may be difficult.
- Decomposing green manures may tie up nitrogen by being too high in carbon.
- Some allelopathy may occur with very small seeded crops following rye, oats, and some other cover crops (Some plants produce chemical substances that inhibit the germination or growth of nearby competing plants— a process called allelopathy).
- Allowing certain cover crops to over-mature can lead to weed problems.
- Some insect pests can be attracted to particular cover crops.

I first learned about the idea of growing low-till vegetables while working on Dan Nagengast's farm near Lawrence, Kansas, in 1996. He wasn't using this technique

About Doug Walton

Doug Walton lives with his wife and two children on their eight-acre farm outside Muskogee, Oklahoma, where they raise organically grown vegetables and herbs. He has been experimenting with cover crops and reduced tillage systems on his farm for the past five years. He is currently conducting a three-year on-farm research project in cooperation with the Kerr Center, the USDA and OSU to evaluate sixteen different cover crops for use in this region. Funding for the project was provided through the Kerr Center's producer grant program.

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but told me of others who were. As it turns out, the USDA Ag Research Service in Beltsville, Maryland, has been doing research on no-till vegetables since the early 1990s. In fact, their results show higher tomato yields and lower production costs using hairy vetch mulches compared to black poly. There are also a growing number of farmers such as Steve Groff in Lancaster County, Pennsylvania, who are leading the way in this area.

What really got me interested in using low-till methods was the simple fact that we've got very slow-draining soils with a fairly high water table in the spring. We have about twelve inches of Parsons silt-loam on top of a thick clay pan. We have good moisture capacity for summer, but it tends to be somewhat damp in the spring, making it difficult to incorporate cover crops in time for planting production crops.

Instead of waiting for soil to dry or for freshly tilled green manures to decompose, all I have to do is mow down my cover crop. If soil conditions are still cool and moist, I rake aside the mulch to allow some warming before planting a few days later. If everything is right, I can plant immediately. I've used this for transplanting warm-season crops such as tomatoes, peppers, eggplants, squashes, cucumbers, basil, and even okra as well as for direct-seeding crops like corn, beans, okra, and cucurbits. Yields have seemed fairly average, with very little supplemental fertilizer. I've not done much research comparing my own yields between no-till and tilled cover crops. That merits further attention.

For mowing the cover crops, I use a straight-shafted string trimmer equipped with a brush knife/blade. I cut as close to the ground as I can without hitting the soil surface. For transplanting my production crop, I use a bulb planter, either hand-held or with an extended handle. I usually go through the entire bed, pulling out plugs in the desired spacing arrangement, then come back through to transplant, using compost to refill the hole if available. Otherwise, I just break apart the plug to refill, which takes a bit longer. For direct seeding, I loosen the top few inches of soil near the planting row with a shuffle hoe, either hand-held or on a wheel hoe. I then make a seed furrow with a Warren hoe or just poke the seed in by hand.

The cover crops that most low-till growers have been using are hairy vetch and rye. Both are winter annuals planted in the fall, usually around mid-September in eastern Oklahoma. Both are extremely winter-hardy and grow prolifically in early to mid-spring. They are planted together for two primary reasons: to obtain a good proportion of nitrogen (from the leguminous vetch) to carbon (from the cellulose-rich rye). Secondly, the rye provides a natural trellis for the vetch to climb upon, thus growing to maximum heights. This trellis effect between the legume

and cereal also makes mowing much easier and quicker.

My primary complaint with hairy vetch is that it doesn't normally begin to bloom in our area until late April or the first part of May, with peak bloom not coming for another week or two. With legumes, the blooming cycle is important for several reasons. At peak bloom, nitrogen content and biomass are at maximum levels, and both decline thereafter. Also, the legume is much less likely to regrow when mowed during mid-to-late bloom. So if I want to maximize the nitrogen content and the amount of mulch, and hairy vetch doesn't approach peak bloom until early or mid-May, then I miss the normal planting dates for many summer crops.

The question for me became: What other legumes might compare in nitrogen production, aboveground biomass, and winter hardiness, yet mature sooner than the hairy vetch? So I applied for and received a producer grant from the Kerr Center in 2000 and am now in my third and final year of research. Thankfully, I've had the help of some professional researchers with USDA Agricultural Research Service, Southern Plains Station in Lane, Oklahoma.

We've been studying eight different winter annual legumes, each mixed with one of two different winter annual cereals, or grasses. Each of these bicultures is planted on or around September 15 in twelve-foot plots on thirty-inch-wide raised beds. Each plot has three rows of the cereal running down the bed, one on each side and one in the center. This allows for two rows of legumes to fill in between the three cereal rows. Soil samples are collected from each plot at the time of planting, then compared to samples collected at the time the cover crop is mowed. Samples of aboveground biomass are collected just before mowing each cover crop, which occurs at 50 to 75 percent bloom of the legume. Visual assessments of cover crop and weed growth are taken during the season.

The data has not been formally analyzed yet, and there's still one more year of data to be collected. However, I've learned quite a bit from some simple observations. The common and wooly pod vetches have all been about two weeks earlier than the hairy vetch, yet they don't seem to have near the biomass. The subclover has also been a few weeks earlier than the hairy vetch and also seems to have less biomass, yet the minimal weed growth has been impressive. This is likely due to the low-growing, mat-like nature of the subterranean clover.

We are also studying four different warm-season summer annual legumes, each mixed with one of two different summer annual cereals. These eight biculture combinations are planted on two separate planting dates, one in late July and one in mid-August. Within a production system, these cover crops could possibly follow an earlier crop of

summer squash, cucumbers, tomatoes, or anything else finished by July or August. The same type of data is being collected as for the winter annuals. Being warm-season plants, these cover crops are killed after a few good frosts, and their residue can be left in place for winter soil protection. The remaining debris can be cleared away for early spring planting of crops such as brassicas, peas, onions, carrots, beets, or potatoes. The amount of tillage can vary according to weed pressure and soil moisture.

These summer annual cover crops can also be mowed in mid-to-late September, in time for some hardier fall crops, such as lettuces, greens, garlic, and others. I have been quite pleased using the cowpea/sorghum-sudan combination ahead of fall planted garlic. I'm growing my winter mulch right in place ahead of planting time.

Once we have a good understanding of the cover crops that are available to us and some general ideas about their use, the possibilities become almost limitless.

Cover Crop Resources

Books:

Feed the Soil. 1982. Edwin McLeod. 8855 Kenberton, Oak Park, MI 48237.

Green Manuring: Principles and Practice. 1927. Adrian J. Pieters. John Wiley & Sons, New York, NY.

Managing Cover Crops Profitably, 2nd Edition. 1998. USDA-SARE, Sustainable Agriculture Publications, Hills Building, Room 10, University of Vermont, Burlington, VT 05405. www.sare.org

Northeast Cover Crop Handbook. 1994. Marianne Sarrantonio. Rodale Institute, 222 Main St., Emmaus, PA 18049. www.rodaleinstitute.org

The Rodale Book of Composting: Easy Methods for Every Gardener. 1992. Deborah L. Martin and Grace Gershuny (eds.) Rodale Press, 33 Minor St., Emmaus, PA 18098.

Other:

Cover Crops and Green Manures. ATTRA Information Packet. Appropriate Technology Transfer for Rural Areas, Fayetteville, AR. (800/346-9140)

Cover Crops for Soil Improvement in Horticultural Crops. Alan Ware. Publication H1100. The Kerr Center, P.O. Box 588, Poteau, OK 74953. www.kerrcenter.com

Green Manures: A Mini-Manual. Research Dept., Johnny's Selected Seeds, Foss Hill Rd., Albion, ME 04910. www.johnnyseeds.com

Sustainable Farming Connection
www.ibiblio.org/farming-connection/covercro/

University of California Sustainable Agricultural Research and Education Program (SAREP) Cover Crop Resource Page. www.sarep.ucdavis.edu/ccrop/

Seed Sources: (Check local farm co-op first)

Adams-Briscoe Seed Co., P.O. Box 19, Jackson, GA 30233. (770) 775-7826, abseed@juno.com

Johnny's Selected Seeds, 305 Foss Hill Rd., Albion, ME 04910. (207) 437-4395, www.johnnyseeds.com

Peaceful Valley Farm Supply, P.O. Box 2209, Grass Valley, CA 95945. (888) 784-1722, www.groworganic.com