An Introduction to the Organic No-Till Farming Method

By Jeff Moyer

It is the hope and dream of many organic farmers to limit tillage, increase soil organic matter, save money, and improve soil structure on their farms. Organic no-till can fulfill all these goals.

Many organic farmers are accused of overtilling the soil. Tillage is used for pre-plant soil preparation, as a means of managing weeds, and as a method of incorporating fertilizers, crop residue, and soil amendments. Now, armed with new technologies and tools based on sound biological principles, organic producers can begin to reduce or even eliminate tillage from their system.

Organic no-till is both a technique and a tool to achieve farmer's objectives of reducing tillage and improving soil organic matter. It is also a whole farm system. While there are many ways the system can be implemented, in its simplest form organic no-till includes the following elements:

- annual or winter annual cover crops that are planted in the fall,
- overwintered until mature in the spring, and then
- killed with a special tool called a roller/crimper.

Jeff Moyer, Transitioning to Organic, from the 2015 Eco-Ag Conference & Trade Show. (1 hour, 3 minutes). Listen in as Moyer, the executive director of Rodale Institute, teaches a class on important details to know before you transition your operation to organic.

After the death of the cover crop, cash crops can be planted into the residue with a no-till planter, drill or transplanter. Whether you grow agronomic or horticultural crops, this system can work on your farm, and we'll show you how to get started with this exciting new technology.

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These techniques and tools can work equally well on both conventional (farms based on chemically based practices) and organic farms (farms that follow the USDA's definition of organic).

Organic no-till is a rotational tillage system that combines the best aspects of no-till while satisfying the requirements of the USDA organic regulations. It is not necessarily a continuous no-till system but one that may include some tillage in rotation, especially to establish the cover crops. After cash crops are planted, no further tillage or cultivation is generally needed, and this greatly reduces the required field operations.

While organic farmers typically work the field several times just to get the crop in the ground, organic no-till farmers can get by with as few as two field operations: rolling the cover crop and planting the cash crop in one pass, and then harvesting the cash crop. By reducing the number of field operations, farmers can save on fuel and time — all the while building up their soil.

Cover crops are the cornerstone of weed management and soil building — so much so that they become as important as the cash crop.

Most organic farmers know something about cover cropping, but with organic no-till you'll get a chance to sharpen your skills. If you are managing a chemically based operation you can still take advantage of these tools and use cover cropping on your farm. Winter annuals like rye and hairy vetch are common examples, but summer planted buckwheat, field peas, many small grains, and annual legumes are also a possibility. A later chapter on cover crops will tell you more about which cover crops can be killed by rolling and when.

Our rule of thumb is simple: if you can step on the plant and it dies, then you can kill it with a roller/crimper. This means that plants like alfalfa or perennial weeds are not good candidates for rolling.

The author pulling back the killed cover crop to show no-till mulch in action with corn seedlings.

When seeded at the correct time during the fall, these cover crops will get started by developing an extensive root system and growing a small amount of vegetative matter. During the winter, the cover crops will either continue to grow slowly (in warmer climates) or essentially remain dormant (in the north).

There are several benefits to a winter cover crop, including erosion control, nutrient cycling, and microbial habitat in the root zone.

During spring, the cover crops jump to life and really put on biomass. Then they can be killed with the roller/crimper as they reach the peak of their life cycle.

With the winter annuals commonly used in the system, this corresponds to the period when they are entering their reproductive phase. For example, with winter rye, the correct time to roll the cover crop is when the rye is in "anthesis" or producing pollen. With hairy vetch, the vetch should be at least 75 percent in bloom, but 100 percent bloom is even better.

An annual crop typically allocates 20 to 30 percent of its resources toward the process of flowering and seed production. In addition, enzymatic changes at this time cause the plant to begin to senesce, or start the process of aging and breakdown prior to death. During this phase of the plant's life cycle, it is much more vulnerable, and can be effectively killed by the roller/crimper.

The Rodale Institute roller/crimper in action.

The roller/crimper is a specialized tool designed by John Brubaker and myself and tested at the Rodale Institute. It works by rolling the cover crop plants in one direction, crushing them, and crimping their stems.

The roller/crimper can be front mounted on a tractor, while a no-till planter, drill or transplanter brings up the rear, planting directly into the rolled cover crop. Or the roller can be pulled in a separate pass.

Since the system is based on biology and mechanics, it is scale neutral — suitable for use on either small or large farms. The roller/crimper can be pulled behind a tractor, a horse, or even by hand depending on the scale of the operation. While other tools, such as a stalk chopper, rolling harrows, and mowers have been used for this purpose; the roller/crimper has several advantages over other tools. It has been specially designed for organic no-till, and performs its function exceptionally well.

Provided that the cover crop is thick enough, the field will take care of itself for the rest of the season.

The mashed cover crops provide a mulch layer for the cash crop, both preventing the growth of weeds, but also breaking down gradually during the season to provide a long-term slow release of nutrients.

To achieve adequate weed control, the cover crop should be planted at a high rate and produce approximately 2.5 tons of dry matter per acre. For this reason, only certain kinds of cover crops, ones that yield a high amount of biomass, work well for the no-till system. It's also important to select cover crops with a carbon to nitrogen ratio higher than 20:1. The higher the ratio, the more carbon, and the more slowly the crop will break down.

This will provide a consistent weed management barrier through the season. These topics will be explained in more detail further in this book.

After harvest, the killed cover crops can be disked under and the next round of cover crops is planted for the following season. Thus, the crop year begins in the fall with planning for the following year. For this reason, organic no-till requires considerable long-term planning.

Principles of Organic No-Till

Organic no-till rests on three fundamental principles:

- soil biology powers the system;
- cover crops are a source of fertility and weed management; and
- tillage is limited, and best described as rotational tillage.

In both the goals and ideology, organic no-till is very similar to other kinds of organic farming.

These include soil building with organic matter and soil biology, managing weeds, insects and diseases through diverse and non-chemical means, and achieving general plant health through soil health and good management practices. However, organic no-till uses different methods to achieve those goals. Much more emphasis is placed on cover cropping, which replaces tillage and cultivation as a means of soil building and managing weeds.

Maximize Natural Soil Biology

In organic no-till, as with all types of organic agriculture, biology replaces chemistry. This means that organic farmers let the soil organisms do the work of facilitating nitrogen fixation, improving nutrient cycling, as well as enhancing soil structure and texture.

These soil organisms include macroorganisms like earthworms and as well as microorganisms like soil bacteria and fungi. Organic no-till goes one step further than the current technology offered in organic systems.

By providing nearly year-round cover and limiting tillage, the soil biology is given a chance to thrive and power the system that is the organic farm.

Chemistry, as used by conventional agriculture, has some fundamental problems. When we say chemistry we mean synthetic products such as man-made fertilizers and pesticides.

Conventional no-till is closely tied to herbicide use, since this is the primary means of weed control. Typically, as tillage is reduced herbicide management is increased in an attempt to control weeds. Although some surface residues are generated from no-till, they are not enough to provide consistent weed control.

This dependence on herbicides generates a host of problems, from resistant weeds to the destruction of beneficial insects.

Genetically modified crops (GMOs) are also commonly used in a conventional no-till system since the marriage of herbicide resistant crops and ag chemicals has been a consistent theme.

There are a number of concerns about GMOs — they may cause allergic reactions in sensitive individuals, they can cross pollinate with non-GMO crops, and there is an increased dependence on chemical herbicides and pesticides. GMOs also prevent farmers from saving their own seed since these technologies are all patented. None of these technologies are currently allowed under the USDA organic standards.