Article 1 - No-till and Cover Cropping for Vegetables - Country Folks Grower February 2019

No till and cover cropping for vegetables

by Tamara Scully

Soil health happens in a cumulative manner, year after year, when attention is paid to sequestering carbon. Carbon helps to add stability to soil aggregates and to enhance soil water retention and soil nutrient retention. It is part of a healthy ecosystem for soil microbiota.

When using no till in conjunction with cover crops, "all of these come together and integrate," Dr. Gladis Zinati, director of the Vegetable Systems Trial at the Rodale Institute, said at during a presentation at the recent No-till and Cover Crops conference hosted by the non-profit North Jersey Resource Conservation and Development.

Over the past 50 years, conventional farming practices have led to decreases in the levels of vitamins, minerals and protein in our vegetable crops. While yields may have increased, the nutrient density of those crops has significantly declined. Practices such as tillage and plowing release carbon from the soil, adding oxygen which microbes digest and release as carbon dioxide. These practices lead to decreases in overall soil health, Zinati said, and contribute to the nutrient decline seen in vegetables today.

By using no-till practices, combined with cover crops, "you are sequestering the carbon back to your soil. You are building your soil organic matter," she said. But "no-till in vegetable is so difficult to do 100 percent."

No matter the crop, there are a lot of factors that need to be successfully implemented to make no-till production of any crop successful. The right cover crop – "not allelopathic to the cash crop" – a good crop rotation schedule, the right cultivar selection, good pest management and the best management of crop residue all have to work together, Zinati explained.

Examining Nutrition

The objective of the Vegetable Systems Trial is to explore the link between soil health and human health by measuring the nutrient density of vegetables grown in a variety of farming systems in side-by-side comparisons. They will be analyzing root, fruit and leaf crops grown in conventional, organic manure-based and organic legume-based growing systems. Each system will be further divided into tillage, no-till and rotational tillage plots.

Researchers will be collecting data on the nutrient density of the food as well as soil health, insect and weed pressure, drought resilience and profitability. The study, which began in 2017, will run for 20 years.

In 2017, research on the striped cucumber beetle was conducted at Rodale Institute, comparing plastic mulch to a rolled oats mulch to determine if there was any impact on the insect. No statistical difference was seen between the presence of the pest grown on the crop in the plastic or the living mulch system. However, the rolled oats mulch produced a cucumber crop with higher nutrient levels.

"It's really helping other things in the plant," Zinati said of the use of the rolled oats cover crop system. Polyphenol levels in the crop grown in the rolled oats were higher than in the crop grown on plastic. Plants use polyphenols to deter pathogens and insects.

Further research examined the difference in nutrient content in winter squash grown under organic conditions using conventional tillage and two no-till organic systems. In the first no-till system, the crop was planted with two feet wide rows, using a walk-behind roller crimper, while in the second the rows were 10 feet apart, wide enough to accommodate the use of a tractor-mounted roller crimper for cover crop termination.

After harvest, levels of carotenoids, including lutein and alpha-carotene, which are important phytochemicals for human health, were assessed. Researchers also measured levels after being in storage to determine what effect time in storage would have.

NO TILL 10

NO TILL from 9

In both no-till systems, the levels of the carotenoids increased significantly after 30 and 60 days of storage. The squash grown in the tractor-pulled roller crimper system had the highest levels of carotenoids. The tillage-grown squash not only had the lowest levels of these important phytochemicals, but the levels decreased in storage over time.

The results demonstrate that differences in crop management can impact the nutrient properties of the crop itself. Further large-scale studies to examine how and why these changes in phytochemical levels occur will be conducted.

Utilizing Cover Crops

"Equipment really plays a huge role in our success" with no-till and cover crop systems, Zinati said.

Having the right equipment, such as roller crimpers, which allow farmers to terminate a cover crop without chemicals or tillage is crucial to cover cropping and no till success. The biomass produced by the cover crop is also important. The residue has to allow planting into it, but also has to be sufficient to suppress weed growth.

Depending on the species of cover crop chosen, the amount of nitrogen fixed will vary. After termination, time for the cover crop to release nitrogen is key. The amount of soil fertility needed will depend on the requirements of the cash crop.

A tillage radish crop provides "biological tillage," she said, and takes the nutrients from the soil and moves them up. The tillage radish does not overwinter, so in the spring, transplanting vegetables into this soil allows the crop to access the now-available nutrients.

Zinati explained there are four stages to the transition from tillage to no-till practices using cover crops. The first five years are needed to start to build the soil. Years six through 10 will see increases in soil organic matter, increases in soil structure and in microbial activity. The next 10 years will accumulate carbon reserves in the soil, and the enhanced nutrient cycling that occurs with high levels of soil health means "you will see the evidence," she said.

From 20 years onward, it's a matter of maintaining optimal soil health. Adding nutrients back to the soil and not letting the crops deplete fertility while continuing to sequester carbon and feed the soil microbiota will keep soil health and productivity optimized, and will translate into nutrient dense crops.

"It takes a lot of effort and vision and planning" to continually improve soil health, Zinati said.