**Reducing tillage in organic vegetables on small farms**

Ryan Maher (rmm325@cornell.edu), Anu Rangarajan, and Brian Caldwell – Cornell University
Mark Hutton, Nicholas Rowley, Mark Hutchinson, and Jeremiah Vallotton – University of Maine

Empire State Producers Expo
Soil Health Session - January 15, 2019

On small-scale organic vegetable farms, reduced tillage (RT) practices and soil amendments can be critical tools for achieving soil health goals. Small farms (<15 acres) are often highly diversified, requiring frequent, intensive tillage, and land-limited, where rotations do not allow for extensive cover cropping to maximize soil building benefits. Permanent beds are seen as a management system to build soil productivity on these farms. Rather than plow and harrow by the field, fields are divided into a set of beds, and field traffic (tractor or foot) is restricted to the same between-bed area, year after year. These pathways can then be managed with cultivation, mulches, cover crops, or perennial sod. Beds are a management unit that help to standardize systems, particularly when a fixed size and length. With field traffic and heavy compaction concentrated outside the planting area, beds can help to reduce the intensity, depth, area, and frequency of tillage necessary for planting. They can work with a range of different crops and row spacings. Often RT systems can require equipment investments for a specific crop or planting window.

To help growers in their own decision-making as they consider the suitability of RT practices in permanent beds, we have used a long-term experiment (4yrs, 2015-2018) to evaluate the benefits and tradeoffs with different RT management practices. This work has been guided by two questions: 1) how can we transition to RT in permanent beds and maintain crop productivity, reduce labor and increase profitability and 2) how can we combine RT with other soil building practices to optimize permanent bed systems. We established beds at two research farm locations - Freeville, NY (Howard gravelly loam, irrigated) and Monmouth, ME (Woodbridge loam, non-irrigated). Two crops, summer cabbage (Farao; yr 1 and 3) and winter squash (Bush delicata; yr 2 and 4) were grown under a range of tillage intensities from deep rototilling to no-till. We also used a no-till system using opaque black plastic tarps (6mil) applied to the soil to suppress weeds and condition soils between crops. Within each tillage practice, we then compared rye hay/oat straw (5 tons per acre per year) to unmulched, bare soil with standard cultivation practices.

To date, results from NY have shown that: 1) shallow tillage systems (<4in) had similar labor inputs and crop yields to deep tillage (8in) in unmulched soil but they were yield-limited in straw (yr 4); 2) straw mulch yields were 45-75% lower in 2 out of 4 years, largely through greater pest pressure, and losses were greater with no-till; 3) despite enhanced weed pressure compared to unmulched soil, straw mulch dramatically increased total labor hours, up to 75%; and 4) tarps provided weed-free planting conditions without tillage and had similar yields and weed pressure to conventional tillage but showed little to no yield benefits.