

REDUCING TILLAGE IN VEGETABLE SYSTEMS: PROGRESS TO DATE

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Reduced and modified tillage (RT) systems (e.g. no-, zone-, strip) represent strategies to reduce soil degradation and erosion and protect water quality. Reduced tillage (RT) systems provide an opportunity for vegetable growers to save fuel and labor while enhancing soil quality, protecting water quality and maintaining profitability. Our team includes soil and crop scientists, economists, plant pathologists, and vegetable growers from MA, ME, PA and NY. We have shown that deep zone tillage systems can provide the environmental and economic benefits of an RT system for many vegetable crops without the harvest delays or losses observed in straight no-till. Each season, more vegetable growers express interest or try RT on their farms. Growers report labor savings averaged 37% and fuel savings 40% for the RT system compared to conventional tillage for field preparation. Other positive attributes of the RT system reported by growers include soil health and drainage improvements, reduced equipment wear and tear, improved crop yields, more timely planting, and reduced soil erosion, visible to their communities as surface water.

Both on station as well as on farm experiments are used to compare zone tillage (soil disturbance in strips 4 to 6 inches surface width and depth) or deep zone tillage (deep vertical tillage underneath a 4 to 6 inch zone tilled strip) with conventional tillage systems. Past research showed no yield differences in deep zone tillage compared to conventional systems for sweet corn, snap beans, dry beans, and winter squash. Results from research trials, photographs, detailed grower case studies of adoption of RT for vegetables and fact sheets on these different tillage approaches have been posted on the project website (<http://www.hort.cornell.edu/reducedtillage/>).

A long term conventional production trial compared deep versus shallow placed nitrogen for impacts on sweet corn growth and yield. Tillage systems included conventional tillage, shallow zone tillage and deep zone tillage. Deep placed nitrogen supported similar yields of sweet corn as conventional shallow placed N plus sidedress. In the deep placed N treatment, all crop N was provided at the time of deep zone tillage.

A long term organic research trial compared deep zone and plow till treatments with three cover crop regimes and two weed management intensities in peppers. Cover crop treatments included rye vetch, oat pea winter killed and oat pea followed by mulching after planting the crop. Weed control treatments were high level of disturbance, using mechanical cultivation plus hand weeding versus a low level of disturbance using only targeted hand weedings. Over wintering cover crop residue reduced yields more often than tillage treatment. In plots following a rye vetch cover crop, weed pressure late in the season was higher than where oats and peas were grown. Rye roots interfered with in season cultivation effectiveness.

A separate experiment examined feasibility of moving residue from a mowed rye vetch cover crop into the row, to improve in row weed control in a deep zone tillage system. Pepper growth and weed pressure were compared in these systems to an oat pea cover crop system, in which all cover crop residue was gone by planting. A special unit was assembled using Yetter row cleaners to move the cover crop residue in the row. Moving the rye vetch residue into the row reduced in row weed growth compared to systems without the residue concentrated in the row. While plots had lower soil temperatures and slower growth in the season, final yields were similar across all treatments.

With new funding from NESARE, we will now evaluate ability of RT systems to improve soil water management which may result from climate change. RT systems may reduce crop losses to flooding, drought and vegetable diseases like *Phytophthora capsici*. Over the next three years, we hope to help 40 growers new to RT apply these systems on at least 20% of their land, to increase management flexibility, timeliness and improve profitability. We estimate that production cost savings will average \$25 per acre, including fuel (2 gallons per acre or \$8/acre) and labor (\$10/acre) and income will increase from *Phytophthora capsici* susceptible crops by 20% or range from \$700 to \$4,000 per acre, depending on the crop and market. We are currently trying to identify farmer collaborators who have fields with a history of *P.capsici*.

With funding from NYS Ag and Markets and the NY Farm Viability Institute, we will also be able to help cost share for rental of zone tillage equipment for vegetable growers new to RT. In addition, we have three zone building units available from Cornell for growers to conduct on farm trials. Please contact your local extension educator or Anu Rangarajan if you are interested in conducting a RT demonstration trial on your farm.