

Reducing Tillage in Tomato Rotations: A Progress Report

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Over the last five years, several members of the University of California's Division of Agriculture and Natural Resources Conservation Tillage Workgroup, in conjunction with a number of Central Valley tomato growers, have conducted a series of studies and demonstrations aimed at evaluating reduced or conservation tillage (CT) production systems for tomato crop rotations. While an immediate goal of these efforts is to reduce production costs, a longer-term objective has been to develop information on the potential of these systems to improve soil quality, store carbon in the soil, and conserve resources. Initial studies, conducted at the University of California (UC) West Side Research and Extension Center in Five Points, the UC Davis campus and in commercial production fields in Tracy, Vernalis and Le Grand, were aimed at evaluating the use of winter cover crops as surface mulches, the feasibility of no-till and strip-till transplanting, and options for in-season weed management. Results from these preliminary evaluations indicated that planting and harvesting processing tomatoes in high residue surface mulches was possible, and that comparable yields to those attained using standard, winter fallow techniques may be achieved with certain reduced till approaches that do not result in excessive cover crop or weed competition with the tomato crop. Non-replicated, on-farm strip trial data for demonstrations conducted in 1999 in Tracy and in 2000 in Vernalis are given in Table 1.

Table 1. Processing tomato yields from 1999 on-farm demonstration in Tracy, CA and 2000 demonstration in Vernalis, CA. Yields are tons / acre.

Tillage / Cover Crop System	Average Processing Tomato Yield
<i>Tracy, CA 1999</i>	
Strip-till vetch cover crop	46.6
No-till vetch cover crop	36.8
No-till winter weeds	47.3
Strip-till winter weeds	45.5
Strip-till winter weeds	45.3
<i>Fallow standard tillage</i>	<i>47.3</i>
<i>Vernalis, CA 2000</i>	
No-till bell bean cover crop	40.5
No-till vetch / bell bean cover crop	39.3
No-till berseem clover cover crop	30.8
No-till pea cover crop	28.2
<i>Fallow standard tillage</i>	<i>38.7</i>

This early work also revealed that in-season weed control by a surface cover crop mulch itself was not adequate, and thus, we investigated and refined the use of a high residue cultivator (Photo 1).



To more fully explore opportunities for reducing intercrop tillage, we then initiated an 8 acre field experiment in the fall of 1999 comparing conservation and standard tillage tomato and cotton production systems with and without cover crops at the University of California's West Side Research and Extension Center in Five Points. This study consists of two cycles of both tomato - cotton and cotton - tomato rotations in adjacent 4 acre fields. Tillage operations following cotton harvest in preparation for tomatoes in the conservation tillage systems consist of a shredder-bedder operation that shreds, undercuts and distributes cotton stalk residue over a 60" bed and a furrow sweep operation to clear residues from furrow bottoms (Photo 2).



Harvest equipment wheel traffic for tomatoes is restricted to the furrows and following each tomato harvest, no tillage (only a winter herbicide spray) is done in the CT systems prior to the next season's no-till cotton planting (Photo 3. This photo shows tomato and cover crop residue).



Data from our 2001 tomato harvest indicate that yields in the CT± cover crop systems were similar to those in the standard till plots, with an elimination of six tillage operations following last year's cotton crop in the CT plots relative to the standard till systems. 2001 cotton yields were reduced 11 and 18% in the CT-cover crop and CT+cover crop systems, respectively, relative to the standard tillage control system. However, there was an elimination of 8 or 9 tillage operations in the CT systems relative to the conventional tillage approach. Estimated resource use per acre indicates the possibility of the CT systems to reduce fuel use relative to the standard till systems. Longer-term implications of these reduced till regimes in terms of soil compaction, water use, profitability, soil carbon sequestration, insects and diseases are being evaluated as the study progresses through a four-year cycle.

This project is the first of its kind in California to systematically compare tillage system alternatives through a crop rotation. While early results of these investigations of reduced till tomato rotations are on-the-whole favorable, many questions and uncertainties remain about the general applicability of these systems in different production environments and over longer periods. "Next generation" studies are currently underway at a number of sites to evaluate refinements in the basic approaches outlined here.

For more information, please contact Jeff Mitchell at (559) 646-6565 or mitchell@uckac.edu. Routine updates on CT research and demonstrations are also available through the UC Conservation Tillage Workgroup. If you would like to subscribe to these periodic updates and become a member of this Workgroup, email Jeff Mitchell.

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