THE CENTER FOR AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS

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Apprenticeship Trains CSA Farmers

"I'm not worried about running out of wheat, corn, and soybeans. I am worried about running out of farmers."

Dan Glickman, Secretary of Agriculture July 1998

Late morning sunshine warms the UCSC Farm's row crop acreage, where David Oretsky is showing Environmental Studies student Jenny Pandol the trick to harvesting broccoli. In the shade of a nearby windbreak, Patrick Shindu of Kenya bundles carrots and beets, while local landscape gardener Thomas Witz packs chard into boxes. Nancy Vail weighs potatoes and summer squash as Rebecca Niggeman, a home gardener from southeast Alaska, checks the blackboard to see which of nearly two dozen crops still need to be harvested.

These budding farmers and their classmates have formed a partnership with community members – many of them campus employees – through the UCSC Farm & Garden's Community Supported Agriculture project. By evening, the produce they're harvesting will fill vegetable bins and salad bowls of eighty Santa Cruz households.

Community Supported Agriculture (CSA) has a simple premise: CSA farms and gardens link directly with local consumers who receive a weekly box of produce on a pre-paid basis throughout the growing season. The UCSC Farm & Garden adds a unique twist to the format: all of the produce is grown on the campus's farm by students and staff of the Apprenticeship in Ecological Horticulture, a six-month training program in organic farming and gardening. While CSA members enjoy locally grown, seasonal food, 35 students are learning what it takes to produce an array of fruits and vegetables using organic techniques – skills that many hope to one day use on their own farms.

Each week from June through mid November, shareholders come to an historic barn on the 25-acre farm to pick up their portion of the harvest. A weekly newsletter offers recipe ideas and alerts members to the latest triumphs and challenges in the gardens and fields. CSA members are encouraged to bring their kids to visit the farm. Many take time to pick herbs and flowers from the CSA cutting garden, or wander through the fields to see how the crops are progressing. And although the shareholders may not have climbed aboard a tractor, talking with the people who grow their food has given them some insights into the challenges that farmers face.

CSA Model Attracts Apprentices

As the market for organic products expands, the industry is attracting more large-scale farmers. "Conventional growers are realizing that organics are a market to target," says Brian McElroy, certification coordinator for California Certified Organic Farmers. "They're coming in with lots of acreage and working on a conventional scale." Established organic growers are also adding to their operations, often focusing on two or three crops for the wholesale market.

But not all farmers – especially those just starting out – have the resources or desire to farm on a large scale. For them, CSA operations may be an ideal fit. "A lot of our students hope to some day own or manage small, diversified

continued on next page

JON KERSEY

David Oretsky, an apprentice in 1997, now helps manage the UCSC Farm's row crop fields and instructs students in CSA production techniques.

For the Farmer

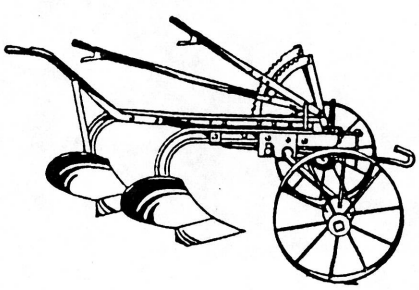
California Growers and Researchers Consider Tillage Options

till: to work (the soil) by plowing and planting, for raising crops

Tilling the soil is as old a practice as agriculture itself, but concerns over tillage's impacts on soil organic matter levels and soil quality are prompting researchers and farmers to consider new ways of farming. In many parts of the U.S., no-till, low-till and other minimum or conservation tillage (CT) techniques are widespread. In no-till systems, growers plant directly into the residue of a previous crop or a killed cover crop without first tilling the field or turning under the residue. In minimum or CT systems, part of the residue may first be incorporated into the soil before planting.

Some of the potential benefits of minimizing tillage may include higher soil organic matter levels, less soil compaction and erosion, improved water infiltration, gas exchange, and nutrient cycling, and lower fuel and labor costs. Minimum tillage may be especially appropriate for organic systems – long-time CT researcher Ron Morse of Virginia Tech has noted the paradox between organic farming's goal of building the soil by increasing soil organic matter, while at the same time losing organic matter through aggressive tillage.

Although most CT has been done in grain crops, recent equipment advances have brought broader applications of the technique, including its use in vegetable row crop systems. In April, growers, researchers, and consultants gathered in Five Points and Davis to consider tillage options for California farms. In meetings organized by Jeff Mitchell, a Vegetable Crops Specialist with UC Cooperative Extension, participants discussed the relationship between tillage, soil organic matter and soil quality, and the pros and cons of reduced tillage as it might be applied to California productions systems.



Tillage Affects Organic Matter Levels

Most California vegetable growers rely on tillage operations to incorporate plant residue and cover crops, level fields, prepare beds, and control weeds. In areas such as the Salinas Valley, where tillage is frequent year-round, California soil scientists are finding that each tractor pass incurs both environmental and economic costs.

A report presented at the meetings by Louise Jackson, a professor in UC Davis's Vegetable Crops Department, notes that in the Salinas Valley, "There are serious problems with water and soil quality. Nearly half the wells in the upper aquifer exceed the public health drinking water standard for NO_3-N [nitrate]... Levels of soil organic matter have decreased by half since the area was dry-farmed at the turn of the century. Intensive management undoubtedly contributes to these problems." [1]

Jackson has found that tillage may trigger loss of soil organic matter and the release of nitrate from the soil system. Based on her study of the "pulses" of microbial activity that immediately follow tillage, she believes that soil microorganisms use available carbon freed up from soil organic matter by the tillage process. Although microbial activity may briefly increase following tillage, the burst of activity quickly declines, as does the organic carbon and nitrogen content of soil organic matter. She found that tillage's long-term effects include a drop in overall levels of soil organic matter and an increase in NO_3-N accumulation, which "... consequently increase losses by leaching and denitrification when subsequent rainfall or irrigation occurs."

Don Reicosky, a soil scientist with the U.S. Department of Agriculture in Morris, Minnesota, has also studied the effects of tillage on carbon loss. He reported that moldboard plowing fractures and inverts the soil, opening it to rapid CO_2 and oxygen exchange. Incorporating residue into the soil feeds a microbial population explosion, which in turn "burns up" organic matter. According to Reicosky's presentation, "The large gaseous losses of soil carbon following moldboard plowing compared to the relatively small losses with no-till have shown why crop production systems using plowing have decreased soil organic matter and why no-till or direct seeding crop production systems are stopping and reversing that trend."[2]

CT System Studies Underway

Despite their apparent advantages in terms of protecting and improving soil quality, no-till and CT have only recently been studied in California vegetable row crop systems. In describing such applications, Jeff Mitchell says, "The concept of no-till mulch systems makes use of off-season or in between season cover crops that are sown on pre-shaped beds. Just before vegetable crop transplanting, the cover crops are

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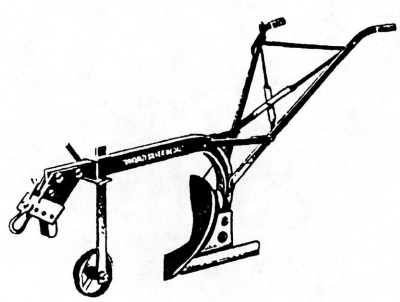

From the Director

I am writing these notes from a hotel room in Beijing, China, where I am participating in what is called the "Asia-Pacific High-Level Conference on Sustainable Agriculture." It is a small gathering organized by AAAS (American Association for the Advancement of Science) and CAST (Chinese Academy of Science and Technology) that has brought together representatives from 11 different countries from Asia and the Pacific Rim.

Two days were spent hearing presentations from each of the participants on a variety of aspects of sustainable agriculture. Yesterday, we ended the conference by developing an action plan and resolution to push an agenda for increased multilateral collaboration in sustainable agriculture research and application across the region. This resolution will be taken back to the respective governments and professional societies for further action. I will be one of a planning team working to finalize the action plan and begins its implementation.

A number of things struck me during this meeting. Most notable was how influential the 1992 United Nations Conference on Environment and Development (the Rio Summit) has been in shifting the awareness of many Asian coutries to the severity of the environmental problems facing the region and the pressing need to develop more ecologically sound agricultural systems. And secondly, how the present economic crisis in Asia has caused many countries to re-prioritize food self-sufficiency and reduced reliance on imports. To achieve this in many cases will require re-prioritizing national support for agriculture and food systems research and development, much of which had been lost over the past 10-20 years.

I learned a great deal from the ideas and approaches presented by the other delegates, many of which have relevance to issues of sustainability in the U.S. and California, in particular. I look forward to the Center for Agroecology & Sustainable Food Systems (the Center) and UC Santa Cruz continuing to be key participants in the development of collaborative ventures that will emerge from this conference.

As you can see from the articles in this issue of *The Cultivar*, staff of the Center have continued to carry out a wide range of activities focused on moving us towards more sustainable agriculture and food systems. Having just completed my first year anniversary as the Center's Director, I continue to be impressed by the amount and quality of work done by the Center, and in collaboration with other individuals and organizations. Nonetheless, I am also keenly aware of the need to improve our resource base and facilities to enable us to be more effective and at less personal cost to the staff.

In the next issue of *The Cultivar*, I will describe the outcome of the strategic planning process we have undertaken, and highlight areas we will be targeting for future resource development. Overall, it has been a busy, challenging, and exciting year for me at the Center, and I look forward to year two with great anticipation.

– Carol Shennan

killed mechanically and/or chemically to provide as thick a surface mulch as possible."

Mitchell and other UC researchers are studying no-till and CT in a variety of crops and settings (see table at right). Results of their work on processing tomatoes, although preliminary, have shown that yields comparable to a standard herbicide/cultivation program were achieved with the rye/vetch, triticale/vetch and snail medic mulches. They also found significantly higher numbers of earthworms in the second consecutive season of no-till management. Researchers are also evaluating the weed control, water conservation and long-term potential benefits to soil quality of mulch practices in the processing tomatoes field trial and in other crop trials at UC's West Side Research and Extension Center in Five Point, CA. Strip tillage (in which a small area on top of the bed is tilled and planted while the rest of the bed is undisturbed) and direct-seeding practices are also being investigated.

UC Studies on No-Till and CT Practices Currently Underway

Crop	Location	UC Contact
Processing tomatoes	Central San Joaquin Valley Sacramento Valley	Jeff Mitchell Tom Lanini Gene Miyao Steve Temple
Fresh market tomatoes	Central San Joaquin Valley	Jeff Mitchell
Bell peppers	Hollister, CA	Richard Smith
Broccoli	Central San Joaquin Valley	Jeff Mitchell Michelle Le Strange
Mixed vegetables	Coachella Valley	Jose Aguiar Milt McGiffen Jeff Mitchell

Based on UC studies and on CT research done on the East Coast, the following components have been identified as key to successful no-till mulch production:

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food security projects can work together to overcome the forces that have produced food insecurity. Together these approaches can mend the tattered strands of the remaining safety net against hunger.

– Patricia Allen

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Conservation Tillage

from page 5

✔ Obtain a dense, uniformly distributed, weed-free cover crop prior to transplanting. According to Ron Morse, "Recommended cultural practices include selecting the most adaptive and compatible cover crops, obtaining a uniform dense stand by drilling high seed rates at close between-row spacing, and providing adequate growth inputs and growing time to maximize cover crop biomass."[3] Sparse, uneven ground cover generally leads to serious weed problems and negates many of the advantages of no-till systems.

✔ Kill cover crops prior to transplanting, leaving a uniformly distributed heavy mulch. Continued growth or regrowth of cover crops after transplanting often becomes "weeds" which seriously decrease crop yields. Uneven distribution of killed cover crop residues may lead to patchy weed problems resulting in yield and quality losses.

✔ Establish transplants with minimum disturbance of surface residues and surface soil.

Applications to Organic Systems

"In terms of taking care of the soil the best way we know how, it doesn't make sense to till it," says Jim Leap, who manages the UCSC Farm for the Center for Agroecology & Sustainable Food Systems. "You lose so much carbon and organic matter, use so much fuel, and it's so labor intensive, especially in an organic system where you're having to incorporate huge amounts of biomass in the form of cover crops. You end up beating up the soil and destroying the habitat for earthworms," he says.

Yet like most conventional growers in California, organic farmers rely on tillage for a variety of operations. Organic growers also face the challenge of trying to control weeds without chemical herbicides – a problem often dealt with via mechanical tillage.

Leap sees weed control as one of the biggest hurdles to implementing CT in organic vegetable production; one of the drawbacks of no-till in conventional systems is that it often requires increased herbicide use. Plant residue left on the soil surface can also keep the soil cool and damp, delaying planting dates and slowing plant growth, and may attract slugs and snails. Yet despite these challenges, Leap is intrigued by no-till and CT systems and plans to conduct trials with squash, pumpkin and dry-farmed tomato crops at the UCSC Farm next spring.

Jeff Mitchell has begun working with San Joaquin Valley organic growers interested in alternative tillage systems, and hopes to expand his work in organic production beginning next year. Mitchell has specialized transplanting equipment available for use or demonstration as well as a growing body of research results from field trials. Says Mitchell, "I'm eager to share my experiences with CT with anyone who might be interested, and would welcome all opportunities to work with growers on issues they face in trying to reduce tillage."*

Mitchell admits that there are many hurdles to overcome in implementing no-till and CT systems in California. However, with concern growing over soil quality, erosion, water use, groundwater pollution and other environmental issues, alternative tillage should receive a closer look by the state's farmers and research community.

– Martha Brown

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