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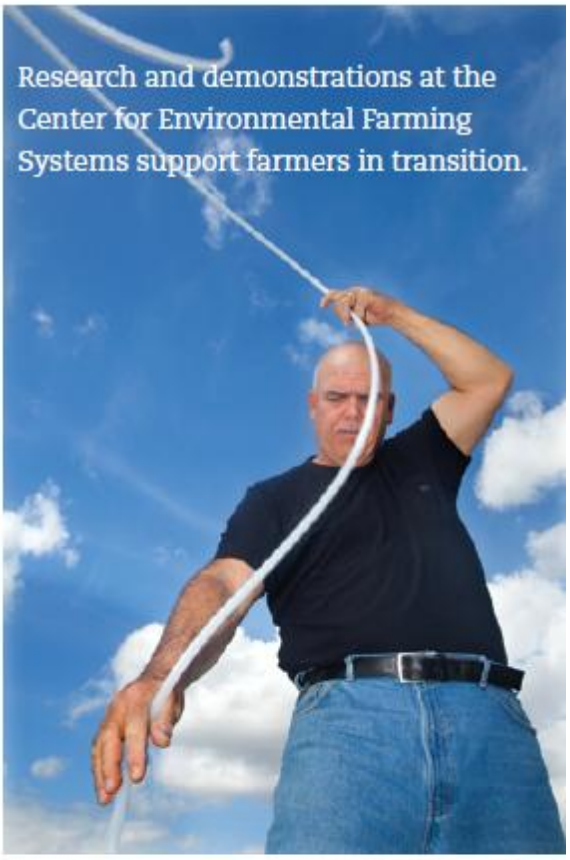
# Re:search


## Converting Waste to Energy

INSIDE

# FARMING SYSTEMS

Research and demonstrations at the Center for Environmental Farming Systems support farmers in transition.



*Dr. Charles Raczkowski, professor of soil science, works a hose into a piezometer, a device used to draw samples from the water table.*

It's a modern-day paradox. Agricultural researchers are beginning to forecast that the plows, pesticides and chemical fertilizers that created such unprecedented abundance in many regions over the past 50 years could prove the demise of agriculture in the long term, unless they are abandoned for more sustainable practices.

The world's diminishing grain yields, a consequence of 50 or more years of high input farming, are a case in point. Agricultural experts are reporting that from a global perspective, the high costs of chemical and fuel inputs for the world's grain harvest, and the damage to soil, water and air that are incurred as a result, are now outweighing the benefits overall.

"(T)he last decades provide uncompromising evidence of diminishing returns on grains despite the rapid increases of chemical pesticide and fertilizer applications, resulting in lower confidence that these high input technologies will provide for equitable household and national food security in the next decades," reported the Food and Agriculture Organization of The United Nations in a 2011 document, "Organic Agriculture and Food Security."

Few people would argue that organic and conservation farming systems contribute more toward a sustainable environment than systems based on plows and chemicals. The big question that remains to be answered is, can production systems that rely on minimal tillage and fewer or no chemicals feed the world? And, just as important, can sustainable farming systems provide sustainable income for farmers?

Agricultural researchers in North Carolina are hoping to provide answers, due in part to evidence emerging from long-term studies such as those taking place at the Center for Environmental Farming Systems near Goldsboro.

The Center is a rare asset to agriculture, hosting some of the nation's few large-scale and long-term studies of sustainable and organic production systems. In addition to research, education plays a large role in its mission. Workshops, demonstrations and growers' schools for organic farmers are regular features. The 2,000-acre research site is co-administered by the state's two land-grant universities, N.C. A&T and N.C. State, as well as by the N.C. Department of Agriculture and Consumer Services.

## The big picture

Large-scale and long-term are what sets CEFS apart. That big-picture perspective is important because agriculture is so variable and subject to the whims of nature that the typical three-year experiment on a small test plot can't tell the whole story, explained Dr. Charles Raczkowski, a soil scientist with N.C. A&T's Agricultural Research Program. His studies on soil physical properties have been ongoing at the Center's 200-acre Farm Systems Unit since 1999.

"Many of the natural processes that occur at the field scale are not represented under small plot experiments," he says.

That's important, he adds, because before researchers

pass their findings on to Cooperative Extension for dissemination to farmers, the research needs to be evidence-based. Agricultural research requires having both time and space to verify results.

"Recommendations have consequences for growers. We have more credibility making recommendations based on evidence gathered from large-scale experiments like we have at CEFS," Raczkowski says.

Those recommendations also have implications for farmers transitioning from conventional to organic systems.

## Saving the farm

Some farmers say the growing market for organic products was their farm's salvation. Others say it was a choice that had less to do with finances than with doing what felt right. Among the former is dairy farmer George Teague, who was confronting a choice between going out of business or continuing to struggle with fluctuating milk and grain prices year in and year out.

"There was no future in it," Teague said. "I knew something had to change."

That change came in the switch from conventional dairy production to organic, pasture-based production in 2007. The organic milk cooperative he now sells to offers a stable and higher price, which makes for a viable dairy business, he said. Meanwhile, workshops at CEFS and demonstration research at his own farm sponsored by the Center gave him new ideas in crop rotation, forage and organic grain production to further improve production. Now, far more than just surviving, Teague's farm is expanding beyond organic milk production, as he has recently started a new venture in the organic feed business.

"I went from discouraging my son from farming, to seeing my son and my nephew now carrying on the sixth generation on the farm," Teague says. CEFS was just one of the many resources he relied on in making the decision to switch to organic. "It gives you lots of ideas that you can adapt to your own situation," he said.

Others say the decision to farm organically has more to do with doing what seemed right from the standpoint of health and environmental sustainability, despite the additional burden of record keeping and fees that organic certification entails.

"It's a choice," said Kenny Haines, who started out his career managing corporate farms, but 25 years ago started his own organic grain farm in Tyner. "Sometimes, doing the right thing is hard, but we're doing what we think is right."

Both Haines and his son, Ben, a partner in the farm business, say they're especially interested in the cover crops experiments at CEFS. The experiments involve a technique for weed suppression, fertility and soil conservation.

"They can work the bugs out, before saying this production system works, and before a farmer lays down a lot of money for supplies and equipment, and not knowing if we have a production system that can perform, and that's important," said Ben Haines.

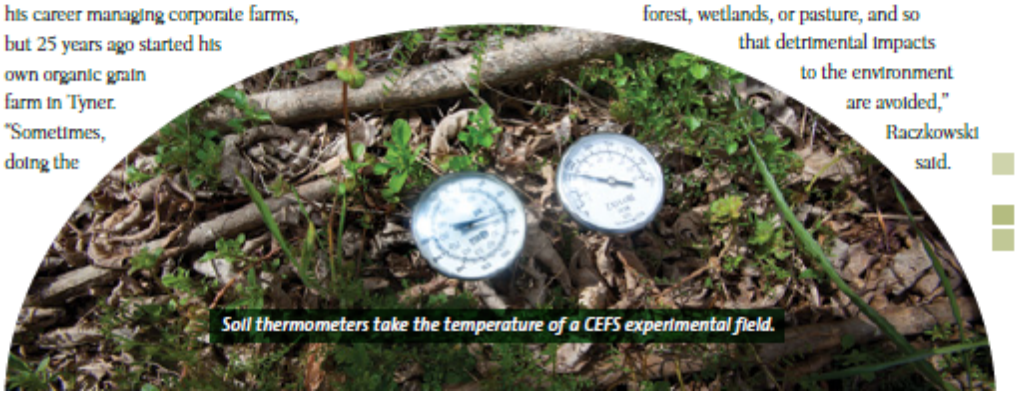
## Farming systems

The Center is home to six research units: pasture-based dairy, beef, meat goats, alternative swine, organic crops, and the farming systems unit. The latter is where Raczkowski and other soil scientists study the long-term effects of five different farming systems. Raczkowski is examining the effects of the five systems on soil physical properties. These properties, including soil compaction, water infiltration and retention, affect plant rooting and growth.

"You don't see a lot of studies of this kind, because they are very difficult to do. It takes a lot of researchers and an interdisciplinary approach," Raczkowski said. Other members of the research team are crop scientists, economists, biologists, weed and pest management specialists, soil chemists and soil agronomists.

Organic agriculture represents one of the fastest-growing segments of agriculture, yet there is still little research on its effects on yield, income and the environment over the long term. One of the recent achievements of the CEFS research was to develop a system for evaluating the impact and risk of various farming techniques. Raczkowski's studies are confirming that soil physical properties improve with no-till and other conservation techniques. Documenting those improvements is important in informing land-use policies having to do with highest and best use of land, as well as in helping farmers weigh the costs and benefits of adopting conservation practices such as crop rotations, no-till or cover cropping.

"Soil physical, chemical and biological properties interrelate and affect soil processes that determine how a soil functions. As land managers, we aim at improving these properties so that the soil functions at an optimum for its intended use, whether for agronomic crops, forest, wetlands, or pasture, and so that detrimental impacts to the environment are avoided," Raczkowski said.



*Soil thermometers take the temperature of a CEFS experimental field.*