Finding the Best Ways to Revive and Protect the Living Soil

Thanks to recent research, we are learning more about the diverse biological community that forms the soil, and how to keep that community healthy. This issue of ATTRAnews looks at why soil conservation is important, and how farmers and ranchers across the nation can learn from on-farm research that’s taking place around the world.

Soil Organic Matter “Banks” Water for the Future

Rex Dufour, NCAT Technical Specialist

Soil holds water according to its texture. However, the level of organic matter also determines how much water a particular soil can hold.

For every 1 percent of organic matter content, the soil can hold roughly 16,500 gallons of plant-available water per acre of soil down to 1 foot deep. That is roughly 1.5 quarts of water per cubic foot of soil for each percent of organic matter. The graph shows the relationship of organic matter to water-holding capacity.

As global warming takes hold, all computer models predict that there will be periods of greater rainfall intensity as well as drought. Farmers can prepare their farmland for this by increasing the percentage of organic matter in their soils. Well-tested techniques to do this are no-till (organic farmers can use roller crimpers!), minimum till, compost applications, crop rotations, and cover crops and green manures.

All these techniques help build soil health and soil organic matter, which in turn will allow for greater infiltration of the rain that does fall, reducing erosion and increasing the moisture-holding capacity of the soil.

Particularly during low-rainfall years, farmers who have good levels of organic matter in their soils will maintain better yields compared to their neighbors with low soil organic matter and low soil moisture-holding capacity.

Well-managed soils have many other beneficial effects on plant health and on livestock and human health, too. The USDA’s Natural Resource Conservation Service (NRCS) has programs such as EQIP, the Environmental Quality Incentive Program, that will pay farmers some of the costs of implementing many of these soil conservation techniques. Check in your phone book for the nearest USDA Service Center and ask them about their programs.

Find Out More About the Hidden World in the Soil

The Soil Biology Primer is an excellent place to learn about the complex interactions of the soil food web. Written by Dr. Elaine Ingham and others for the Soil Quality Institute of the Natural Resource Conservation Service, the Primer is published by the Soil and Water Conservation Society (www.swcs.org). It is available free online: www.urbanext.uiuc.edu/soil/SoilBiology/soil_biology_primer.htm

Learn more about Soil Biological Communities of the arid West at the informative Web site of the Idaho office of the Bureau of Land Management. Great photos of the microscopic fungi, bacteria, protozoa, and nematodes that populate the soil food web: www.blm.gov/nstc/soil

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Extensive root systems of plants like this Side Oats Grama grass can support a healthy community of soil micro-organisms. Drawing: Dr. James Nardi, University of Illinois at Urbana-Champaign.
On-Farm Research Open to All

Over the past decade there has been a remarkable increase in research about sustainable soil management and farming systems. University farms are experimenting with various agricultural practices, including organic methods. Farmers and ranchers are also teaming up with researchers to track comparisons on real farms, away from the university setting. Many of the research results are posted on the Internet, so it’s possible to learn about promising new directions for experimentation. Here are some Web sites that offer research reports and the results of all this new work.

**Midwest Organic and Sustainable Education Service** (MOSES) sponsors workshops, a February conference, a Research Symposium: [www.mosesorganic.org/research.html](http://www.mosesorganic.org/research.html) and other projects: [www.mosesorganic.org](http://www.mosesorganic.org)

**Organic Center** promotes credible peer-reviewed scientific studies about organic production and food safety: [www.organic-center.org](http://www.organic-center.org)

**Organic Eprints** was developed by the Danish Research Center for Organic Farming as an open archive for organic research reports from around the world. Most of these include English abstracts: [www.orgprints.org](http://www.orgprints.org)

**Organic Farming Research Foundation** has raised money and campaigned for more organic research since 1990. Their 2007 National Organic Research Agenda suggests future priorities: [www.ofrf.org/publications/publications.html](http://www.ofrf.org/publications/publications.html). OFRF-funded project reports can be found at: [www.ofrf.org/funded/funded.html](http://www.ofrf.org/funded/funded.html)

**Sustainable Agriculture Research and Education** (USDA SARE) provides a searchable database of the thousands of groundbreaking Farmer-Rancher grants and other projects it has funded since 1988: [www.sare.org/projects](http://www.sare.org/projects)

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**Universities with Outstanding Organic Research Programs**

**Center for Environmental Farming Systems**, North Carolina State University and North Carolina A&T State University: [www.cefs.ncsu.edu](http://www.cefs.ncsu.edu)

**Cornell Univ. Organic Research:** [www.organic.cornell.edu/research/index.html](http://www.organic.cornell.edu/research/index.html)

**Iowa State Organic Ag. Program:** [http://extension.agron.iastate.edu/organicag](http://extension.agron.iastate.edu/organicag)

**University of Minnesota Organic Ecology:** [www.organicecology.umn.edu](http://www.organicecology.umn.edu)

**Washington State University Organic Farming Systems & Nutrient Management:** [www.puyallup.wsu.edu/soilmgmt/SusAg.htm](http://www.puyallup.wsu.edu/soilmgmt/SusAg.htm)

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**ATTRA Publications about Soil Management**

In addition to the publications listed here, ATTRA offers hundreds more that provide general information and specific details about all aspects of sustainable and organic agriculture. They are available to download for free from ATTRA’s Web site: [www.attra.ncat.org](http://www.attra.ncat.org)

Or call 1-800-346-9140 to order a free paper copy.

- Alternative Soil Amendments
- Alternative Soil Testing Laboratories
- Arsenic in Poultry Litter: Organic Regulations
- Assessing the Pasture Soil Resource
- Biodynamic Farming & Compost Preparation
- A Brief Overview of Nutrient Cycling in Pastures
- Drought Resistant Soil
- Farm-Scale Composting Resource List
- Foliar Fertilization
- El Manejo Sostenible de Suelos
- Manures for Organic Crop Production
- Notes on Compost Teas
- Nutrient Cycling in Pastures
- Overview of Cover Crops and Green Manures
- Potting Mixes for Certified Organic Production
- Pursuing Conservation Tillage Systems for Organic Crop Production
- Rye as a Cover Crop
- Soil Management: National Organic Program Regulations
- Soil Moisture Monitoring: Low-Cost Tools and Methods
- Sources of Organic Fertilizers and Amendments
- Symphylans: Soil Pest Management Options
- Sustainable Soil Management
- Sustainable Management of Soil-Borne Plant Diseases
- Worms for Composting (Vermicomposting)
We are what we eat. This folk wisdom relates to plant health as well as to human health. Any organism that is provided a poor diet will be susceptible to a variety of ills and unable to grow well and be vigorous.

The soil is the primary source of nutrition for plants. When the soil is unhealthy, with low levels of organic matter, poor biological activity, and subsequent imbalances of nutrients, plants growing in that soil are likely to be more susceptible to attacks by various pests and diseases, and less able to respond and recover from these attacks. Plant pest problems may only be symptoms of an underlying problem — poor soil health.

The soil is the most complex ecosystem on earth, and we are only beginning to understand how this complexity relates to plant health. Consider that plants have evolved over hundreds of millions of years in non-agricultural systems. Over the millennia, plants have developed strategies and partnerships with soil organisms that enable plants to access the water and nutrients needed to successfully grow and reproduce.

Many soils around the country are in poor shape from excessive chemical and physical disturbance. Adding synthetic chemical fertilizers to these soils creates a situation in which a few nutrients suddenly become available in amounts that plants are evolutionarily unprepared to deal with. In some cases, such as the use of anhydrous ammonia, the act of fertilizing is directly destructive to the soil ecology. (See *Agronomy of Grassland Systems* by C.J. Pearson and R.L. Ison, 1987, Cambridge Univ. Press, p. 77.)

The effects of good soil management on plant health can be difficult to quantify because plants are evolutionarily unprepared to deal with. In some cases, such as the use of anhydrous ammonia, the act of fertilizing is directly destructive to the soil ecology. (See *Agronomy of Grassland Systems* by C.J. Pearson and R.L. Ison, 1987, Cambridge Univ. Press, p. 77.)

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Farm Aid’s Farmer Resource Network: A New Sustainable Agriculture Tool for Beginning and Experienced Farmers

The nonprofit organization Farm Aid has launched an online Farmer Resource Network to help farmers answer the demand for high-quality, family-farmed foods. The Farmer Resource Network connects family farmers to hundreds of organizations that are developing new approaches to production and marketing. These practical innovations provide the support farmers need to sustain their land, grow good food, and benefit from greater consistency and economic stability on their farms.

Farmer Resource Network providers can share stories about successful farm operations and connect family farmers to people with ideas to diversify and strengthen their farms. Using the online database, farmers can search 20 categories of sustainable farming resources to find help with marketing, farm preservation, legal issues, production practices, and more.

Farm Aid’s national partners in launching the Farmer Resource Network include NCAT/ATTRA, the Organic Farming Research Foundation, and Rodale Institute. The online resource database of the Farmer Resource Network can be searched at www.farmaid.org/ideas.

Farm Aid’s mission is to build a vibrant family farm-centered system of agriculture in America. For the past 23 years, Farm Aid board members and musicians Willie Nelson, Neil Young and John Mellencamp have hosted an annual concert to raise funds to support Farm Aid’s work with family farmers and to inspire people to choose family-farmed food.