



Break the Weed Cycle

Farmers, ranchers, and researchers are coming up with an increasing number of ways to manage vegetation using few or no herbicides. In this issue we look at some of the best techniques for keeping the weeds out of your fields.

Manage Weeds Without Herbicides

By Susan Tallman, NCAT Agriculture Specialist

This article is adapted from an upcoming series of publications about organic small grain production in the Northern Great Plains. The principles outlined here can be applied to many crops in other locations.

Weed management is one of the big concerns in organic crop production. Often when conventional growers consider organic farming, weed management without herbicides is their first objection. Clean, weed-free fields are a source of pride for most farmers, and it can be difficult to imagine clean fields without the use of herbicides.

I was skeptical when I first encountered organic farming. In 1996 I was invited to tour three organic farms in Big Sandy, Mont. I was expecting to see fields covered in weeds, with poor, spotty stands of grain. Instead, I saw clean fields, healthy crops, and a crop diversity beyond the typical wheat and fallow system. The farmers were growing specialty wheats, sunflowers, buckwheat, alfalfa, lentils, and more. Compared with their conventional monoculture neighbors, their diversity was impressive.

These farmers were not “organic by neglect.” In other words, they didn’t keep on farming like their conventional neighbors, but neglect to spray herbicides. Instead, they learned the biological principles of pest control and put them into practice. This takes a different kind of knowledge and more effort and experimentation than using herbicides, but the important message is that clean fields are possible in an organic system.

Combine Techniques to Beat the Weeds

Conventional crop production manages weeds with herbicides applied at just one point in the weed life cycle – emergence. But in order to most effectively manage weeds without herbicides,



Residue between the rows in no-till cotton helps prevent moisture loss and weed growth. Photo by David Nance, USDA-ARS.

farmers must combine many techniques to build a comprehensive weed management strategy.

These techniques include reducing tillage, selecting varieties for early emergence and canopy closure, spacing rows close together, grading for the largest seed, seeding at high density, careful timing of emergence and control, rotating crops, cleaning weed seeds from equipment, flaming, haying, planting cover crops, and intensive livestock grazing. See the resources listed on pages 2 and 3 to learn more about these strategies.

Take Inventory of Your Weed Problems

Before thinking about organic weed control, it is important to take an inventory of your fields. Which weed species are currently a problem for you? Are they annuals or perennials, grasses or broadleaves?

Remember that weeds like to mimic their host crop. For example, a major weed in winter wheat is downy brome, or cheat grass. Cheat grass is a winter annual grass, just like winter wheat. The key to limiting cheat grass in a field is to switch to spring crops or broadleaf crops. Switching to a different crop allows a modified tillage window and gives the mimic weed no

place to hide. By rotating through a diverse range of crops, you can limit the weed and disease pressure on your farm.

When taking an inventory of your fields, take special note of any difficult, persistent perennial species. Tillage seems to take care of annuals, but the perennials are more troublesome. In the Northern Plains, for example, Canada thistle and field bindweed are a major concern. *Take particular care to control the most problematic weeds before beginning an organic crop system.*

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Basic Principle	Weed Management Practices
Minimize soil disturbance.	Use no-till, reduced-till, and mulch (cover crops killed with a roller/crimper implement or chemicals).
Vary crop types.	Rotate between grass & broadleaf crops. Plant cover crops & green manures to break the weed cycle and enhance fertility.
Encourage rapid canopy development.	Increase seeding density. Plant in narrow rows. Select cultivars carefully.
Reduce seed bank.	Don't let weeds go to seed. Provide habitat for seed predators (carabid beetles). Keep soil disturbance to a minimum.
Select largest seeds.	Grade out seed for largest size. Larger seeds within a variety compete better than their smaller counterparts.

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Weed Management Resources

Many of these publications are available to download for free from the listed websites.

Michigan State University Extension offers many resources about weed management including several innovative free bulletins, such as *Managing Your Farm to Increase Weed Seed Predation, Ecology and Management of Weed Seed Predators*, and *Weed Seedbank Dynamics*. www.msuweeds.com/publications

Steel in the Field: A Farmer's Guide to Weed Management Tools looks at how farmers across the country are managing weeds with cultural and mechanical methods. Second edition, 2002. From SARE's Sustainable Agriculture Network, this is available as a book (\$18) or can be downloaded from SARE's website for free. (301) 374-9696, www.sare.org/publications/steel/index.htm

The Sustainable Weed Control Rag: Notes for Sustainable Weed Management for Vegetable and Row Crops is a presentation by Mark Schonbeck at the 2008 Southern SAWG Conference, Louisville, KY www.sare.org/2008Conference/handouts/Schonbeck.pdf

Weed the Soil Not the Crop by Anne and Eric Nordell. The Nordells are Pennsylvania market farmers well-known for their complex system of rotations and horse-drawn cultivation, which provides excellent weed management. www.newenglandvfc.org/pdf_proceedings/weedthesoil.pdf

Crop Rotation on Organic Farms: A Planning Manual by Charles Mohler and Sue Ellen Johnson, Natural Resource,

Agriculture and Engineering Service and SARE, 2009. www.sare.org/publications/croprotaion.htm

Managing Cover Crops Profitably 3rd Edition, 244 pages, Sustainable Agriculture Network, 2007, www.sare.org/publications/covercrops.htm

Practical Farmers of Iowa Weeds page (www.pfi.iastate.edu/ofr/RT_weeds.htm) and the **Weed Research** page (www.pfi.iastate.edu/ofr/weed_management_research.htm) are good jumping-off points to learn about field trials on members' farms.

Integrated Weed Management: Fine Tuning the System by Erin Taylor et al., 2008, 132 pp, \$14. From Michigan State University Extension, (517) 353-6740 www.msuweeds.com/publications/iwmm_fine_tuning_the_system

Ecological Management of Agricultural Weeds by Matt Liebman et al., 544 pages, Cambridge University Press, 2001.

Weed 'Em and Reap is a series of excellent DVDs with growers and researchers explaining their innovative weeding systems in the Northwest, Montana, Virginia, and North Carolina. Part 1: Tools for non-chemical weed management in vegetable cropping systems. Part 2: Reduced tillage strategies for vegetable cropping systems. From the OSU Dept. of Horticulture, Corvallis, Oregon. (541) 737-3464, <http://hort.oregonstate.edu/WeedEmandReap>

Using Animals to Manage Weeds

Herbivores—cattle, sheep, goats, geese, and insects—can be used to reduce populations of specific weeds in special situations. Cattle, for example, relish Johnson grass. Weeder geese were commonly used in cotton fields before the advent of herbicides. Musk thistle populations can be satisfactorily reduced by crown- and seed-eating weevils. Sheep can graze understory vegetation in mature orchards without damaging the trees. Goats are used to manage large stands of various noxious plants.

Targeted Grazing: A Natural Approach to Vegetation Management and Landscape Enhancement edited by Karen Launchbaugh, University of Idaho, 2008, offers details on grazing sheep, goats and other animals to manage invasive weeds on farms, range, and wildland. ATTRA's Linda Coffey and Margo Hale contributed to a very helpful Resources section. To download chapters, see the University of Idaho's Targeted Grazing website, www.cnr.uidaho.edu/rx-grazing

Livestock Grazing Guidelines for Controlling Noxious Weeds in the Western United States by Jason Davison et al., Universities of Nevada and Idaho Coop Extensions and Western SARE, 2007. Based on surveys with experienced weed managers, these guidelines detail the best ways to use livestock to manage a long list of troublesome weeds in California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. www.cnr.uidaho.edu/rx-grazing/Guidelines.htm

The following publications can be downloaded from the ATTRA website. Call 1-800-346-9140 for a free print copy.

- Alternative Control of Johnsongrass CT 116
- Biointensive Integrated Pest Management IP049
- Farmscaping to Enhance Biological Control CT065
- Field Bindweed Control Alternatives CT103
- Flame Weeding for Agronomic Crops CT157
- Flame Weeding for Vegetable Crops CT165
- El Manejo Integrado Orgánico de Algunas Plagas de la Agricultura (online and CD only)
- Organic IPM Field Guide (online and CD only)
- Principles of Sustainable Weed Management for Croplands IP039
- Sources of "Spraying Prohibited" Signs for Organic Farms RL035
- Thistle Control Alternatives CT 156



Tools for Ecological Pest Management

Biointensive Integrated Pest Management (IPM) IP049

Design agricultural ecosystems to the disadvantage of a pest and to the advantage of its parasite-predator complex. Biointensive IPM shares many components of conventional IPM, including monitoring, use of economic thresholds, recordkeeping, and planning.

Biorationals: Ecological Pest Management Database (online only)

This pest management tool emphasizes reduced-risk materials that can be used in conjunction with ecological pest management strategies. The database covers diseases, insects, mollusks, vertebrates, weeds, and preventive techniques to manage them. It is searchable by pest category, pest name, pesticide trade name, and active ingredient. www.attra.ncat.org/attrapub/biorationals

The Roller/Crimper Revolution

No-till and reduced-till farming can be great ways to eliminate weeds, conserve soil moisture, prevent erosion, protect soil organisms, and provide habitat for spiders (insect predators) and beetles (insect and weed-seed predators). Conventional no-till systems rely heavily on the use of herbicides to kill cover crops that might compete with the following crop.

Roller/crimpers are relatively new mechanical tools that can help growers reduce or eliminate their herbicide use. These implements kill cover crops by crushing the plant stems. The killed cover crop becomes a protective mulch for the following crop.

For the operation to be effective, timing is very important. Crimping must be done when the crop is most susceptible, usually when it is heading out or beginning to flower.

The Rodale Institute is credited with building the first roller/crimper in the United States in 2002. Since then, innovative producers and researchers across the country have come up with many different styles of roller/crimpers. Some systems reduce passes through the field by mounting the roller/crimper on the front of the tractor and pulling a planter behind. See the ATTRA website for more information on which designs work best in various conditions.

Rodale Institute's No-Till Revolution website has photos and articles as well as videos, www.rodaleinstitute.org/no-till_revolution. Rodale's Roller Crimper Gallery is a collection of photos of cover crop roller/crimper tools, http://newfarm.rodaleinstitute.org/depts/notill/roller_gallery/index.shtml.

Michigan State University Roller/Crimper Research is part of the very extensive information on cover crops and weed management from MSU. Contact Dale Mutch, mutch@msu.edu, 1-800-521-2619, at the MSU Kellogg Biological Station Land and Water Program, www.covercrops.msu.edu/crimper/about.html.

USDA-ARS National Soil Dynamics Laboratory Research, Alabama Researchers Ted Kornecki, Dana Ashford, Wayne Reeves, Andrew Price, and their colleagues have studied various methods of using roller/crimpers to kill cover crops for no-till agriculture. Some of their research reports can be found on these websites: www.ars.usda.gov/pandp/people/people.htm?personid=3104 and www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=237561.



To reduce passes through the field, roller/crimpers can be mounted on the front of a tractor that's pulling planters on the back. Photo: www.rodaleinstitute.org

New roller/crimper designs use chevron-shaped crimper blades to reduce vibration and maximize pressure on cover-crop stems. Rollers can be filled with water to increase their weight. The blades are blunt because sharp edges would cut into the soil and increase weed germination. Photo: New Zealand model from www.merfield.com/research



Rotation, Rotation, Rotation: Cover Crops Can Suppress Weeds

Weeds flourish on bare soil. Cover crops take up space and light, shading the soil and reducing the opportunity for weeds to establish themselves. The soil-loosening effect of deep-rooting green manures also reduces weed populations that thrive in compacted soils.

Some cover crops are especially useful because they are allelopathic, suppressing other plants that attempt to grow around them. Rye is one of the most useful of these cover crops because it is winter-hardy and can be

grown almost anywhere. Rye residue contains generous amounts of allelopathic chemicals.

When left undisturbed on the soil surface, these chemicals leach out and prevent germination of small-seeded weeds. Weed suppression appears to be effective for one or two months. If the rye is tilled into the soil, the effect is lost. Wheat, members of the mustard family, and summer annual forages related to sorghum and sudangrass have a similar allelopathic effect.

ATTRA Publications about Cover Crops

- Pursuing Conservation Tillage Systems for Organic Crop Production IP183/164
- Conservation Tillage CT105
- Overview of Cover Crops and Green Manures IP024
- Rye as a Cover Crop CT168

— This article is adapted from ATTRA's *Principles of Sustainable Weed Management for Croplands and Overview of Cover Crops and Green Manures*

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It goes without saying that you should *never let weeds go to seed*. Some weeds can produce up to 200,000 seeds per plant. These seeds can stay in the soil seedbank for decades. If weeds have become a major problem, it may be better to disc in the weedy patches of the field before they go to seed. Although this will sacrifice a portion of the cash crop, it may save you

exponential problems in years to come.

Haying is another excellent option for controlling weed seed production. Farmers with a weedy grain crop may choose to hay it before the weeds go to seed. This gives you an option to have some economic return on your crop while controlling the weed seedbank.



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ATTRA Webinars Available Online

Over the past year, ATTRA agricultural specialists presented several webinars on important sustainable agriculture topics. These presentations are live, web-based seminars, with opportunities for questions from the audience.

If you missed the original presentations, you can watch them online anytime. See the link for ATTRA Webinars in the Quick Links box on ATTRA's home page, www.attra.ncat.org.

- Do-It-Yourself Biodiesel: Keeping It Safe, Keeping It Legal
- Making Organic Small Grains Work on Your Farm
- Getting Started in Farm-Scale Biodiesel Production
- Sheep and Goats: What They Can Do For You
- Hoop Houses for Crop Extension

Webinars Planned for 2010

- Biodiesel III--Taxes and Financial Incentives for Farm-Scale Biodiesel Production (April 8th)
- Farm to Cafeteria/Local Foods (May)
- Grassfed Beef (August)
- Organic No-Till Options (September)
- Organic Apple Production (November)



Learn about the NRCS Organic Initiative

The USDA Natural Resources Conservation Service (NRCS) offers financial assistance for organic farmers to implement conservation practices on their land. Producers who are transitioning their farms to organic production systems may also apply.

This Organic Initiative is part of the Environmental Quality Incentive Program

(EQIP). The specifics differ by state. The 2010 deadline was March 12, but farmers who are interested in applying for next year should learn the details and start planning their applications now.

To read about the Organic Initiative and how to apply, see the extensive information on ATTRA's website, www.attra.ncat.org/eqip

New & Updated Publications

- Comparing Energy Use in Conventional and Organic Cropping Systems IP339/337
- Dairy Farm Energy Efficiency IP355
- Grazing Contracts for Livestock IP247
- Biodiesel: The Sustainability Dimensions IP281
- Paddock Design, Fencing, and Water Systems for Controlled Grazing IP152/50
- Raising Dairy Heifers on Pasture CT110

ATTRAnews

Teresa Maurer, Project Manager

Karen Van Epen, Editor

Amy Smith, Production

March/April 2010 • www.attra.ncat.org

ATTRAnews is the newsletter of the National Sustainable Agriculture Information Service. The newsletter is distributed free throughout the United States to farmers, ranchers, Cooperative Extension agents, educators, and others interested in sustainable agriculture. ATTRA is funded through the USDA Rural Business-Cooperative Service and is a project of the National Center for Appropriate Technology (NCAT), a private, nonprofit organization that since 1976 has helped people by championing small-scale, local, and sustainable solutions to reduce poverty, promote healthy communities, and protect natural resources.



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