



## Weed Management and Sustainable Agriculture

*Organic farmers and ranchers consistently say that weeds are among the worst problems they confront. This issue of ATTRAnews reports on ways to deal with weeds and minimize or eliminate herbicides.*

### Using Cattle and Sheep to Graze Noxious Weeds

*By Lee Rinehart, NCAT Livestock Specialist*

Ranchers in the Intermountain West have been combating invasive plants for the past century. In many places their efforts seem to have gained no ground at all. Invasive plants like leafy spurge, spotted knapweed, and Canada thistle continue to encroach onto rangeland, reducing biodiversity and seriously impacting wildlife habitat and ranch productivity. Millions of dollars are spent each year on herbicides to little avail, which has many land managers searching for a more sustainable approach to weed management.

During the last decade, researchers have been looking to the ecosystem itself for answers. Out of this "systems approach" has emerged the study of animal behavior and its relation to animal diet and habitat selection. Several recent projects utilize the principles of livestock behavior to manage rangelands and reduce the impact of noxious weeds.

**Teaching Cattle to Eat Weeds.** An exciting project at the Grant-Kohrs Ranch

National Historic Site in Deer Lodge, Montana, is coordinated by Kathy Voth of Livestock for Landscapes, a private land management education organization. The experiment has focused on training cattle to eat some of western Montana's most noxious weeds—leafy spurge, spotted knapweed, and Canada thistle.

The plan began with yearling heifers eating clipped weeds sprayed with molasses. By the end of the trial, the heifers were consuming about 20 percent of their daily pasture intake in weeds. Forage analysis determined that spotted knapweed is similar in nutrient concentration to alfalfa in the same stage of maturity. The Grant-Kohrs Ranch staff observed that for weeds to be a significant part of the heifers' diet, they had to be highly nutritious.

Dietary diversity is important to the success of this operation. Variety encourages the cattle to experiment with unfamiliar foodstuffs. Eating diverse plants also helps the animals' digestive



Sheep grazing to manage leafy spurge, a highly invasive plant, growing uncontrolled on the left side of this fenceline.

Photo courtesy of USDA NRCS.

system neutralize the negative aspects of any toxic food. Staff observed animals switching from grass to alfalfa to weeds throughout the day, giving credence to the idea that animals can balance their own diet if offered enough choices.

For more information:  
[www.livestockforlandscapes.com/grko.htm](http://www.livestockforlandscapes.com/grko.htm)

**Sheep Improve Cattle Range.** Other important work is being conducted at the Montana State University Sheep Institute by Rodney Kott and Jim Moore. The Institute connects sheep producers with landowners who have weed infestations. Moore has been tracking the changes in range condition on parcels infested with leafy spurge and grazed with sheep for several years. The results have been surprisingly good, given that leafy spurge has an extensive root system that makes it very difficult to control.

According to its website ([www.sheepinstitute.montana.edu](http://www.sheepinstitute.montana.edu)), the Sheep Institute worked with 31 sheep ranchers and 1,000 landowners in 2004. Approximately 30,000 sheep grazed over 100,000 weed-infested acres. In pastures grazed by sheep for at least two years, the leafy spurge composition decreased about 9 percent per year, while the grass component increased by 10 percent. This research suggests that grazing sheep on cattle ranches can positively impact range condition and profitability over time.

### Organic No-Till Weed Management with Roller-Crimpers

Until recently, organic no-till was problematic because of the difficulty of reliably killing the cover crops. Several field trials have demonstrated that mechanical roller-crimpers can kill a cover crop just as effectively as herbicides, opening the way for a higher degree of ecological weed, crop and soil management. An excellent review of no-till techniques and research by NCAT's Steve Diver is



Rolling and planting in one pass saves energy, mechanical wear and tear, and conserves soil structure.

Photo courtesy of [www.newfarm.org](http://www.newfarm.org)

available: [www.attra.ncat.org/calendar/question.php/2006/05/08/p2221](http://www.attra.ncat.org/calendar/question.php/2006/05/08/p2221)

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# Organic Weed Research at Our Land Grant Universities

By Tammy Hinman  
NCAT Horticulture Specialist

Many universities are now conducting organic weed research and extension field trials. Check out the following list of resources. You can also find information about others on the Weed Management page of the ATTRA website: [www.attra.org/pest.html#weed](http://www.attra.org/pest.html#weed)

Remember that research is not limited to universities. Many regional organic farming organizations conduct collaborative projects. You can also conduct your own on-farm research. See the website of the Organic Farming Research Foundation for excellent tips on how to do it: [www.ofrf.org/research/On-farm.Research.Guide.PDF](http://www.ofrf.org/research/On-farm.Research.Guide.PDF)

## In the Southeast

**Breeding a Better Cover Crop: A Screen of Rye Germplasm for Weed Suppression and Nitrogen Scavenging.** Chris Reberg-Horton, Nancy Creamer, and

Noah Ranells, Center for Environmental Farming Systems, North Carolina State Univ. 2001. [www.cefs.ncsu.edu/grantfundedprojects.htm](http://www.cefs.ncsu.edu/grantfundedprojects.htm)

**Managing Purple and Yellow Nutsedge in Organic Vegetables.** Carlene Case, Center for Organic Agriculture, Univ. of Florida, with Florida A&M, Clemson Univ., USDA ARS in Georgia. 2002-2006. [www.sare.org/reporting/report\\_viewer.asp?pn=LS05-170&rv=2005&rf=0](http://www.sare.org/reporting/report_viewer.asp?pn=LS05-170&rv=2005&rf=0)

## In the West

**Alternatives to Plastic Mulch in Vegetables.** Carol Miles, Washington State Univ. BioAg Program, 2003-2005. <http://agsyst.wsu.edu/AltMulch.htm>

**Organic Non-Tillage Controls for Canada Thistle.** Adrian Card, Colorado State Univ. Agriculture Extension, 2005-2006. [www.coopext.colostate.edu/boulder/AG/agweeds.shtml](http://www.coopext.colostate.edu/boulder/AG/agweeds.shtml)

## In the Midwest

**Effect of Cover Crops for Weed Manage-**

**ment in Organic Vegetables.** Kathleen DeLate and Andrea McKern, Iowa State Univ. 2004-2005. <http://extension.agron.iastate.edu/organicag/researchreports/nk05peasbeans.pdf>

**Weed Management in Organic Flax.** Elwell Agroecology Farm, Univ. of Minnesota with Iowa State Univ. 2006. [http://organicecology.umn.edu/wpcontent/files/Elwell%20Experiments\\_2006.pdf](http://organicecology.umn.edu/wpcontent/files/Elwell%20Experiments_2006.pdf)

## In the Northeast

**Effect of Weed Management Strategies on Weed Growth and Fruit Quality in a Certified Organic Apple Orchard.** Renae Moran, Univ. of Maine, Monmouth. 2001-2002. [www.ofrf.org/publications/Grant%20reports/01.f.10.Moran.pdf](http://www.ofrf.org/publications/Grant%20reports/01.f.10.Moran.pdf)

**Integrated Weed and Soil Management Using Soybean and Cowpea Cover Crops.** Daniel C. Brainard, Freeville Organic Research Farm, Cornell Univ. 2005. [www.hort.cornell.edu/department/facilities/organicfarm/htmls/legumecc.htm](http://www.hort.cornell.edu/department/facilities/organicfarm/htmls/legumecc.htm)

## Resources for Weed Management

**Handbook on Prescribed Sheep and Goat Grazing for Vegetation Management** offers details on grazing to manage invasive weeds on farms, range, and wildland. ATTRA's Linda Coffey and Margo Hale contributed to a very helpful Resources section. Check ATTRA's livestock webpage (<http://attra.org/livestock.html>) or the University of Idaho's informative Prescribed Grazing website ([www.cnr.uidaho.edu/rx-grazing](http://www.cnr.uidaho.edu/rx-grazing)) to download a copy of the handbook when it becomes available in the fall of 2006.

**Practical Farmers of Iowa** is an organization of producers who work together to solve problems like weeds that plague all farmers. Through their website they share their hard-earned experiences. The Weeds page ([www.pfi.iastate.edu/ofr/RT\\_weeds.htm](http://www.pfi.iastate.edu/ofr/RT_weeds.htm)) and the Weed Research page ([www.pfi.iastate.edu/ofr/weed\\_management\\_research.htm](http://www.pfi.iastate.edu/ofr/weed_management_research.htm)) are good jumping-off points to learn about field trials on members' farms.

**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](http://www.sare.org/publications/steel/index.htm)

**Weed 'Em and Reap** – These excellent DVDs show growers and researchers explaining their innovative weeding systems as they use them in their fields 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://oregonstate.edu/dept/hort/faculty/stone/NeedEmandReap/>

## ATTRA Publications about Weed Management

These publications can be downloaded from the ATTRA website or call 800-346-9140 for a printed 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)



# A Whole Farm Approach to Managing Weeds in Onions: Eric and Anne Nordell's Beech Grove Farm, Pennsylvania

By Tammy Hinman, NCAT Horticulture Specialist

Managing weeds in organic farming is a continuous and evolving challenge. Onions are a particular problem because the crop may be in the field from very early spring through early fall. Onions also have relatively little canopy protection and are shallow rooted. Anne and Eric Nordell have developed a truly innovative strategy of managing weeds by using cover crops and rotations.

Beech Grove Farm is located on 90 acres in north-central Pennsylvania. The Nordells operate their diversified vegetable farm using their own hands and four draft horses. They grow the bulk of their cash crops on a well drained six-acre field that is divided into a dozen half-acre lots.

At any one time in the growing season, half the cropping area is in cash crops and the other half is fallow. A field of spring-planted crops next has a year of fallow, then summer-planted crops. On the fallow sections, they use two cover crops and a bare fallow to control weeds. With this rotation sequence, they build their soil and eliminate weeds.



Interseeding artistry, from left: Vetch interseeded into onions, a row of snap peas growing on a living trellis of oats, buckwheat interseeded into lettuce, and winter squash row covered against cucumber beetles.

An excellent illustration of this system is the Nordells' ground preparation for onion production. The fallow sequence begins a full year in advance of planting. In the fall, after the cash crop has been harvested from the plot where the onions will go, the Nordells seed winter-hardy rye. The following spring when the rye begins growing in earnest, they mow it using a sickle bar.

Throughout the spring, this is done three times in alternating directions when the rye re-grows to about 2 to 2 1/2 feet. Repeated clipping prevents the rye from

going to seed and encourages tillering (the growth of additional side stalks). The result is a partially rotted rye that serves as sheet compost.

In late June after the third mowing — when the rye has put on the bulk of its growth but summer weeds have not yet had a chance to seed — they plow the field with narrow, deep furrows. This is done by removing the jointer and adjusting the plow to cut the furrow so that it almost slices the soil, laying the residue on its side. This method of plowing helps maintain soil structure, permits air and moisture circulation, and aids in decomposition. By deep plowing at this time, they target the perennial weeds at the weakest point in their life cycle. The technique breaks down the highly carbonaceous materials when the soil is biologically active, without robbing it of nitrogen.

At this point, cultivating with a springtooth harrow over a 5-6 week period brings perennial rhizomes to the surface to dry out and knocks down annual weeds at their peak growth. Then the Nordells apply well-composted manure that is virtually free of weed seed. This timing allows the manure to break down before the cash crops are planted and saves a step in the spring, while enhancing the root and top growth of the fall-planted cover crop.

In about mid-August they plant spring annuals such as oats and peas because these crops put on a lot of top growth in the fall and then winter-kill, leaving an easily incorporated residue that allows timely planting of onions. In the spring the Nordells shallowly till the soil to avoid bringing weed seeds to the surface. They plant their onions into this and plan on cultivating three times during the season — to keep moisture in the soil, rather than to control weeds.

More recent field experiments

Variations on a Four Year Crop Rotation

Spring	Rye	Rye
Summer	Bare Fallow	Buckwheat
Fall	Oats & Peas (Winter Kill)	Oats (Winter Kill)
Spring	(Surface Till) Early Crops (Overseed clover)	(Surface Till) Early Crops (Overseed clover)
Summer		
Fall	Clover	Rye
Spring		Bare Fallow
Summer	Bare Fallow	Italian Ryegrass and Clover
Fall	Rye & Vetch	
Spring	(Skim Plow) Late Crops	(Skim Plow) Late Crops
Summer		
Fall	Rye	Rye

Nordells' Cropping System. This chart illustrates the complexity of the farm's seasonal rotations. Excerpted from the Whole Farm Approach to Managing Weeds by Anne and Eric Nordell.

from the Nordells include a bare fallow tillage in the spring rather than summer to aggressively target cool-season weeds, interseeding a single row of cover crops into pathways to add additional nitrogen and organic matter, and no-till onions in fields where there is no cool-season weed pressure.

For a compilation of the Nordells' weed management articles (\$13 postpaid) or a 72-minute video of their slide presentation at the 2007 Upper Midwest Organic Farming conference (\$18 postpaid), write to:

Ann and Eric Nordell,  
410 Route 184, Trout Run, PA 17771



Using their rotation system, the Nordells have greatly reduced the weeds in their fields. Photo by Steve Vanek, courtesy of the Northeast Organic Network (NEON).



## Update on FY07 Agriculture Budget: September Action Expected

The Sustainable Agriculture Coalition has provided the following Congressional update on funding for several key sustainable agriculture programs. Full Senate action and conference resolution of differences is expected in early September. If you would like an update on timing or a report on other sustainable agriculture and conservation programs not listed here, please call (202) 547-5754 or (608) 238-1440.

All figures are in millions.

Sustainable Agriculture Program	President's '07 Proposed	House Bill	Senate Committee
SARE	\$9.1	\$12.1	\$12.3
SARE Professional Development	\$3.8	\$4.0	\$4.0
ATTRA	\$0.0	\$3.0	\$ 2.5
Rural Business Enterprise Grants	\$0.0	\$39.6	\$39.6
Value-Added Producer Grants	\$20.3	\$28.0	\$48.0
Renewable Energy Sec. 9006	\$10.2	\$23.0	\$25.0
Outreach/ Assistance to Socially Disadvantaged Farmers/ Ranchers (SDA)	\$6.9	\$7.0	\$5.9

## Questions about the National Animal Identification System?

The National Animal Identification System (NAIS), which the USDA is currently in the process of implementing, is intended to identify livestock and record their movements over the course of their life spans. Many farmers and ranchers are concerned about the impact of NAIS on small livestock operations. Livestock specialists working on the ATTRA project have developed an introduction to the system at [www.attra.ncat.org/livestock](http://www.attra.ncat.org/livestock). It includes a timeline, contacts, and how to affect the process.



Postdoctoral research associate Frank Mitloehner, of Texas Tech University, places an identification mark on a steer to help keep track of the animal during observation.

Photo courtesy of USDA NRCS.

## New and Updated Publications from ATTRA

- ◆ Alternative Poultry Production: Equipment (IP295)
- ◆ Energy Saving Tips for Irrigators (IP278)
- ◆ Ethanol Opportunities and Questions (IP292)
- ◆ Beef Marketing Alternatives (IP290)

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