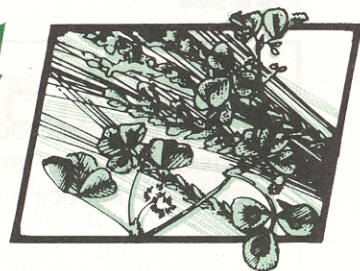


SUSTAINABLE FARMING

Quarterly



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Let Them Eat Weeds

Beneficial insects make major inroads

— By David Granatstein,
coordinator of the Washington
State University Center for
Sustaining Agriculture and Natural
Resources in Wenatchee —

Anyone who farms or gardens knows the damage little insect jaws can do to our tender plants. But just as a weed is a plant in an unwanted place, a hungry plant-eating insect in the right place can be a real friend.

Over the past 15 years, WSU entomologist Dr. Gary Piper has looked far and wide for insect friends to help control ever-present weed problems in the state. Piper has watched the interest in biological control of weeds grow over this period as successful field programs have been implemented, and with increasing concern about the costs and effects of widespread herbicide use.

Attempts to use biological control on weeds in Washington date back to 1948 when researchers established several European beetles to combat the spread of St. Johnswort. Other early targets included tansy ragwort, puncturevine, gorse, Scotch broom, dalmatian toadflax, and Canada thistle. Over half of the biological control organisms released successfully established in the field.

Piper's work is primarily focused on weeds that invade non-

cropland areas, such as pasture and range, rights-of-way, wetlands, aquatic areas and forests. Washington has extensive acreages of all of these lands in the state, and weeds that establish in these areas can quickly spread into crops.

Biological control by introduced, weed-specific natural enemies is well suited for use on non-cropland weeds where the low economic return per acre makes other control approaches unfeasible. Also, it is easier to establish natural enemies in land that is not in crop production because habitat is less disturbed than in fields planted in annual crops.

Biological control is a slow process that reduces weed populations to tolerable levels, according to Piper. Typically, successful control of a noxious weed takes 5 to 10 years and the introduction of 6 or more "bioagents." Insects (or other organisms such as fungi) control weeds in four ways:

- ✓ killing the plant outright;
- ✓ weakening or stressing the weed so more desirable plants can compete with it;
- ✓ reducing the weed's reproductive capacity by destroying flowers, seeds or other parts; and
- ✓ creating damaged areas

MORE WEEDS, PAGE 2

Inside the SFQ

- Saskatchewan's organic grain farmers compete favorably – Page 3.
- The right tillage tool can reduce your need for herbicides – Page 4.
- WSU researchers fine tune single-replicate testing on the farm – Page 6.
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Water, water everywhere... and now Joe's cattle have more than a drop to drink

— By Stephanie Rittmann,
sustainable agriculture program
associate for the Alternative
Energy Resources Organization
in Helena, Mont. —

A farmer in semi-arid central Montana has built a 60,000-gallon water storage system that allows him to graze livestock on land formerly unusable as pasture.

Joe DeMars built the water saver with help and financial assistance from the Bureau of Land Management (the BLM paid for almost the whole thing.)

To find out how you can build a water saver like Joe's, see diagrams and the rest of the article on page 5.

WEEDS, FROM PAGE 1

through which secondary microorganisms can gain entry, infect the weed, and produce additional injury.

More than half the noxious weeds in Washington have been accidentally or intentionally introduced from Eurasia. All the weeds on Washington's noxious weed list are exotics. Unfortunately, the natural enemies did not travel with the weeds and they spread rapidly when environmental conditions were suitable.

The knapweeds (diffuse and spotted knapweed, and yellowstar thistle) are good examples of how this happens. Piper has been involved in the release of more than 15 bioagents for this group of weeds alone. Eleven have become established and are slowly nibbling away at the problem.

Biocontrol of rush skeleton-

weed (*Chondrilla juncea*) in the state is an encouraging story, says Piper. This weed infests rangeland, semi-arid pastureland, crop fields, road corridors and other areas with repeated soil disturbance. Since its discovery in Washington in 1938, rush skeletonweed has infested two million acres in 18 counties.

Three bioagents — a fungus, a fly and a mite — have been

Piper describes biological control of weeds by introduced natural enemies as a safe, permanent and ecologically desirable method of weed suppression. And it is a good investment. For each dollar invested in research, development, and application of bioagents, a return of up to \$30 can be expected. This is in contrast to \$3 to \$5 returned for each dollar spent on an herbicide-based

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introduced. The fungus kills reproduction in older plants. The fly lays eggs that form galls on leaves and stems, disrupting sugar production and reducing vigor. The mite attacks flower buds and reduces seed production.

Since the release of these three bioagents in 1976, rush skeletonweed density has declined by 50 to 75 percent in many eastern Washington counties, including Lincoln, Adams, Franklin, Spokane, and Whitman.

With new weeds always arriving, Piper has little time to rest and watch his insect friends work. Purple loose-strife, an aggressive invader of wetland areas, is currently expanding its territory in Washington and other states. Biocontrol is an ideal option because wetlands are sensitive ecologically in terms of biological diversity and water quality. Three insects were introduced in 1992-1993 to combat the weed, and all did establish. Two more insects were released on purple loosestrife in 1994.

control program.

Piper cautions that biocontrol may not always work or fit a situation. It is sometimes most effective when used in combination with other practices (e.g., integrated weed management). And, if the ecological conditions that allowed the weed to invade in the first place are not addressed, success with biocontrol on one weed may only lead to the invasion by another noxious species.

Since 1948, 53 natural enemies have been released in Washington to suppress 22 weeds of exotic origin. Some 70 percent of these introduced organisms have successfully established in the field.

With this record of success, Piper is encouraged to continue his search for more bioagents to join the growing ranks of insect helpers. They are quietly munching away on their old friends from back home and helping us protect the integrity and productiveness of our non-cropland areas in the state. □

The *Sustainable Farming Quarterly* is a publication of the Alternative Energy Resources Organization, 25 S. Ewing St., Suite 214, Helena, MT 59601. Phone (406) 443-7272; fax (406) 442-9120.

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Saskatchewan grain farms pass organic muster

— By David Granatstein,
coordinator of the Washington
State University Center for
Sustaining Agriculture and Natural
Resources in Wenatchee —

Large-scale grain farmers on the northern plains of the U.S. and Canada are succeeding in the field with production systems that meet the stringent organic certification standards.

Researchers from the Saskatchewan Research Council (University of Saskatchewan) recently released a report on a three-year study that compared production practices and economics of organic grain farms with "conventional" neighbors. The study utilized surveys, field monitoring, and farm demonstrations to gather the data. Comparisons with other existing survey data were also used. This included data from surveys of farmers participating in the whole-farm Top Management Program, a planning program in which production costs and future financial performance are evaluated. The objective is to help farmers in the province improve their financial management.

Crop rotations varied considerably from farm to farm, with organic and conventional growers using similar amounts of summer fallow. More organic growers had green manures in the rotation, which provided an important source of nitrogen for the subsequent wheat crop. Many growers produced peas or lentils in the rotation as a cash crop. Some of the organic wheat crops tested low in protein, indicating a shortage of nitrogen.

Growers compared two methods of green manure management: normal incorporation versus

mowing and surface mulching. Yields with the mow/mulch system were consistently lower than with the tilled system, in part due to volatile loss of ammonia from the decomposing residues, a phenomenon documented in previous studies. In drier locations, yields after green manure were lower than after summer fallow, while the reverse was true in moister locations.

A lack of available soil phosphorus is a common problem in much of the study area. Few of the organic farmers applied any phosphorus. Several trials were conducted to examine possible phosphorus inputs, including rock

organic farms (15 to 40 percent) compared to conventional farms (about 15 percent). Yield losses varied greatly among organic farms, which suggests that some growers have developed more effective techniques that might be useful to others attempting organic production.

Several demonstrations of post-emergence cultivation techniques were conducted during the study. This included use of a rotary hoe, tine harrow, and rotary harrow. All three tools provided weed reduction, but there was no significant yield response.

Other concepts considered

**Table 1. Costs and returns for wheat production on different groups of Saskatchewan farms, 1990-1992
(organic premiums not included).**

	<u>Costs</u>	<u>Gross Income</u>	<u>Net Returns</u>
	———— Canadian \$ / acre ————		
Conventional	50	95	46
Top Manager	52	81	31
Organic	40	84	44

phosphate and seed inoculation with a soil fungus (Provide PB-50), which is reported to improve phosphorus availability. Neither treatment led to conclusive yield improvements.

The organic farms typically had greater weed pressure than comparable conventional farms. Yield losses in wheat due to weeds were similar (about 10 percent), while losses in peas and lentils were considerably greater on the

included the use of allelopathic green manures (e.g., young canola) to suppress weeds, and tillage under low light conditions (shown to reduce weed seed germination up to 50 percent). Growers under organic production rules need more research on non-herbicide weed control options, and some of these could be useful complements to herbicide-based programs.

MORE ORGANIC, PAGE 4

ORGANIC, FROM PAGE 3

Production costs and returns were estimated for the various systems in the study, but only for the wheat crop. Organic growers had consistently lower costs of production than the typical or Top Management conventional grower. (See Table 1 on page 3). Gross income was similar to Top Management growers and lower than conventional growers, leading to comparable net returns between organic and conventional growers and lowest returns for Top Management growers.

These calculations were based on market prices without any premiums for organic crops. Organic growers typically sold about 50 percent of their wheat crops at a premium. When premiums were included in the budget estimates, cost of production rose slightly while gross income rose significantly. This led to an average increase in net returns of \$33 Canadian per acre (an 87 percent increase), realized on about half of the acres of wheat on the typical organic farm.

In addition, net economic returns from organic peas and lentils were considerably higher than returns from conventional farms.

The researchers are optimistic about the potential for organic grain farming in Saskatchewan. With additional research, some of the soil fertility and weed control problems could be addressed, perhaps leading to substantial yield improvements on the organic farms.

Organic food markets have been steadily growing over the past five years. And where net returns without premiums are comparable between organic and conventional production systems, the organic status could be a strong marketing advantage.

Using the right tillage tool can reduce the need for herbicides

A recent article in *The New Farm* magazine (July/August 1994) describes a number of unfamiliar tillage tools being tried by growers in various applications. Some are being used to kill heavy cover crops without herbicides, such as the undercutter sweep at Ohio State University.

Mechanical spaders have long been used in Europe and are recent arrivals in the U.S. They can dig deep to reduce soil compaction while keeping crop residue in the top half of

the tillage zone. Power harrows are used as a secondary tillage tool to make a finer seedbed and seal in moisture. Several reservoir tillage tools make "pits" or "dams" in row crops to help improve infiltration of irrigation water and reduce water erosion.

The Dyna-Drive is a ground-driven tool that partially incorporates residue while leaving — or even increasing — the percent residue cover on the soil surface. It is used as a one-pass implement and can reduce tillage hours and save soil moisture — DG

Putting aside the debate over the relative merits and drawbacks of organic and conventional, growers may be prompted to hybridize from both approaches when net returns are similar and come up with systems that are more profitable and more environmentally sound. One researcher went so far as to calculate the effect of a tenfold increase in the number of organic farms on the rural economy in Saskatchewan. He estimated a 7.8 percent increase in provincial farm income (with premiums) for this potential niche market, recognizing that premiums would probably drop as production expanded.

Organic grain production does not appear to work everywhere, however. In the eastern Washington dryland region, a number of growers have attempted organic production and only one or two are succeeding on a commercial scale. No large-scale growers are using it across their entire farm. This is in contrast to growers in

Montana and other parts of the northern plains, with similar soils, annual rainfall, and rotations, who have been successfully farming several thousand acres organically for five to ten years.

A major difference appears to be the winter precipitation pattern in Washington versus more summer rainfall east of the Rocky Mountains. Thus, northern plains growers have an opportunity to cash in on organics, while regulators and the general public need to recognize how much farming practices can differ from region to region and avoid mandating failure in one area based on success in another.

REFERENCE

Viability of Organic Farm Practices, Rutherford, A., M. Gimby, G. Smith, A. Mair, and E. Coxworth. 1992. Saskatchewan Research Council, Saskatoon, SASK, Canada. □

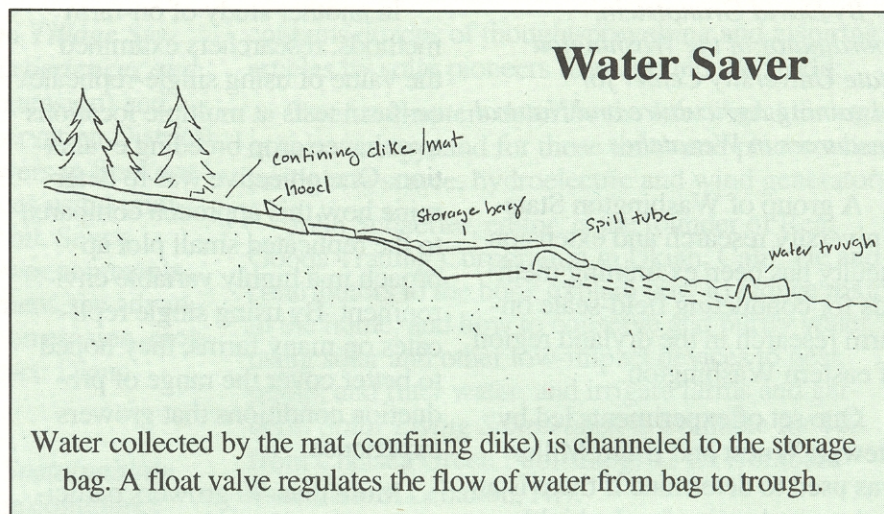
Water saver brings dry land into productivity

CONTINUED FROM PAGE 1

The water saver that Joe DeMars built in Montana consists of a 70-by-150-foot plastic covered shallow pit located on a gentle slope. The mat collects rainwater, which is channeled through a pipe into a 12-foot deep plastic lined storage bag.

The storage bag holds 60,000 gallons of water. A pipe runs from the storage bag to a 1,200-gallon concrete stock tank, which is set into the hillside to prevent the water from freezing.

With the exception of one open end, the tank is covered with concrete and a layer of soil. A float valve in the tank keeps the water flowing as livestock drink. The plastic mat and storage tank are surrounded by fence to prevent livestock and wildlife damage.



The BLM paid for everything except the stock tank.

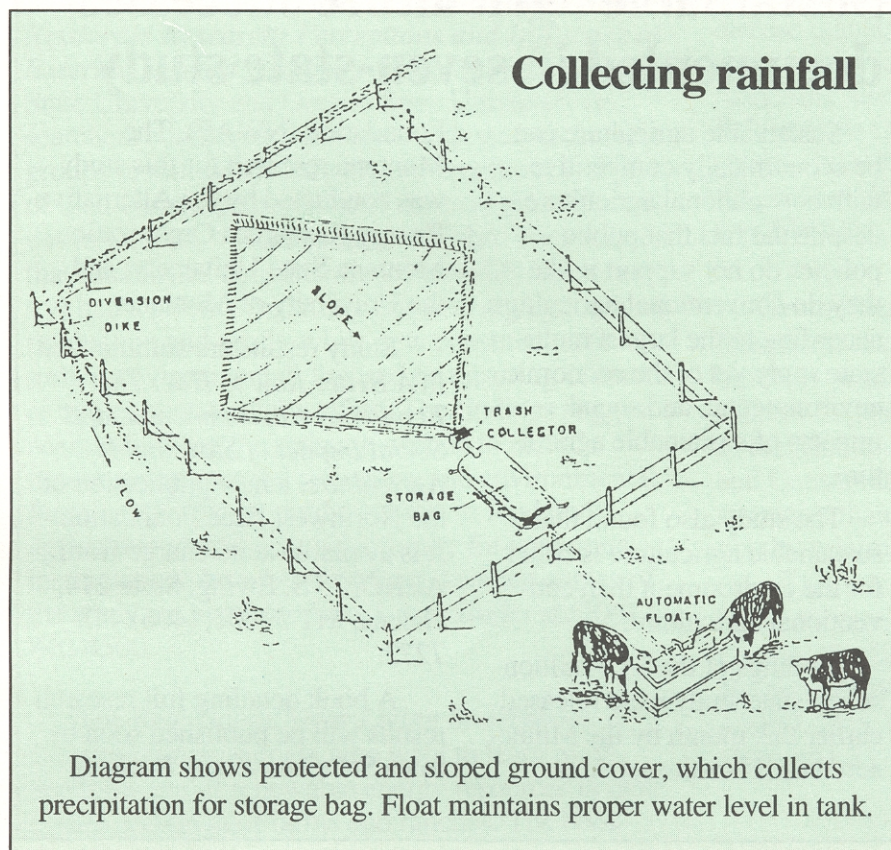
DeMars is one of 10 producers who started the Fergus County Intensive Grazing Strategies Group in 1993 to share information and learn more about how

their grazing management strategies affect local ecosystems, particularly riparian areas. The members have added activities to educate youth, urban dwellers and owners of small acreages about range management.

The Fergus County Intensive Grazing Strategies Group is part of the Farm & Ranch Improvement Club Program in Montana, a growing network of 26 producer-led groups. Receiving small grants and organizational assistance from the Alternative Energy Resources Organization (AERO) in Helena, and the Montana Department of Natural Resources and Conservation (DNRC), club participants pursue projects that seek practical solutions to shared agricultural problems.

Call AERO at (406) 443-7272 for more information about the Farm & Ranch Improvement Club Program.

A similar program serves producers in eastern Washington and Idaho. For more information, call the Palouse-Clearwater Environmental Institute at (208) 882-1444 or the Idaho Rural Council at (208) 344-6184. □



WSU researchers fine tune on-farm testing

— By David Granatstein,
coordinator of the Washington
State University Center for
Sustaining Agriculture and Natural
Resources in Wenatchee —

A group of Washington State University research and extension faculty has been examining methods for conducting field-scale on-farm research in the dryland region of eastern Washington.

One set of experiments led by Stewart Wuest and Baird Miller was used to determine if there is an optimum plot size for the highly variable conditions of the region. The researchers selected uniform areas in fields of winter wheat already planted by the cooperating growers. They then designated a series of side-by-side harvest strips slightly wider than the growers' combine header. In alternating strips, harvest was done either as a single 1,500-foot cut or as a series of 250-foot or 500-foot cuts. The variance for each yield estimate was then calculated and plotted against the plot length.

Variance decreased with increasing plot length at all sites. Based on the results, the researchers recommend that on-farm plots be as long as possible, with a minimum of 750 feet. This design using long, side-by-side strips appears able to detect fairly small treatment differences. A minimum of three replications is recommended.

Using this approach, the Least Significant Differences for grain yield in field-scale, farmer managed tests were about four bushels per acre on low variability sites and eight bushels per acre on high variability sites. (Source: Wuest et al., 1994. *J. Production Agric.* 7(2):211-215).

In another study of on-farm methods, researchers examined the value of using single-replicate on-farm tests at multiple locations to enhance crop breeding evaluation. One objective was to determine how this approach compared to the replicated small plot approach in a highly variable environment. By using single replicates on many farms, they hoped to better cover the range of production conditions that growers experience.

More than 40 growers participated in the study by each planting four or more side-by-side strips of selected spring barley cultivars. Each strip was slightly wider than the combine header and ran for the length of the field. Results from these tests were compared to those

from the standard small plot trials.

Cultivars responded similarly in the two testing systems, and the single replicate testing is not likely to recommend different cultivars than the small plots.

However, the single-replicate system revealed more significant differences among cultivars than the small plots in two out of three years. Thus, the researchers conclude that the single-replicate system has an equal or lower probability of releasing a low-yielding cultivar than the small plot system. They suggest that the single-replicate on-farm tests may be a cost-effective complement to a traditional small plot breeding evaluation program. (Source: Johnson et al., 1994. *J. Production Agric.* 7(1):75-80). □

Sustainable agriculture successes documented in seven-state study

Sustainable agriculture can be economically competitive with conventional agriculture despite the fact that public policies do not support it like they do conventional agriculture, according to the largest multi-state study yet of the economic, environmental, and social impacts of sustainable agriculture.

The study also found that sustainable agriculture is better for the environment than conventional agriculture.

Findings of the \$4.5 million seven-state study were released earlier this month by the Minnesota-based Northwest Area

Foundation (NWAFF). The Montana research for this study was conducted by the Alternative Energy Resources Organization, Montana State University, and the University of Montana.

Study results are summarized in *A Better Row to Hoe: The Economic, Environmental, and Social Impact of Sustainable Agriculture*, a new publication of the Northwest Area Foundation. It is available at no charge from AERO, 25 S. Ewing, Suite 214, Helena, MT 59601; (406) 443-7272.

A book detailing full research results will be published soon by Iowa State University Press. □

RESOURCES

Management Skills for Minimum Tillage Systems in Spokane County: Farmer Experiences and Viewpoints. Diana Roberts (WSU Extension) and Christine Armstrong (Spokane Conservation District) teamed up to interview 27 grain growers in Spokane County, Wash., about their experiences using minimum tillage equipment to conserve soil. Seven systems are described, including grower comments on the goals for the particular implement, the advantages and disadvantages, and effects on erosion, crop performance and other aspects. Contact: Diana Roberts at (509) 533-2048.

Proceedings of the Science and Sustainability Conference. Selected papers from the conference "Science and Sustainability: Reshaping Agricultural Research and Education," Oct. 24-26, 1994 in Bellevue, Wash., have been published in the most recent issue of the *American Journal of Alternative Agriculture* (Vol. 9, No. 1&2, 1994). Topics include issues relating to land-grant institutions and a series of case studies of various approaches to whole-systems research and education. Contact: IAA at (301) 441-8777.

Land Grant University Agricultural and Natural Resources Research: Perceptions and Influence of External Interest Groups. A team of Washington State University and Oregon State University researchers conducted interviews with various interest groups (commodity, industry, environmental) to learn of their current perceptions of the land grant universities in Oregon, Washington, and Idaho. They found that established constituents (commodity, ag industry) had a priority regarding maximizing agricultural production and profit, while new constituents (consumer, environmental) focused on ensuring consumer and environmental welfare. The findings suggest a need to broaden the research agenda to include human safety, natural resources, and environmental factors. The current public interest in food and agriculture provides an opportunity for land grant institutions to broaden their base. Limited copies of the study are available from Lorna Butler at (206) 840-4500.

The Real Goods *Solar Living Sourcebook* is designed for consumers who want to learn more about the use of renewable energy resources in their homes and on their farms and ranches. The book

contains dozens of thought-provoking and inspiring articles by solar pioneers from around the world.

Twelve chapters describe the latest breakthroughs in solar energy, and for those times and places when sunlight is scarce, hydroelectric and wind generators.

John Schaeffer, editor, is the founder of Real Goods Trading Corporation in Ukiah, Calif. He and contributors to the book explain how to reduce toxins in the home, and how to conserve and purify water using solar and other low-impact devices to heat, pump, and filter water, and irrigate farms and gardens. *Solar Living Sourcebook* is available for \$23 from Chelsea Green Publishing, 52 La Bombard Road, North Lebanon, NH.

A Sustainable Agriculture Resource Guide for Oregon and Washington. This 220-page volume published by the Oregon State University Extension Service is a must for growers, agricultural scientists, students, ranchers, irrigators and marketers in the Pacific Northwest who want to learn more about sustainable agriculture. The guide includes sustainable ag organizations, books, periodicals, data bases, computer software and video tapes, plus a descriptive bibliography covering everything from pest and disease management to cover crops and soil and water conservation. On-farm experimentation and marketing also are discussed. Send \$9 per copy to Publications Orders, Agricultural Communications, Oregon State University, Administrative Services A422, Corvallis, OR 97331-2119. Request publication EM 8531.

Groundwater Protection for Farmers and Ranchers: Alternative Farming Strategies is a brochure produced by the Alternative Energy Resources Organization for the Water Quality Division of the Montana Department of Natural Resources and Conservation. It describes alternative farming strategies than can help stop groundwater contamination by minimizing the need for agricultural chemicals. This is a condensed version of AERO's 1991 book, *Protecting Groundwater from Agricultural Chemicals: Alternative Farming Strategies for Northwest Producers*. Copies are available free from AERO, 25 S. Ewing, Suite 214, Helena, MT 59601; (406) 443-7272. □

CALENDAR

FEBRUARY

23-24: *Nitrogen, Environment, and People — An International Conference*, Everett, Wash. Sponsored by agencies and universities in the Pacific Northwest. Contact: Nancy May at (206) 676-6736.

25-27: *Canadian Natural Products Spring Show*, Vancouver Trade and Convention Center, Vancouver, B.C. Contact: Maureen Murphy at (905) 479-6939.

MARCH

7-10: *Sustainable Agriculture — Working with Producers*, Holiday Inn, Bozeman, Mont. This training, sponsored by the Alternative Energy Resources Organization, offers Extension, SCS and university



professionals from Montana, Idaho, Wyoming, Utah and eastern Washington the opportunity to learn about emerging sustainable farming systems and how to assist those producers who want to adopt them. The training will be followed by opportunities for participants to apply what they learned in a practical setting during the 1995 growing season. A follow-up meeting will be scheduled in the fall. Contact: AERO (406) 443-7272.

25: Great Northern Botanicals Association annual meeting, Bozeman, Mont. Contact: Mark Mackin at (406) 227-5237.

APRIL

No date set: Part II of the Sustainable Agriculture tele-video is tentatively slated for April. The conference focuses on range management and dryland farming. Contact: Scott Cotton at the University of Wyoming, (307) 766-5478.

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