

ORGANIC FARMING RESEARCH FOUNDATION

Winter 2004 Number 13

INFORMATION BULLETIN

The Next Great Challenge: Breeding Seed for Organic Systems

by Micaela Colley and Matthew Dillon

It's appropriate for the organic movement to acknowledge the tremendous strides made in the past decade. We can easily see the increased acreage and greater market share that organic farming has gained. Less measurable but still tangible are a range of benefits to consumers, the environment and rural communities reaped by organic's infiltration into the agro-mainstream. Yet, amidst success there's often another formidable task around the corner. Right now, an urgent need in organic agriculture is for greater volumes of organically produced seed. But a weightier concern—at an organic *systems* level—is the essential need to encourage seed (and animal) breeding programs that are both designed in concert with organic systems, and in the public domain. As it is with many aspects of the organic movement, organic seed and breeding development will have significant scientific, economic and institutional challenges.

The present need for increased organic seed supplies is driven by USDA's implementation of the National Organic Program Rule. The Rule requires that organic growers use organic seed, except, "When an equivalent organically produced variety is not commercially available." By itself, fulfilling the requirement for organically grown seed is a very large task. For example, Miles McEvoy, Organic Program Manager for the Washington State Department Agriculture, estimates that in 2003 less than one percent of organic acreage in the state was sown with organic seed. But many in the organic movement (and others) see an even more important need—and opportunity—to steer seed breeding efforts in new directions. Changing the course of seed breeding encompasses many issues but the critical objectives are putting public participation and ownership back into the priorities and products of public seed breeding programs, and (re)establishing

approaches to breeding that emphasize the agro-ecological context of plants and animals.

These very ambitious goals require settings and methods different from the dominant proprietary models at work today. They will also require a number of years to bear fruit. The following discussion focuses on some of these "new" approaches to breeding.



Seed Breeding for Organic: The State of the Industry

A mixture of institutional and market forces has led to the significant lag in organic seed and breeding efforts. Organic seed availability is low in part because few seed companies have developed resources specifically for organic production. In the private sector, seed companies with larger research and development (R&D) resources haven't invested significant funds in organic programs, in part because the organic market sector is relatively small, but also because vague NOP Rule language has provided no solid timeline for fully requiring the use of organic seeds. When larger seed companies do focus on organic, it usually consists of a simple production shift whereby the varieties offered conventionally are moved to organic fields, but with no selection or improvements for the needs of organic systems. The few pioneering seed companies that do offer organically grown seeds tend to be small and lacking in significant resources for breeding efforts.

Meanwhile, public seed breeding efforts, once predominantly in the public sector through land grant universities, have moved increasingly to consolidated private seed companies. Factors precipitating this shift include changes in university funding with greater private linkage and an increased focus on genomics. Pressure is placed on university breeders

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2003 was an important year for organic farming and for OFRF. Organic farmers and consumers successfully defeated the first serious attempt to undermine the National Organic Standards since their implementation in October 2002. Our new *State of the States 2nd Edition* report revealed real growth in organic programs at the nation's land grant institutions. And the Organic Agriculture Caucus in the House of Representatives and a growing Senate organic working group are bringing added legitimacy and power to organic farming issues in Washington, DC.

OFRF continues to fund farmer-led research and distribute our information resources to growers, researchers, policymakers and the

media. Despite a slow economy, our supporters allowed us to fully implement all of our 2003 program objectives. Here is a brief overview.

Grantmaking

OFRF received 73 proposals totaling over \$680,000 for our 2003 grant cycles. The Board of Directors awarded 23 competitive grants totaling \$184,571 for organic research and education projects. Our total grantmaking since 1990 now stands at \$1,342,226 in support of 213 projects—a proud achievement for a small nonprofit and a challenge to our public research institutions to match our level of investment in the future of organic agriculture. The OFRF Board

continued its support of Stephen Jones's project developing wheat varieties that perform well in organic production systems—one of the nation's only traditional (non-GMO) wheat breeding programs—and funded work in a wide range of regions and topics, including compost teas for pathogen control, weed management in no-till systems, economic analysis of organic citrus systems, and a CSA training manual.

Media & Strategic Outreach

OFRF has had a substantial impact in the media in 2003. We used our influence with regional and national press to shed light on a serious attempt to undermine the integrity of organic standards in February, when Georgia Congressman Nathan Deal attached a rider to the Federal budget bill to allow poultry growers to use conventional feed and still market their chicken as organic. Executive Director Bob Scowcroft was often quoted in the

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INFORMATION BULLETIN

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PRINTED BY
Community Printers
Santa Cruz, CA

The *Information Bulletin* is published by the Organic Farming Research Foundation, a non-profit foundation dedicated to fostering the improvement and widespread adoption of organic farming practices. Our mailing address: PO. Box 440, Santa Cruz, California 95061, telephone: (831) 426-6606, fax: (831) 426-6670, email: <research@ofrf.org>, web: www.ofrf.org. Material in this publication may be reprinted with credit.

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OUR MISSION • To sponsor research related to organic farming practices • To disseminate research results to organic farmers and to growers interested in adopting organic production systems • To educate the public and decision-makers about organic farming issues

Fourth National Organic Farmers' Survey Results Show GMO Impacts to Organic Farmers

The results of OFRF's *Fourth National Organic Farmers Survey* show that organic growers have incurred a variety of direct financial and operational impacts related to the risks of contamination by genetically engineered crops, or "GMOs." The reported impacts ranged from laboratory testing expenses, to alteration of cropping patterns, to actual loss of sales. These impacts were especially notable in nine states stretching from North Dakota to New York, and among organic corn and soybean growers.

In the nine high impact states (ND, MN, WI, IA, IL, IN, OH, MI, NY), 13.6% of responding growers (45 of 330) reported that they had borne, "direct costs or damages related to the presence of GMOs in agriculture."

Nationally, 17% of survey respondents indicated that GMO testing had been conducted on some portion of their organic farm seed, inputs or farm products. Eleven percent of those organic farmers that had GMO testing conducted indicated that they received positive test results for GMO contamination on some portion of their organic seed, inputs or farm products. In addition:

◆ 48% of the survey respondents indicated that they have taken some measures to protect their organic farms from GMO contamination. The greatest percentage, 24%, indicated that they have communicated with neighboring farmers about GMO risks to their farm.

◆ 19% indicated that they have increased the size of buffer zones to neighboring farms, 18% have discontinued use of certain inputs at risk for GMO contamination, 15% have adjusted timing of crop planting, 13% have altered cropping patterns or crops produced, and 9% have changed cropping locations.

◆ 30% of respondents characterized their farm's GMO contamination risk as high or very high.

◆ Survey respondents identified contaminated seed stock as their primary concern as a possible source of GMO contamination of their organic farm products (identified as a moderate to high risk by 48% of respondents). This was followed by GMO pollen drift in the field (identified as a moderate to high risk by 42% of respondents) and contaminated farm inputs other than seed, (identified by 30% of respondents as a moderate to high risk).

These results probably represent only the beginning of a rising trend. Transgenic crops continue to dominate the landscape of many U.S. farm states. Contamination occurs not only through cross-pollination of susceptible crops, but also through commingling in handling, distribution and seed supplies.

Compensation for organic growers' costs and damages is not likely to be solved anytime soon. The USDA organic rule does not consider incidental GMO contamination (as opposed to willful use of transgenic technology) to be a labeling violation or cause for de-certification. Therefore, the consequences of contamination are enforced only in the marketplace.

In spring 2002, OFRF mailed a 22-page survey to certified organic farmers throughout the U.S., with 1,034 farmers responding. The 4th National Organic Farmers' Survey, *Sustaining Organic Farms in a Changing Organic Marketplace*, is OFRF's first survey to focus specifically on organic farmers' experiences in the organic market. The full results will be published in spring 2004.

—Mark Lipson & Erica Walz

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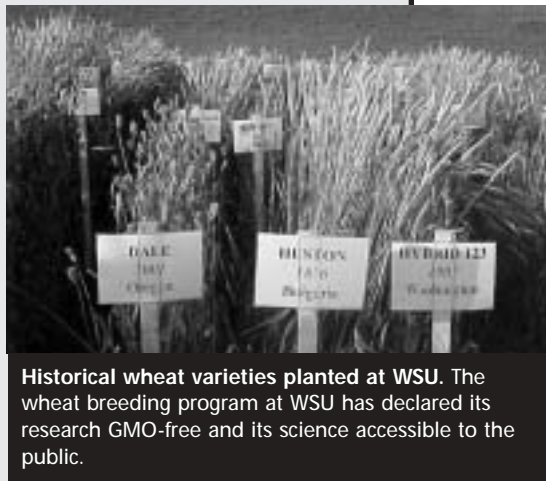
University researchers explore old varieties

Assessing historical wheat varieties for useful traits

At Washington State University--Pullman, a team led by Dr. Steve Jones and Kevin Murphy are growing 163 historical varieties of wheat under organic conditions. They believe that each variety potentially possesses traits that could enhance the disease resistance, weed competitiveness and productivity of modern varieties. Kevin Murphy notes, "These characteristics may be considered unimportant in high chemical input systems and therefore ignored within conventional breeding programs."

For example, if seeds used in breeding are treated with a fungicide before planting, traits such as resistance to the fungus *Pythium* or tolerance to *Tilletia* spp. (Stinking Smut) may go unnoticed. In addition, certain wheat varieties may be effective at reducing weed pressure through increased nutrient use efficiency, allelopathy, horizontal canopy coverage and/or height development rates. Jones and Murphy are

also crossing these historical wheats to modern varieties and evaluating the subsequent generations. They work closely with farmer-cooperators both for variety testing and for evaluation of useful traits. Murphy says, "We place the utmost importance on breeding wheat on certified organic farms under the same conditions and systems practiced by the farmer." Steve Jones believes that their initial seed material could be adapted in other regions, but that as they continue to develop stock



Historical wheat varieties planted at WSU. The wheat breeding program at WSU has declared its research GMO-free and its science accessible to the public.

it will be particularly suited for the Northwest. This breeding research and subsequent seed stock will remain in the public domain.

to develop proprietary breeds that are profitable to industrial sponsors. Breeding for the relatively small organic market has little chance of gaining a foothold in this type of university climate.

Adding to institutional issues are the poor market conditions (and subsequent lack of R&D) for organic seed caused by historical concerns among farmers about the low quality and high cost of organic seed. Price and quality concerns have made many farmers' interest in organic seed lukewarm, at best. The vast majority of organic producers continue to rely on seed that they've become accustomed to and developed markets for over the course of time--seed that is developed for productivity under high input fertilizer and pesticide conditions.

Organic producers should not be expected to embrace organic seed for the sake of a "pure" organic approach. Organic seed must perform at least as well as the conventional varieties that growers have become comfortable with. The opportunities are as vast as the need. Understanding the philosophy and learning the skills of breeding for organics is as essential as creating the funding and research infrastructure.



The Science of Breeding for Organic: Some New Approaches

What does it mean to breed for organics? Organic growing conditions present different weed pressures, fertility practices, and pest and disease complexes than conventional fields. Frank Morton, an independent plant breeder in Oregon, describes his vision of breeding for organics as, "Breeding for the whole farm ecology, developing seed that increases the positive interactions of the farm ecosystem." Varieties could be developed for better weed competition, or nutrient uptake, or beneficial soil microorganism and root interactions. For example, modern carrot breeding, while focusing on root shape, has largely overlooked selection for strong, vigorous tops, which would particularly benefit organic growers. Strong tops are more competitive with weeds, requiring less labor-intensive hand weeding. A spinach variety bred for organics could have enough mildew resistance to grow well in cool damp conditions without the use of fungicides.

Some seed companies are beginning to offer organically grown hybrid seed. There is certainly a value to hybrids and a place for their development for organic production. However, the breeding process and proprietary nature of hybrids does not lend them to farmer/breeder cooperative efforts, nor is the end product suited for subsequent on-farm selections or regional adaptation. On the other hand, when breeding open-pollinated (OP) varieties, seed may be saved from a variety by the grower or plant breeder, and the genetic elasticity inherent in OP breeding allows selection for chang-

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ing environmental conditions such as diseases, heat, cold, drought, soil type or other localized stresses.

Open-pollinated breeding also offers a way of selecting for a broad range of traits. Most modern disease resistance breeding focuses on one disease at a time by identifying and isolating a single gene that confers resistance, and then breeding that gene into subsequent varieties. This approach confers vigor through a trait that has been termed "vertical" resistance. However, another breeding model, called "horizontal" resistance, takes advantage of numerous genes during the selection process. Plant scientist Raoul Robinson has explained and described the advantages of this method at length in his book *Return to Resistance*. This method is also known as durable or polygenic (multiple gene) resistance.

Selecting for horizontal resistance works in the following way: In a genetically diverse, open-pollinated plant population, individual plants are affected by pests and disease to varying degrees. By selecting the plants that perform best under the presence of the pest or disease, the entire population begins to develop resistance, through several different traits and a range of genes. During this process, the breeder does not need to know which genes confer resistance in the healthier plants. For example, a population of lettuce may have plants with more upright leaves which evade splashing from disease spores, or a thicker cuticle which prevents spores from penetrating the surface, or an ability to grow rapidly and outgrow the period of susceptibility. Horizontal resistance takes longer to confer to a variety, but is a more enduring form of plant resistance than single gene resistance. Plants can be evaluated under a host of disease and pest pressures, and selected for a whole range of beneficial genes.



The Future of Organic Plant Breeding: A Participatory Model

The need for organic seed production and breeding will continue to grow as organic production increases. There is now growing interest in breeding for organics--what remains to emerge is the form or forms that this breeding may take.

There are three distinct forms of plant breeding: formal, farmer and participatory. Formal breeding can be either public or private, and is conducted by professional scientists with the goal of releasing new varieties for the market. While farmers may (or may not) be used in the evaluation of these varieties, they have no real decision making power. Farmer breeding is often referred to as "Seed Saving," wherein the farmer selects plants from crops in production that possess desirable qualities and then collects seed from them for future planting. The essential makeup of the variety is maintained through mass popula-

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Oregon breeder focuses on performance

Breeding lettuce to excel under organic conditions

In the Willamette Valley of Oregon, Frank and Karen Morton of Shoulder to Shoulder Farm are breeding lettuce for resistance to *Bremia lactucae* (Downy Mildew),

degree. These survivors are saved as separate lines, allowing that there will be a small amount (about 5%) of between-variety crosses. In the following generation he isolates these crosses and saves seed separately as potential new lines. The seed

from the rest of the population is repeatedly grown under disease conditions for several generations to develop an increasingly resistant strain. Frank notes that, "The varieties that start with more genetic variability are the ones that make the most improvement from the selection pressures." Once a resistant strain is established he continues his program to select for other horticultural traits, like bolt resistance, heading, uniformity, or exceptional beauty.

Frank has exchanged seed and information with the USDA lettuce breeding program in Salinas, California. He says he "would like to see more support for organic plant breeding and stronger links between independent breeders, farmers saving seed, and public institutions to support this type of work."

Frank starts the breeding process by planting a wide range of varieties, including his favorites and those known or suggested to have some resistance, in a field with heavy disease pressure. If needed, he will inoculate the ground with the disease to ensure its presence. Many strains won't make it to bear seed; others that are too diseased will be selected out. The strongest survivors will have traits that make that strain resistant to some



Frank Morton: "We need stronger links between breeders, farmers and institutions."

Sclerotinia sclerotiorum, *Xanthomonas* spp., and Tip Burn, all problems in organic lettuce and lettuce seed production.

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Tri-Societies Features Organic Symposium

Men in suits and women in dresses, name tags dangling from their necks, ventured from downtown Denver hotels toward the convention center in early November. It was that time of year again, when the Agronomy, Soil, and Crop Science Societies of America hold their Annual Meetings. University-based scientists, industry representatives, and independent crop consultants came to present their latest research results, discuss policy issues, view the latest technological innovations, and plan for the future.

In an historic development for organic farming research, the first full organic symposium since 1981 was held at the meetings on Nov. 4-5, 2003. It has been over twenty years since such a strong program of organic research findings was presented at the generally conservative "tri-societies" meetings.

The need to establish a presence at professional society meetings has been discussed numerous times at gatherings of OFRF's Scientific Congress on Organic Agricultural Research (SCOAR). In past years, individual sessions and posters at the tri-societies meetings have presented organic research findings and policy issues. This year, SCOAR's goal was fulfilled in a significant way: the two-day symposium featured four sessions (three oral and one poster) for a total of 35 presentations on organic farming research and related policy issues.

Representing OFRF, I presented a talk on our recently released *State of the States: Organic Farming Systems Research at Land Grant Institutions 2001-2003* (see sidebar), and presided over one of the sessions.

The first symposium session consisted of talks describing the status of organic farming and research in the U.S. and abroad. Agroecologist Miguel Altieri, based at the University of California at Berkeley, showed colorful slides depicting agriculture from around the world, and challenged organic advocates to go beyond input substitution and to focus on cultivating biodiversity. Altieri estimated that 80% of organic farmers in the U.S. grow monocultures relying on input substitution--applying organically acceptable materials in place of chemical inputs--rather than consciously designing and managing biodiverse agroecosystems which can sponsor their own soil fertility and pest protection. He also pointed out that increases in organic production in the Third World are not contributing to local food security because most of the crops are grown for export, rather than to feed local communities. Altieri ended his talk with some radical recommendations, including limiting organic farm size in the U.S., implementing social standards into the national organic standards, and placing a global moratorium on genetically modified crops.

Altieri was followed by Cornell's Laurie Drinkwater, who presented methodologies for conducting research in organic agriculture. Drinkwater emphasized the importance of utilizing systems approaches to studying the complex processes occurring on organic farms, while acknowledging that component studies provide useful information as well.

Cathy Greene, economist with USDA's Economic Research Service, presented her data on organic production acres in the U.S., showing that certified organic acreage more than doubled between 1992 and 1997, then doubled again between 1997 and 2001. Organic poultry and dairy have been the fastest growing sectors of the organic market. Greene also reported that organic lettuce acreage is a full 5% of the nation's total, and 4% of the total carrot acreage is certified organic. Her overall message is that organic farming continues to expand at a rapid pace.

In an historic development for organic farming research, the first full organic symposium since 1981 was held at the meetings.

A number of interesting presentations filled out the opening session. Agronomist Charles Francis with the University of Nebraska discussed the proliferation of organic academic programs in the Nordic region and elsewhere in Europe. National director of USDA's Sustainable Agriculture Research & Education (SARE) program Jill Auburn reported on the portfolio of organic research and education projects funded by SARE. Diana Jerkins, a program leader with USDA's Cooperative State Research, Education, and Extension Service (CSREES), talked about federal funding opportunities for organic research. Iowa State entomologist and OFRF Board member Jerry DeWitt presented photographs of organic farms and commentary on their unique nature, and USDA Agricultural Research Service (ARS) scientist Carolee Bull told about ARS organic research activity around the country.

The symposium's second session presented specific organic research results. Highlights included ARS scientist James Hansen's project, "Using radio frequency treatments to disinfest arthropod pests from stored products." Warren Wilson College plant pathologist Mark Boudreau discussed intercropping to control disease in an organic peanut-corn system. Steve Scheuerell from Oregon State University discussed disease control with compost tea. Walter Goldstein with the Michael Fields Agricultural Institute presented data showing that

Organic Research Acres Double in Two years

This summer, OFRF released the second edition of **State of the States: Organic Farming Systems Research at Land Grant Institutions, 2nd Edition**. SOS II, as it's fondly called, debuted at a farm tour organized by Dave Vetter of the Grain Place, an organic farm and processing plant in Marquette, Nebraska. Our first edition on publicly-funded organic research and education (SOS I) was published in 2001. SOS II inventories information through 2003, and shows dramatic changes in the organic research scene since 2001: the total number of organic research acres in the U.S. land grant system has more than doubled between 2001 and 2003, while the number of certified organic research acres has trebled. Still, organic research acreage still lags far behind the proportion of U.S. farmland that is certified organic.

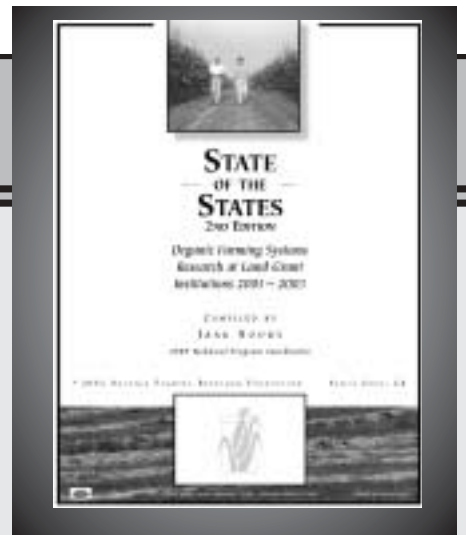
The study found that, overall, organic research occupies only 1,160 acres (0.13%) of the 885,862 available research acres in the land grant system. A recent USDA report documents that overall, 0.3% of all U.S. farmland is certified organic. In high-value crops such as vegetables, a full 2% of U.S. acreage is certified organic. OFRF found that certified organic research acreage is only 496 acres (0.06%) of the total available research acreage. This represents a trebling of the 154 certified organic

research acres that OFRF reported in 2001, a growth trend that OFRF expects will continue. The OFRF Board has set a goal that 10% of federal agricultural research funds be directed to organic research by 2006.

The five states having the strongest organic research programs in 2001—Iowa, Ohio, Minnesota, North Carolina, and West Virginia—are joined by new programs in Washington and New York. South Carolina, Maryland, Florida, and New Hampshire have emerging organic research programs and are bringing research land through the transition to certified status. Michigan and California both have relatively high numbers of organic research projects being conducted, but lack a centrally coordinated organic research program. Land grants in Wisconsin, Oregon, and Pennsylvania have notably few resources for the large numbers of organic farmers in these states.

OFRF considers the effort made to certify research areas as organic to be an indicator of a land grant institution's level of commitment to organic research.

"If they have certified organic research acres, they are much more likely to provide accurate information to local organic growers," said Bob Scowcroft, OFRF executive director. "They have made a long-term commitment to organic, and are held to the same standards that the farmers are."



The land grant system consists of 68 land grant universities, a national network of agricultural research stations, and Cooperative Extension personnel in every U.S. county. Because the land grant system is funded with federal tax dollars, OFRF expects it to respond to the needs of all its constituents, including the growing number of organic farmers.

The State of the States II report is available through the OFRF website; it is particularly suited for use in an electronic format as it contains links to many websites. It may be accessed at www.ofrf.org. Printed copies, featuring photographs by Cynthia Vagnetti, may be ordered for a donation of \$10 each to defray printing and postage costs. Contact OFRF at phone 831-426-6606, email research@ofrf.org

organic corn yielded more, had less root disease, fewer roots, and lower nitrogen uptake than conventional corn.

Paul Porter, an agronomist at the University of Minnesota, was key in organizing the symposium. He was pleased with the turnout (which ranged from 30 to almost 200 at times) and stated, "Symposium topics rotate around from year to year. We probably wouldn't do this every year. The structure is not geared toward that. But I don't think it will be 20 years until the next one."

Charles Francis with the University of Nebraska commented, "Ninety-five percent of the posters and papers presented at the national meetings are focused on minutiae and 'agronomic trivial pursuit.' In this professional setting, the organic symposium was refreshing with its emphasis on whole

systems, landscape issues, and the social dimensions of sustainability." ❁

The USDA SARE program made a special grant to create a compact disc containing the proceedings from the four-session organic symposium, and to fund the creation of a website featuring all of the presentations. This disc contains a diverse array of contemporary organic research findings, and is highly recommended to growers, researchers and consumers. Free copies of the CD may be ordered from the Minnesota Institute for Sustainable Agriculture, phone: 612-625-8235, email: misamail@umn.edu, website: www.misa.umn.edu. Click on Forum, then 2003 Organic Ag Symposium. —JS

OFRF Policy Team makes progress in Washington

All of us at OFRF are very happy to report the return of Policy Program Director Mark Lipson. Mark is now fully recovered from extended treatments for cancer that took him out of circulation for all of 2002 and much of 2003. "I'm excited to be back at OFRF," says Lipson. "There's a lot to catch up on, especially as a result of the great work by Brise Tencer over the last couple of years."

"I can't express deeply enough my gratitude for the incredible support that Marcy and I received from everyone associated with OFRF," Lipson continues. "We want to thank everyone for their thoughts and prayers during the last two years."

Indeed. And while the very *thought* of farm policy might be enough to make an organic farmer head back outside for the tractor, we are nevertheless excited to share some of the recent highlights and accomplishments of OFRF's policy program.

Congressional Organic Agriculture Caucus is launched

In February 2003 an Organic Agriculture Caucus was formed in the U.S. House of Representatives. According to their mission statement, the Organic Agriculture Caucus is:

A bipartisan association of congressional members dedicated to enhancing availability and understanding of information related to the production and processing of organic agricultural products. The caucus shall serve public interest through promoting sound policies to advance organic production and marketing.

There are now 35 caucus members, including 9 Republicans, 1 Independent, and 24 Democrats.

Working with the Caucus is a growing aspect of OFRF's policy program. OFRF played a key roll in the caucus's formation and member enrollment. We've presented two caucus briefings, in April 2002 and September 2003, which included overviews of current issues related to the organic industry as well as legislative recommendations, particularly related to agricultural appropriations (budget bills). We will continue to provide information on current issues and plan on another legislative briefing to caucus members and staff in January or February of 2004.

To see a current list of members of the Organic Caucus, visit OFRF's Policy page at: <http://www.ofrf.org/policy/index.html>. If your Representative is not listed, call or write their office and ask them to join this bipartisan caucus to stay informed about current issues related to organic agriculture.

Funds directed to USDA organic programs

OFRF continues to play a prominent role on Capitol Hill as a primary source of information and funding recommendations about the various USDA organic research and service programs. The 2004 Fiscal Year agriculture appropriations bill is part of an omnibus package containing six other appropriations. As this issue goes to press, the omnibus appropriations bill has been passed in the House of Representatives, but awaits final vote in the Senate. The total spending in the 2004 agriculture appropriations bill is significantly lower than 2003 levels and many programs saw huge cuts. Despite this, most of the programs OFRF advocated for were given "level funding" (the same amount as in 2003) or higher. Some of the highlights are:

- \$1.9 million for the "Organic Transitions" research grants program;
- \$500,000 for an Organic Data Initiative. This new program was created in the 2002 Farm Bill but was unfunded. The \$500,000 would be new money, something almost unheard of in this tight fiscal year;
- Full funding for the Conservation Security Program. This important program was returned to an uncapped entitlement program;
- Language supporting increased organic research within USDA-ARS;
- \$1.5 million for administration of the National Organic Program and the National Organic Standards Board;
- Protecting the mandatory \$15 million (\$3m/yr for 5 years) Organic Research and Extension Initiative established in the 2002 Farm Bill.

Information to USDA-REE

OFRF has been working with USDA administrators on the objectives and implementation of various research, extension and education programs now directing resources towards organic agriculture. The biggest priorities in this area have been the new Organic Research and Extension Initiative (OREI), which should issue its first Request for Applications in January 2004, and our recommendation for a National Program Leader for organic research within USDA CSREES. As part of this general effort, Mark Lipson and Bob Scowcroft made a presentation in July to USDA Undersecretary Joseph Jen and the National Agricultural Research, Education, Extension and Economics Advisory Board while they were touring organic production and processing facilities in California. Brise Tencer has had several

meetings with key staff at the USDA CSREES to discuss the growing organic industry and its research needs. In June, she submitted a letter to Dr. Otto of USDA CSREES describing the need to create a position for a National Program Leader for Organic Agriculture (a copy of that letter is available on the OFRF website).

Organic Certification Cost Share

There are two pots of money available to organic farmers for organic certification cost share. One is a national program created in the 2002 Farm Bill that is available to growers, handlers, and retailers of organic products. The Farm Bill allocated \$5 million for this program. States apply for these funds and are responsible for dispersing this money.

The other program provides certification cost-share funds to growers only in 15 states (eligible states include: Connecticut, Delaware, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming). This money is made available through the Agricultural Marketing Assistance (AMA) bill. In 2002 and 2003 there was \$1 million per year in cost share funds through AMA. In 2004, there will be \$1 million available.

Both programs cover up to 75%, to a maximum of \$500, of the cost of certification. To apply for either of these two programs, contact your state department of agriculture. Generally the grower, processor, or retailer pays their certifier directly, then applies to the State Department of Agriculture through a simple form for reimbursement. If you have questions about this program or who to contact, Bob Pooler of the USDA NOP at 202-720-3252 or contact Brise Tencer of the Organic Farming Research Foundation at 831-426-6606 or Brise@ofrf.org.

The Scientific Congress on Organic Agricultural Research (SCOAR)

The SCOAR project is nearing the end of its current funding. In addition to the OrganicAgInfo website (discussed below), two other major products are forthcoming from the SCOAR team: a "National Organic Research Agenda" document, and a companion paper on the scientific rationales for pursuing the organic agenda. This pair of publications is now due for completion in the Spring of 2004. These will complete the initial phase of SCOAR, begun three years ago as a collaboration of growers and scientists to explore organic research priorities. Meanwhile, the OFRF Board and Staff will be working with the SCOAR Steering Committee to make plans for the project's future objectives and funding.

Agricultural Biotechnology

The highlight of our recent work on transgenic crops and their impacts on organic farmers has been analysis and media coverage about the results from the most recent OFRF *National Organic Farmers Survey*. The 2002 Survey data has provided the first solid documentation of economic and agronomic impacts on organic farmers from the escape of GM crops into the agricultural environment. Our press release about this data was widely reprinted and resulted in several articles distributed nationally. Other program activity on this front will be taking place this fall as part of other national efforts coordinated by the Union of Concerned Scientists and others. ♪

OrganicAgInfo.org

We are pleased to announce the launch of an exciting resource for information on organic agriculture: <http://www.organicaginfo.org>. OrganicAgInfo.org is an on-line database of research reports, farmer-to-farmer information, outreach publications, and more. The database can be searched by keywords, region, crop or livestock type. All information on this web site is available free of charge.

Best of all, if you have information on organic agriculture that you think would be useful to others, you can upload it to the site yourself. To add an item to the web site, please click where it says "We encourage submissions to the site," on the home page. You will need to create a user name and password during your initial visit. Any information submitted on-line is reviewed by our reviewers before being posted. This unique feature will allow the information in the database to grow through participation of the community it serves.

Visitors to the site also can rate and comment on information already posted on the site. We hope you find these unique, interactive aspects of the site useful.

OrganicAgInfo.org is being hosted by North Carolina State University, and was funded by a grant to the Scientific Congress on Organic Agricultural Research (SCOAR) and the Organic Agriculture Consortium (OAC) from the Initiative for Future Agriculture and Food Systems (IFAFS) through the USDA CSREES. If you have any questions or concerns, please contact Kathy Bielek of the Organic Agriculture Consortium at OAC@osu.edu, or Brise Tencer, Brise@ofrf.org, (831) 426-6606.

Currently the site has an average of over 2,058 hits per day. There are 22,400 individuals (unique IPs) that have visited the site over the last four months.



farmers to identify themselves as such when applying for insurance, and not doing so will present a significantly greater risk than in past years of not obtaining payment for catastrophic events.

Many comments were submitted by organic farmers in response to the Final Rule for the 2004 crop insurance regulations, the majority expressing dissatisfaction with the inequity of paying a higher premium while receiving conventional price coverage. Organic farmers also protested the lack of coverage for pesticide drift and GMO contamination. Because Congress wrote the legislation governing crop insurance, which states that FCIC can only insure losses due to unavoidable loss resulting generally from natural causes, any change to this policy must be made by Congress. While this is not likely to change in the near future, this issue will remain important to organic farmers as contamination from pesticide and genetic drift remain significant production and market threats. Non-GMO conventional farmers share the same lack of coverage.

Significant changes for 2004 are that written agreements [for organic] will not be needed if RMA currently covers the crop in the county, and organic farmers will *not* have the option to purchase conventional crop insurance.

Still, there are some positive changes in crop insurance policies for organic farmers. Several new types of policies are available which offer favorable options to the organic community. One of the best options for small-scale organic farmers is the Adjusted Gross Revenue (AGR) program. This is a relatively new program that works by insuring the revenue of the entire farm rather than an individual crop. The AGR program uses information from a producer's 1040 tax forms (Schedule F) to calculate the policy revenue, and guarantees a percentage of average insurable gross farm revenue derived from farming operations. This program is particularly useful for organic farmers with diversified operations, providing protection against natural disasters and market fluctuations. Unlike other insurance products, organic farmers using AGR get paid prices for their losses that reflect the premiums organic products receive, rather than county averages for their conventional counterparts. Best of all, the farmer does not need to sign a written agreement and is not levied a 5% surcharge. Unfortunately, however, this is a pilot program and as such is currently only offered in 18 states and in certain counties, primarily in areas with diversified fruit and vegetable production. To find out more about this program, visit the RMA website at: www.rma.usda.gov.

A related, even newer program, is AGR-Lite. Initiated in

Table 1. United States 2002 Causes of Loss; Certified Organic and Conventional Farms

Cause of Loss	Organic	Conventional
Drought	38%	63%
Excess precipitation	33%	13%
Excess heat	13%	5%
Cold wet weather	6%	1%
Insects	3%	0%
Hail	3%	5%
Freeze	3%	2%

Source: USDA Risk Management Agency. Organic figures are based on policies issued with organic written agreements.

2003 in Pennsylvania, it will extend to all 12 northeastern states in 2004, with other states pending for 2005. Like AGR, AGR-Lite insures based on total historic farm revenue. Unlike AGR, AGR-Lite allows the producer to select a regular crop insurance policy for a particular crop, and then use the AGR revenue insurance approach for the rest of the farm.

Another option for organic farmers is the Group Risk Plan (GRP), which uses a county index as a basis for determining a loss. Organic farmers benefit because they do not need to pay a higher premium. This policy pays all producers under GRP when a county loss is triggered, regardless of whether or not the individual producer suffered a loss. A negative aspect of GRP is that the kinds of insurable crops are very limited.

Other positive trends include efforts by RMA to begin redressing the organic price issue. On October 8 they announced the recipients for \$24.7 million in risk management partnership grants. Almost \$4 million went to organic projects, including expanded organic price collection, assessments of price risk and organic product marketing, and risk management training and tools for organic producers.

While organic farming practices are considered a risk because producers do not use conventional agrochemicals, insect loss in reality only consisted of a very small part of the loss. In 2002 RMA paid just \$64,350 of the \$1,885,709 in indemnities for insect loss to organic farmers with written agreements. Comparing causes of loss paid under conventional practices versus organic between in 2002, there was less than a 5% difference between organic and conventional crop loss resulting from insects, hail, freeze, and cold wet weather (see Table 1).

Organic crop insurance opportunities are definitely improving, but are not yet equitable. It is important that RMA continue to work with the organic community to improve insurance options available to organic farmers. Many organic growers continue to request the expansion of the AGR and AGR-Lite to all parts of the United States. We also expect that if organic farmers continue to be charged 5% more than conventional farmers they begin receiving organic price premiums when they incur a loss. ☛

The effects of green manure, compost and feather meal on soil nitrogen dynamics and bell pepper yield

Summary

This project was designed to determine the effects of applying varying rates of nitrogen (N) as compost or feather meal (pre-plant and side-dressed) on plots of transplanted bell peppers with and without a prior green manure crop. These treatments were applied to plots at Nojoqui Farm, a certified organic farm in Buellton (Santa Barbara County), CA and certified organic fields at the USDA Experiment Station in Salinas (Monterey County), CA. The project sought to determine the effects of these N treatments as green manure, compost, and/or feather meal on weekly soil residual nitrate-nitrogen (SNN), and bell pepper yield. Results showed a clear effect of the prior green manure crop over the season at one site. There was greater weekly SNN availability in FM treated plots than in compost treated plots. Data on yield effects were limited due to sunburn at both sites. While feather meal treated plots showed higher yields of early and extra large peppers, a cost-benefit analysis showed greater economic returns on control plots with no fertilizer applications, due to cost per pound of nitrogen, than any of the treatment plots.

Methods

Treatments were:

Prior Green Manure (GrM) or No Green Manure Crop (NOGrM). (Peaceful Valley Soil Builder mix: Vetch, fava beans and 10% oats, applied at 75 lbs/acre.)

Organic Nitrogen Fertilizer Materials

- * Dairy Manure Compost (New Era 1.5% N, 27% moisture)
- * Feather Meal (12% N)(Peaceful Valley Farm Supply)

Rates of Nitrogen (lb / Acre):

- * 0
- * 120 lb total N treatment:
no N amendment pre-plant
- * 208 lb total N treatment:
88 lb of N equivalent pre-plant
- * 296 lb total N treatment:
176 lb N equivalent pre-plant

Each of the treatments received subsequent 40 lb N equivalent applications at 10 days, 46 days and 66 days post-transplant at Buellton; and 21 days, 42 days and 68 days post-transplant at Salinas.

Experimental design. The study was conducted in a split-plot design with five replications (Buellton) or four replications (Salinas). Green Manure/NOGrM were main plots and materials were sub-plots. Field plots were 20 ft long by three beds (40") wide at Buellton and 85 ft. long and three beds wide at Salinas. The GrM treatments were seeded in November and incorporated the following April prior to planting.

Pre-plant applications were made uniformly over the surface of the bed and incorporated. "King Arthur" bell peppers were transplanted into treated plots on May 5 (Buellton) and May 17 (Salinas). Each of the rate treatments subsequently received 40 lb N equivalent of each material at each side dress application on May 25, June 20, and July 10 (Buellton) or on June 7, June 28, and July 24 (Salinas). These were banded down the rows of bell peppers and cultivated into the soil. Treatment rates were the same at Salinas but the timing of transplanting and fertilizer application was approximately 15 days later.

Soil nitrate nitrogen (SNN) samples were taken weekly in each field plot.

Results and discussion

Soil Nitrate Nitrogen (SNN)

Effect of green manure. At each site, approximately 57,000 lb of GrM were incorporated per acre, with a dry matter content of 11%. There was a clear effect of the prior GrM incorporation on weekly SNN over the season at Buellton, with an early burst for 2-4 weeks following GrM incorporation and a continuing small but consistent positive

OFRF project funding: \$10,000 Awarded: Fall 1999

Principle investigator:	Mark Gaskell, Farm Advisor, University of California Cooperative Extension, Santa Maria, CA tel: (805) 934-6240, e-mail: mlgaskell@ucdavis.edu
Collaborators:	Helmut Klauer, General Manager, Nojoqui Farm; Organic Farmer Liaison Committee, USDA Experiment Station, Salinas, CA
Project locations:	Nojoqui Farm, Buellton, CA; USDA Experiment Station, Salinas, CA
Project period:	1 year (1999-2000)
Final report:	Submitted May 2001. The complete report is 14 pages, and includes 18 figures.

Complete project reports are available by mail from OFRF or at www.ofrf.org.

effect of GrM on SNN throughout the season. In Salinas, there was not an early release apparent from this sampling data, perhaps because the GrM was incorporated five weeks prior to the beginning of sampling in Salinas. At the Salinas site, the SNN increased in the GrM plots at weeks 8-12, but otherwise the effect of GrM was small and inconsistent during the season.

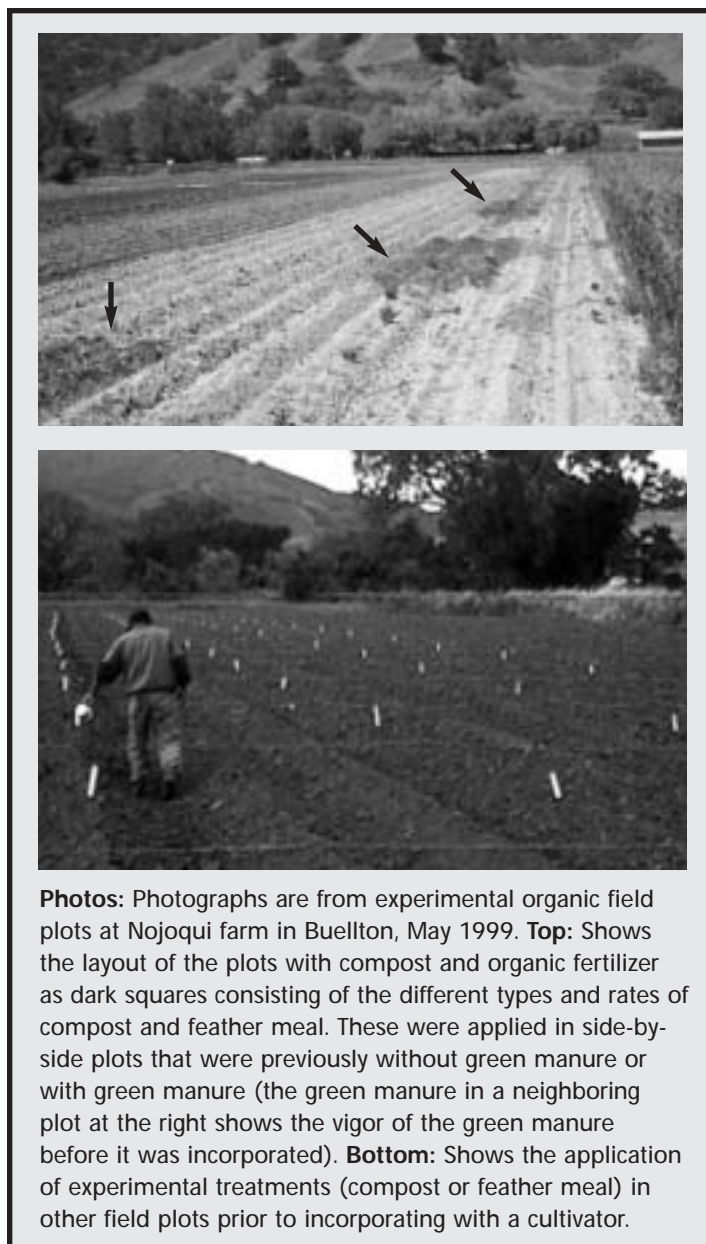
Effects of feather meal and compost. There were marked and consistent differences in weekly residual SNN among feather meal and compost materials and rates. The weekly SNN was greater in FM treated plots than in compost treated plots over the course of the season at both sites. The SNN following FM application was generally related to the amount of N applied and lagged application by one to three weeks at both sites. There are research reports that recommend a range of 20-30 ppm nitrate-N as a desirable soil level for vegetables, and it is clear that the FM can attain and sustain those levels at the rates evaluated in this experiment.

The effect of compost application on weekly SNN was small at Buellton following an initial release from the pre-plant application and incorporation. At Salinas, there was a more marked increase in SNN following compost application, SNN increased with increased compost application some weeks, and there was an effect of the side dress compost applications. Compost treated plots did not elevate SNN sufficiently to be a reliable source of N for vegetables. The SNN of compost treated plots was always lower than similar N rates of plots receiving feather meal at both sites. This is in agreement with prior studies indicating greater weekly SNN availability in FM treated plots than compost treated plots.

Pepper Yield

The yield of early peppers and extra large (XL) peppers were both increased with increasing amounts of N as FM up to 208 lb N per acre. Yield of extra large fruit and early harvested fruit is important because these often bring price premiums to growers. The yield of early and extra large peppers were increased by higher rates of FM whether a prior GrM crop was incorporated or not but the shape of the response was different for GrM and NOGrM plots. There was a positive response of XL sized peppers up to 208 lb N per acre as FM if there was no prior GrM crop, but following a GrM crop the response was apparent up to 120 lb N per acre. The plots without a prior GrM crop needed approximately 208 lb of N as FM to reach XL yields similar to plots with a prior GrM crop with 120 lb of N as FM. Based on these data, incorporation of the GrM material has an equivalent effect to application of an additional 100 lb of N as FM.

There were not significant differences in total yield of



peppers due to the different materials or rates. The yield following application of varying rates of compost was more variable and there were no significant yield responses to varying rates of the compost. The fact that there was overall less variability and a more consistent relationship between yield and rate of FM also suggests that there are marked differences in the materials irrespective of N rate. The weekly SNN following compost application discussed above was also highly variable and not related to rate of application, suggesting that compost has little effect on yield because it has little short-term effect on soil N. The data for yield overall was more variable than soil sample data because of fewer replicates available for yield determination. Yield could only be measured on three of the five replicate plots in each treatment at Buellton because peppers in two of the five replications were sun and wind burned at transplanting.

At Salinas, all plots were sunburned following transplanting and harvest was delayed and the yield data was not useful for Salinas.

The higher SNN in FM treated plots apparently contributed to a higher yield of early and extra large peppers. The higher SNN likely contributed to earlier and larger peppers but apparently even without high SNN, the longer-term N supplying power of the soil was adequate for overall pepper production. Also, it may be that smaller plants achieve comparable yields to those that produce earlier, larger peppers by setting more peppers throughout the season.

Cost/Benefit Analysis

The data show a clear yield response of early and XL peppers to FM application, and although there is a price premium for early and XL peppers, the response was not sufficient to improve income at current costs of FM (Figs. 1 and 2). Using \$0.60/lb for early or XL peppers and \$0.50/lb for all others (Nojoqui Farm estimates), income calculated for the different treatments closely follows yield data which show no striking overall differences among treatments. When income is based on dollar value of peppers produced per dollar of fertilizer applied (compost at \$2/lb of N; FM at \$2.05/lb of N), the zero fertilizer rates show clear advantages. There appear to be unexplained yield differences among untreated plots without GrM having higher yield than untreated plots with GrM. These were not statistically significant differences and it is not clear why there would be such an effect.

This experiment should be repeated to verify the observed responses and to expand the number of replicates for yield determination in treated plots. Additional studies should be conducted to determine more precisely how rate and timing of the application of the different organic fertilizer materials could be optimized. 🍌

IN CONTEXT

Year 2 of study narrows focus to two materials

This study served a follow-up to a previous experiment conducted by Mark Gaskell in 1998, in which six nitrogen fertilizers—pelleted chicken, fish meal, liquid fish, liquid soybean meal, feather meal, and seabird guano—were compared with compost for ability to provide N in bell pepper production. (OFRF project No. 98-04, *Efficient use of organic nitrogen fertilizers*, reported in *Information Bulletin* No. 9.)

In that study, the N fertilizers, including compost, were applied at rates of 60 lb, 120 lb and 180 lb N per acre. These rates generally proved too low to maintain targeted soil nitrate nitrogen (SNN) levels of 20-40 ppm desired for vegetable production. The results showed that SNN levels consistently fell below background levels of 10 ppm.

Nevertheless, compost and feather meal were shown to supply the greatest additional economic returns per dollar of fertilizer applied—approximately 23% and 12%,

respectively, on first and second pick, with feather meal in particular resulting in additional early and extra large pepper yields.

For the study presently reported, feather meal alone was compared with compost, at higher N application rates than in the previous study. Materials were applied on plots—with and without a previous green manure crop—at rates of 120 lbs, 208 lbs, and 296 lbs N per acre.

These exaggerated N rates were applied to maintain targeted soil nitrate nitrogen levels above 20 ppm throughout the cropping season. This resulted in compost applications of approximately 10 tons per acre at the highest N delivery rate of 296 lb N/acre. This is a higher compost application rate than most growers will apply on a production scale, but a primary project objective was to achieve the desired SNN levels, and determine any resulting effect on yield.

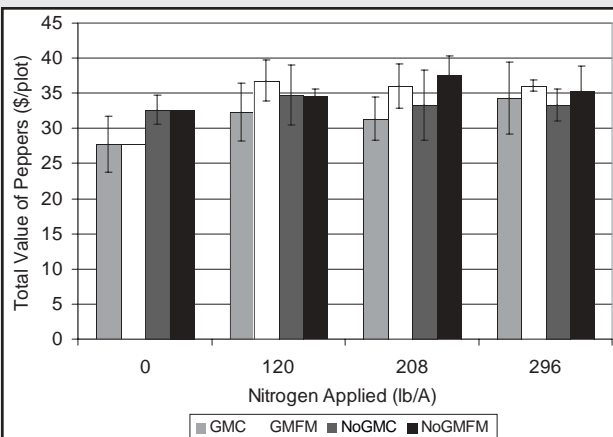


Figure 1. Total income from peppers produced with varying rates of compost (C) or feather meal (FM) with or without a prior green manure (GM) crop. Buellton, CA 2000 season.

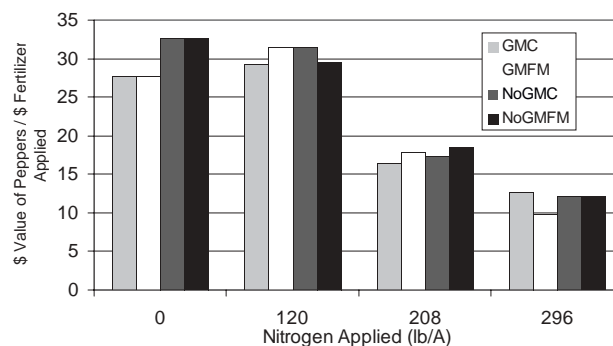


Figure 2. Income from peppers (\$) per dollar of fertilizer applied as varying rates of compost (C) or feather meal (FM) with or without a prior green manure (GM) crop. Buellton, CA 2000 season.

Evaluation of kaolin-based particle film coatings on insect and disease suppression and heat stress in apples

Summary

Particle film technology is a recent development with tremendous potential for organic and integrated pest management. In this study, Surround WP, a kaolin (clay) based particle film, was evaluated for effectiveness in suppressing plum curculio, codling moth, red-banded leafroller, oriental fruit moth, San Jose scale, and certain fungal pathogens in apples, while fine-tuning application recommendations for Midwestern growers. An evaluation of the particle film's ability to protect apple trees from heat stress was also conducted. During this two-year experiment, codling moth, oriental fruit moth, and San Jose scale were not present in sufficient numbers to determine efficacy against these pests. However, results showed significant levels of control of plum curculio, red-banded leafroller and fungal diseases, as well as protection from heat stress and improvements in apple fruit grade. The particle film technology tested in this study appears to offer possibilities in safely suppressing both insects and disease in Midwestern apple production.

Particle film technologies such as kaolin clay may be capable of suppressing pests and diseases that have historically been very difficult to control. Fine film coatings are sprayed onto leaves and fruit, forming a protective barrier that controls or suppresses many insects and mites simply by repelling or irritating them. Beneficial insects such as lady beetles and honeybees that do not feed on the leaf or fruit generally remain unharmed. The films may also be able to confound the infection and propagation mechanisms of certain fungal and bacterial pathogens. The particles can also provide physiological benefits to crops by lowering canopy temperature, reducing heat stress to leaves, and protecting fruit from sunburn.

Surround WP Crop Protectant was researched and developed by scientists with the USDA under cooperation with Engelhard Corporation of Iselin, NJ, and has been commercially available since 2000. Engelhard modified the kaolin mineral to make it uniform, sprayable, and of optimum size for insect adhesion and irritation while allowing the passage of photosynthetically-active radiation and reflec-

tion of infrared radiation. Surround WP has been federally labeled for use on many horticultural crops, including apples, pears, grapes, citrus, tropical crops, nuts and tomatoes. The Organic Materials Review Institute (OMRI) has listed Surround WP as "allowed" in organically-certified farms.

Previous research suggested that some control of important Midwest apple pests might be possible if adequate levels of kaolin particle films are present on leaves and fruit at times when insects are vulnerable, such as during oviposition, hatch, or feeding. However, detailed data has been needed to optimize application rates and timing in relation to pest population levels in order to achieve adequate control.

Materials and methods

The study involved two separate apple orchards, both planted in 1991 at the University of Missouri's Southwest Research Center at Mt. Vernon.

Orchard 1 consisted of 90 trellised dwarf 'Liberty' and 'Jonafree' apple trees. The orchard was set up in linear plots of three trees per cultivar, alternating cultivars within the row, resulting in 15 plots of three trees per cultivar. Three replications of five treatments were randomly assigned to each cultivar's 15 plots in a completely randomized design.

Treatments were:

- 1) 50 lbs/acre Surround WP once per week (50W);
- 2) 50 lbs/acre every two weeks (50Bi);
- 3) 25 lbs/acre once per week (25W);
- 4) 25 lbs/acre every two weeks (25Bi);
- 5) Untreated control.



Above: Surround WP in the package.

OFRF project funding: \$7,650 Awarded: Fall 1999 & Fall 2000

Principle investigator:	Andrew Thomas, University of Missouri-Columbia, Southwest Research Center, Mount Vernon, MO tel. (417) 466-2148 e-mail: ThomasAL@missouri.edu
Project location:	University of Missouri Southwest Research Center, Mt. Vernon, MO
Project period:	2 years (2000 and 2001)
Additional support:	Materials provided by Engelhard Corp., Iselin, NJ.
Final report:	Submitted June 2002. Complete final report is 12 pages including 9 tables.

Complete project reports are available by mail from OFRF or at www.ofrf.org.

Table 1. Mean percentage of fruits infested with plum curculio.

Year	Cultivar	Control	25Bi	25W	50Bi	50W
2000	Jonafree	71%	37%	31%	6%	16%
	Liberty	65%	20%	20%	21%	15%
2001	Jonafree	46%	46%	6%	13%	4%
	Liberty	81%	76%	30%	32%	22%

Table 2. Mean percentage of leaves infested with cedar apple rust.

Year	Cultivar	Control	25Bi	25W	50Bi	50W
2000	Jonafree	41%	11%	6%	2%	5%
	Jonagold	5%	2%	3%	2%	3%
	Ultragold	3%	3%	4%	2%	3%
2001	Jonafree ‡	12%	11%	11%	15%	13%
	Jonagold	6%	11%	7%	17%	7%
	Ultragold	16%	13%	11%	8%	12%

‡ Mean of three late-summer samplings; no difference among any treatments in any sampling.

Applications of Surround WP treatments began at petal fall (25 Apr 2000; 26 Apr 2001) and continued until about one week before harvest (1 Aug 2000; 5 Aug 2001). Trees were hand-sprayed with a tractor-mounted PTO-driven sprayer at 150 psi pressure or greater, thoroughly covering both top and bottom of foliage and fruits.

Orchard 2 contained 20 semi-dwarf trees, ten each of the cultivars 'Ultragold' and 'Jonagold' on 'M7' rootstock. Each individual tree served as a plot. Two replications each of the same five treatments were randomly established per cultivar.

Dormant oil was applied pre-bloom both years to help control scale insects and aphids. No other pesticides were used outside the experimental materials. Irrigation water was applied as needed via a drip system. Weeds were controlled manually. A fertilization program using a locally-produced organic alfalfa-based 3-1-5 fertilizer was initiated in 2000.

Traps were used to monitor insect pest populations. Observations were collected throughout the growing season on both insect damage and fungal disease on both leaves and fruit. Most fruit data were collected upon harvest (August 7-11, 2000; August 10-13, 2001). At harvest, apples were scored for the following damage: Insect damage from plum curculio, codling moth, red-banded leafroller, San Jose scale and the fungal diseases flyspeck and sooty blotch. Oriental fruit moth damage was not evaluated because of the very low population of these insects in the orchard.

Apples were graded, with "1" being a near-perfect marketable apple, "2" being an apple of good quality suitable for cider, and "3" an unusable apple. Apple fruit yields were also

documented. Leaves were examined for the fungal diseases cedar apple rust and Phoma leaf spot and surface feeding damage by red-banded leafroller larvae. Data on heat stress and leaf temperature were measured.

Results and discussion

Insect traps revealed very little presence of codling moth in the orchard during both growing seasons, and effectiveness of Surround WP against this species was not evaluated. San Jose scale was present but not in economically-important numbers. Plum curculio, however, was present throughout both seasons with large numbers of adults trapped in mid-May and late July. Red-banded leafroller was abundant both years with a large peak of adults in mid-June followed by a smaller peak in late July.

Our results show that Surround WP was able to significantly ($P=0.05$) suppress a variety of insect and fungal pests in apples.

Plum curculio was significantly suppressed by Surround WP. In 2000, only 16% of Jonafree and 15% of Liberty fruits treated with 50 lbs/acre weekly (50 W) were infested by plum curculio, whereas 71% of Jonafree and 65% of Liberty fruits in untreated plots were destroyed. In 2001, 4% of Jonafree and 22% of Liberty in 50 W plots were infested, while 46% and 81% in untreated plots, respectively, were destroyed (Table 1).

Suppression of red-banded leafroller damage to fruit was not consistent, while almost complete control of larval leaf feeding was achieved. Much of the leafroller fruit damage occurred early in the season when coverage of the young, small fruit with the particle-film material was perhaps less effective. Among all four cultivars evaluated, leaf damage was significantly suppressed by all Surround WP treatments compared with untreated trees. No differences were detected among any of the treated plots. For example, among Jonafree plots, leaves treated with any Surround WP treatment had between 1 and 4% of its leaves damaged while 36% of untreated leaves were destroyed. Similarly, with Liberty, between 1 and 5% of treated leaves and 32% of untreated leaves were damaged.

Flyspeck and sooty blotch are superficial fungal diseases that ruin the appearance of the apple fruit. Surround WP significantly suppressed both flyspeck and sooty blotch on Jonafree fruit in 2000 and 2001. With Liberty, sooty blotch was largely controlled in 2001, but not in 2000, nor was flyspeck controlled either year. In most cases with these two diseases, a trend toward less disease with stronger and more frequent applications was evident.

Cedar apple rust, an important foliar disease, was significantly higher in untreated trees compared with all treated trees for both Jonafree and Jonagold in 2000 (Table 2). No

differences were detected, however, with Ultragold in 2000. In 2001, no consistent or significant differences in rust infection were detected among any of the treatments for Jonafree and Ultragold, whereas with Jonagold, two of the treated plots actually had more rust than the control. Liberty is resistant to cedar apple rust and was not evaluated. This inconsistency from one year to the next is difficult to explain, but was perhaps due to differences in weather conditions, cultivar susceptibility, and virulence of the pathogens from one year to the other.

Phoma leaf spot was evaluated only in 2001. Control was highly significant with Surround WP treatments among all four cultivars. Infection rates ranged from 0 to 5% for 50W trees to between 14% and 23% of leaves on untreated trees.

Grade of apple fruits was significantly improved by Surround WP treatments (Table 3). In both 2000 and 2001, not a single untreated apple was rated Grade 1 (near perfect), whereas 19% and 54% of Liberty and 5% and 21% of Jonafree were rated Grade 1 in 2000 and 2001, respectively, with nothing more than 50W Surround treatments. For Grades 2 and 3, significant differences were detected between untreated apples and the Surround WP treatments, regardless of rate or frequency. Even though significant differences were not detected among the various treatments, the trends toward the better quality apples were with the highest rate and frequency of application. Cultivar by treatment interactions were also detected among nearly all cultivars. Fruit yield by weight for both Liberty and Jonafree was not affected by treatment either year.

Comparisons were made to attempt to more precisely sort out differences among the various treatments. For plum curculio suppression in 2000, rate was more important than frequency, which was not significant. In 2001, both frequency and rate were statistically significant in reducing insect damage. For both flyspeck and sooty blotch, significant dif-

ferences were detected between weekly versus biweekly treatments in 2000, but not between the 25 and 50 lb rates. This pattern, however, was not consistent in 2001 as no differences were detected between frequency or rate. These findings suggest that frequency of application may be more important than application rate in suppressing fungal diseases, whereas rate may be more important for suppressing insect, at least plum curculio. It seems logical that a consistent but not necessarily heavy coating of film on the fruit is needed to modify the leaf surface characteristics enough to interfere with fungal infection, while a good strong dose of material may be needed to repel tenacious insects such as plum curculio. This hypothesis also tends to agree with the data in that a high dose sprayed frequently tends to repel the plum curculio better.

We were "fortunate" to have had several hot, windy, and dry days in 2001 to test how well Surround WP protected the trees from heat stress. Data were obtained on nine occasions using an LI-6400 Portable Photosynthesis System. The trees were well-irrigated, however late summer temperatures and surface evaporation remained extremely high for several weeks. Little, if any, rain occurred to wash the particle-film coatings from the leaves during much of this sampling period, and a good, uniform coating was present during all samplings.

Presumably, a tree under severe stress will partially or fully close its stomata, thereby reducing transpiration, and thereafter, photosynthesis. Two of the data samplings, conducted on the hottest and most stressful days of all nine experiments, showed evidence of significant differences in plant stress factors among treatments. One of these samplings, from Experiment 4, is shown in Table 4. The data tend to support the hypothesis that Surround WP coatings may reduce stress and therefore increase photosynthesis under extreme situations. In general, photosynthesis, stomatal conductance, and transpiration increased with increased application rate and frequency of Surround WP.



Photos: Field plots, 2000. **Left:** Mark Muller, junior author, with Surround WP coated apple trees; **Center:** Close-up of Surround WP coated apples; **Right:** Orchard row showing Surround WP coated trees to the left, and uncoated trees at right.



Table 3. Mean percentage of Grade 1 fruits.

Year	Cultivar	Control	25Bi	25W	50Bi	50W
2000	Jonafree	0%	2%	4%	4%	19%
	Liberty	0%	1%	1%	0%	5%
2001	Jonafree	0%	7%	42%	32%	54%
	Liberty	0%	0%	13%	20%	21%

Table 4. Plant stress data from Experiment 4, Jonafree and Liberty combined.

Treatment	Net photosynthesis	Transpiration rate	Leaf Temp. (°C)
Control	8.6	2.39	38.4
25Bi	11.6	3.30	39.2
25W	11.2	3.24	38.8
50Bi	15.3	3.91	36.5
50W	14.7	3.68	39.0

Conclusions

During two very busy and successful seasons of testing, the Surround WP product proved to be extremely effective at suppressing a variety of important insects and fungal diseases in apples. It significantly improved the overall quality or grade of fruit. The particle film coatings also appeared to be able to relieve heat stress under extremely stressful weather situations.

As for specific application recommendations to farmers as a result of what we have learned, it appears that in most cases and with most pests, the stronger the dose and the more frequent the application, the better. Our highest and most frequent rates of 50 lbs/acre sprayed weekly generally resulted in the best-protected plots in the orchards. Because a strong and persistent coating seems to be most successful, we would recommend farmers maintain a good, even coating on their trees and fruit at all times that a particular targeted pest is present and virulent. The nature of this study was very academic in that we sprayed the plots right on schedule without taking into account rainfall, insect presence or virulence, etc. Most orchardists would likely use it in a much more precise and targeted manner.

An interesting question raised by this study that cannot be presently answered is the following: If an entire orchard were treated with Surround WP, thereby leaving no unsprayed "control" trees for insects to find and easily

attack, would the insects be forced to "break through" the particle film barrier to feed and lay eggs or would they be completely repelled from the entire orchard? A new, larger-scale study may be needed to address this question.

This study has been very exciting and challenging. Surround WP is not a panacea. It must be diligently and precisely applied at the most appropriate times. Without doubt, new and even better particle-film plant protection products will be developed and released as more research is conducted and the technology advances over the next several years.

Cost/benefit analysis

Surround WP is rather difficult to obtain economically. The standard retail price direct from the manufacturer is about \$15.00 per 25 lb. bag plus an additional \$2 or so shipping for large quantities (\$17.00 total). One Missouri retailer is asking \$31 per bag. Large commercial orchardists may be able to buy Surround WP by the pallet or truckload direct from the manufacturer.

Most conventional Midwestern apple orchards are sprayed about 15 times per season. The labor and machinery cost for this is estimated at \$51.00 per acre per year. For maximum insect and disease control, Surround WP must be sprayed nearly as frequently. Costs for chemical insecticides and fungicides are estimated at \$345 per acre per year. Surround WP at \$17 per 25 lb bag, if sprayed at the most effective, high rate of 50 lb/acre would cost approximately \$510 per acre per year. The lower rate of 25 lb/acre would cost

Findings suggest that frequency of application of Surround WP may be more important than application rate in suppressing fungal diseases, whereas rate may be more important for suppressing insects.

approximately \$255 per acre per year. Organic orchardists might carefully incorporate it as part of a total integrated pest management system, and possibly use less. For example, a farmer who carefully monitors insect levels in the orchard may spray Surround WP frequently and heavily to combat a target insect when it is most virulent, while spraying lower rates and/or less often when threats are reduced.

The purpose of our experiment and this report was not to speculate on the economics of organic versus chemical apple production in general. However, one can easily take the above figures, and make a determination as to the potential economic benefit of using Surround WP. But probably the most important point is that an effective product such as Surround WP may be able to make the difference as to whether or not organic apple production is feasible (and economical) at all in the Midwest. ☺

Targeted mowing as a weed management method to increase allelopathy in rye

Summary

Winter rye is an outstanding cover crop for suppression of early season weeds. This is largely attributed to allelopathy, plant chemicals that inhibit weed germination and growth. However, lack of suppression of late season weeds and inconsistent results between years and regions hinder the use of rye as a cover crop. This study, part 1 of a 2-year project, explores targeted mowing as a method that may increase weed suppression of rye by manipulating its allelopathic activity. We examined the effect of targeted mowing of rye in the fall and spring on the suppression of germination, growth, and reproduction of redroot pigweed. This targeted mowing allowed rye to re-grow before being killed by sickle bar mowing. We tested the hypothesis that mowing induces an increase in allelopathic activity, which enhances rye's weed suppression ability. Results showed that spring mowing significantly reduced redroot pigweed emergence compared to no mowing or fall mowing treatments in rye root residue plots. This suggests that targeted mowing operates to increase weed suppression by increasing the allelopathic activity of rye roots. In addition to the mowing processes, we also tested the addition of rye materials in the form of rye shoot residue and a leached rye shoot residue (shoots that were soaked in water to remove the allelopathic chemicals). The effect of spring mowing on emergence was most noticeable in the experiment's split-split plots in which pigweed seeds were exposed to rye root residue only. Mowing did not have a significant effect on pigweed biomass or seed production. Part 2 of this experiment will help determine if spring mowing can reduce weed emergence sufficiently for a tomato crop to be more competitive and thus produce higher yields.

Objectives

- ✿ To evaluate if mowing rye affects rye's weed suppression of redroot pigweed, and whether the time when rye is targeted for mowing alters its weed suppression ability;
- ✿ To identify which part of the rye plant, shoot or root, is most affected by targeted mowing. (Two studies have shown that rye root residue can suppress weeds more than shoot residue.);
- ✿ To examine the effect of targeted mowing on the life cycle of redroot pigweed;
- ✿ To examine whether changes in redroot pigweed suppression in response to mowing correlated with changes in hydroxamic acid (Hx) content of mowed rye. Hydroxamic acids are the chemicals in rye that have been shown to be

allelopathic against other plants. Allelopathy is an environmental response to resource competition with neighboring plants.

Materials and methods

The experimental design was a split-split plot complete block with 4 blocks. Each block contained two whole plots, one **seeded with rye (+Roots)** and the other **not seeded with rye (-Roots)**. These "+Roots" and "-Roots" whole plots were randomly assigned within each block and were 9m x 8m each. Each of these 2 whole plots contained 3 split plots for different **mowing treatments**. Each of these 3 mowing split plots contained 3 split-split plots for different **shoot residue treatments** (Fig.1).

Prior to cover crop planting, the field was chisel plowed and disked. On October 3, rye (*Secale cereale* cv. "Wheeler") was drilled into "+Root" whole plots. Root whole plots were initially sprayed with vinegar to control winter annual weeds, and split-split plots within the unseeded whole plots were kept bare by hoeing and hand weeding throughout the season until June.

Mowing treatments applied to split plots were:

- ✿ **Fall mowing** at the tiller stage (FM), in November
- ✿ **Spring mowing** at the elongation stage (SM), in March
- ✿ **No mowing** (NM) as a control.

Mowing treatments were originally to be applied by using a lawn mower. However, due to drought conditions, the rye lay too flat on the ground for effective mechanical mowing. Thus, targeted mowing was applied by hand-cutting

OFRF project funding: \$7,000 Awarded: Spring 2001

Principle investigator:	Neda Diab, Dept. of Natural Resources and Landscape Architecture, University of Maryland--College Park tel. (301) 405-4367 e-mail: nddiab@wam.umd.edu
Collaborator:	Dr. Joseph Sullivan, Assistant Professor, Dept. of Natural Resources and Landscape Architecture, University of Maryland
Project locations:	USDA Agricultural Research Center, Beltsville, MD (organically managed)
Project period:	1 year (2001-2002)
Final report:	Submitted January 2003. The complete report is 18 pages, including 7 figures, photos, & bibliography.

Complete project reports are available by mail from OFRF or at www.ofrf.org.

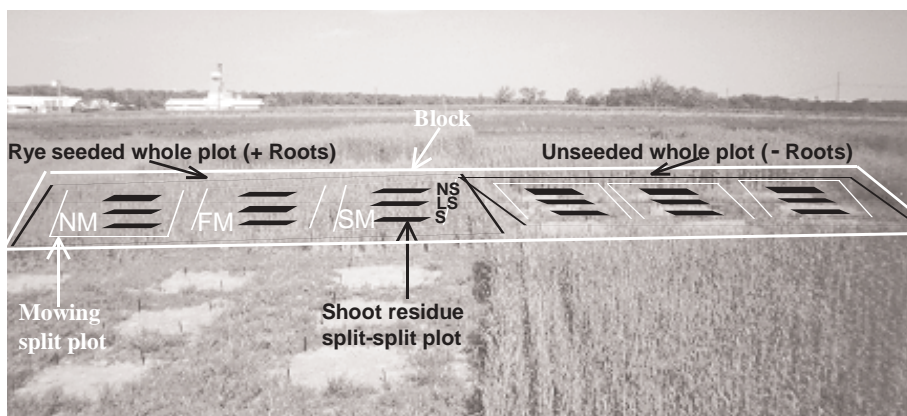


Figure 1. Experimental design showing one block containing two whole plots, each of which contains three mowing split plots, each of which contains three shoot split-split plots. There were a total of four blocks running horizontally. **Mowing plot levels:** No mowing (NM), fall mowing (FM), and spring mowing (SM). **Shoot residue plot levels:** No shoot (NS), leached shoot (LS), and unleached shoot (S).

rye leaves, simulating mowing. As such, this report refers to mowing with the understanding that it is simulated mowing by hand-cutting rye.

After cutting the spring mowing plots in March, rye was allowed to regrow until it passed the heading stage in May at which time standing rye biomass was collected and all plots were sickle bar mowed to kill the rye. Mowing rye when it is past the heading stage reduces the potential for regrowth. In early June, split-split plots designed for shoot residue treatments were randomly assigned within each mowing split plot. Shoot residue treatments applied to these split-split plots consisted of **no shoots** (NS), **leached shoots** (LS), and **unleached shoots** (S) (Fig. 1). One harvested quadrat remained without shoot residue for the No Shoot treatment (NS).

All rye shoot residue removed from each of the 5 quadrats was oven dried at 60°C. Unleached shoot residue (S) was set aside. Leached shoot residue (LS) underwent a 3-day leaching process in water at room temperature, and was then oven dried again at 60°C.

Before returning leached and unleached shoot residue to the field, 200 redroot pigweed seeds were broadcast in each 0.25m² split-split plot and covered with a thin layer of soil. Redroot pigweed seeds in split-split plots were then covered with leached or unleached residue according to design. Emerging pigweed seedlings were counted weekly for 4 weeks after planting (WAP). These counts were cumulative in that the first week's count was recounted in the following weeks. As such, a reduction in the number of seedlings over time indicated seedling mortality.

Six weeks after planting redroot pigweed, up to 4 seedlings within each split-split plot were assigned for above ground biomass measurements while the remaining seedlings were removed to reduce seedling competition. Finally, seeds were collected as plants matured by tapping seed heads into coin envelopes and then weighing the seeds.

Bioassay of allelopathic activity.

Samples of leached and unleached shoot residue, as well as the leachate water collected during the leaching procedure were assayed for allelopathic activity using "Simpson Black-seeded" lettuce seeds (*Lactuca sativa*). Shoot residues and the leachate were prepared in the laboratory and lettuce seed germination rates were tested on a medium that included each of these preparations and a distilled water control. (These processes took place in Petri dishes and on filter paper.) Seeds were scored for germination once the control seeds in distilled water had germinated, which took 2-3 days. Results were presented as percentages of the control.

Chemical analysis of allelochemicals.

To assess the effect of mowing on allelochemical synthesis in roots and shoots of rye, mesh bags filled with root-free soil were planted in the field at the same time as rye planting to allow rye roots to grow into them. These bags were harvested over time along with the rye leaves above them for quantification of hydroxamic acids by High Performance Liquid Chromatography (HPLC). However, poor separation of these chemicals was achieved under current HPLC conditions using methods provided in the literature. As such, chemical extraction and quantification by HPLC was not possible as originally proposed.

Results and discussion

Due to drought conditions in Maryland during the experiment and the time at which pigweed seeds were planted in June, germination, biomass, and seed production were lower than typically seen with redroot pigweed plants in agricultural fields. On average, only 10% of the weed seeds germinated, and plants headed at a very small size.

The removal of allelochemicals from rye through leaching shoot residue was confirmed by testing the effect of the residue on germination of lettuce seeds (Fig. 2). Leached shoot (LS) residue showed significantly higher germination of lettuce seeds than unleached shoots (US), confirming that leached shoot residue was less allelopathic than unleached shoot residue in the field.

In rye seeded whole plots (+Roots), the spring mowing (SM) plots had significantly less redroot pigweed seedlings than either 'no mowing' (NM) plots or 'fall mowing' (FM) plots at 4 weeks after planting (WAP). Since the opposite trend was seen in unseeded whole plots (-Roots), the decrease in weed emergence due to spring mowing in the rye whole plots suggests that weed suppression of spring mowing was a result of the effect of mowing on roots.

To examine this effect of spring mowing on roots, each shoot residue treatment (no shoot, leached shoot, and unleached shoot) was compared across mowing split plots located in rye seeded whole plots only (Fig.4). Results showed that in NS plots in which pigweed seeds were subject to root residue only, pigweed seedlings in 'spring mowing' plots were significantly less than those in 'no mowing' plots, and 'fall mowing' plots. This confirmed that the effect of mowing on seedling emergence is primarily through the effect of mowing on roots. Results also showed that in 'unleached shoot' residue plots, there was a decrease in seedling numbers in 'spring mowing' plots compared to 'no mowing' and 'fall mowing' plots, but the decrease was not statistically significant (Fig. 4). This suggests that shoot residue may alleviate the suppressive effect of roots when rye is mowed.

In addition, differences in the effect of mowing treatments on redroot pigweed emergence were not the result of differences in rye biomass in the various mowing treatments. There was no significant difference between the mowing plots in standing rye biomass at the time of sickle bar mowing in May. This suggests that mowing in fall or spring did not compromise or enhance the ability of rye to accumulate dry matter.

While spring mowing affected redroot pigweed emergence, it did not significantly decrease pigweed biomass and seed mass. Nevertheless there was a general stepwise decrease in pigweed biomass in response to mowing in 'no shoot' and 'unleached shoot' plots in rye whole plots, but it was not a statistically significant decrease. In addition, seed production appears to have been less affected by mowing than biomass, and differences seen at the onset of seed production disappear as time progresses.

Conclusion

Targeted mowing in early spring may be used to manipulate the allelopathic activity of rye roots, thus decreasing weed emergence. Since redroot pigweed emergence was affected while its biomass and seed production were not, targeted mowing may be more effective when weed plants are most sensitive to allelopathic chemicals, namely at the seedling stage of growth. The question that remains to be answered is whether targeted mowing in the spring will sufficiently decrease weed emergence and growth in order to provide an increase in crop yield. Currently I am conducting an experiment to determine if spring mowing can reduce weed emergence sufficiently for a tomato crop to be more competitive and thus produce higher yields. Of interest is whether spring mowing can reduce the competitiveness of weeds sufficiently for the crop to be more competitive, and whether rye shoots that are not removed from the field after rye kill will respond to mowing in a similar pattern to rye roots.

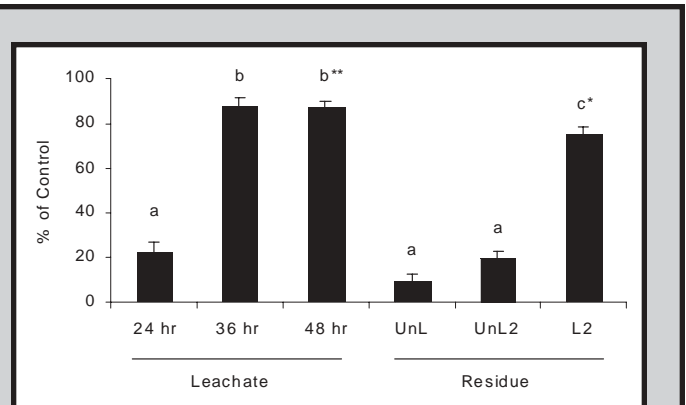


Figure 2. Effect of rye residue and leachate on germination of lettuce seeds. **Treatments:** Leachate after 24 hrs., 36 hrs., and 48 hrs. of leaching; unleached residue at the time of leaching (UnL); unleached residue from the field 2 weeks after placement in the field (UnL2); leached residue from the field 2 weeks after placement in the field (L2).

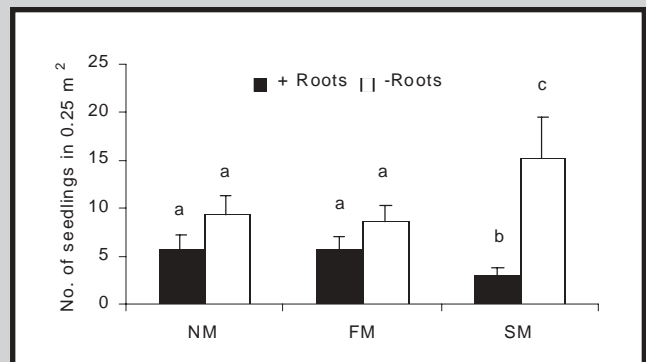


Figure 3. Effect of mowing on emergence of redroot pigweed in rye-seeded (+Roots) and unseeded plots (-Roots) at 4 WAP. **Mowing plots:** no mowing (NM), fall mowing (FM), and spring mowing (SM).

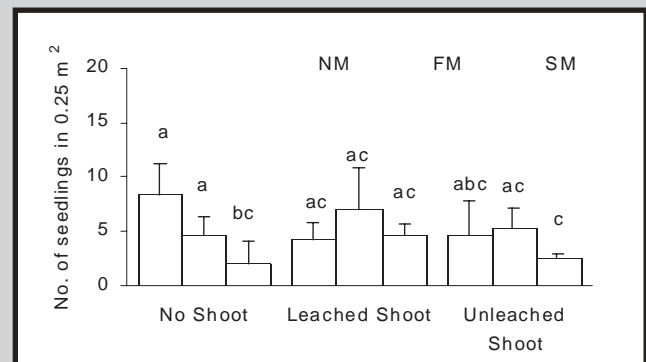


Figure 4. Effect of mowing on redroot pigweed emergence within each shoot residue plot across mowing plots in rye seeded whole plots at 4 WAP. **Mowing plots:** no mowing (NM), fall mowing (FM), and spring mowing (SM).

Improving the quality of organic herb production

Summary

Current research in organic herb production at Iowa State University has included investigations into certified organic methods of fertilization and use of organic mulches for weed suppression. Organic medicinal herb research plots were established in 1999 in Ames, Iowa, to investigate the effect of organic fertilizer and compost on *Echinacea purpurea*, *E. angustifolia* and lemon balm plant growth and yields. Fertilization results with herb crops were not consistent. Soil amendments increased herb leaf growth only in the case of *Echinacea angustifolia*. With lemon balm, which is harvested for leaf matter, fertilization effects were more pronounced, but not to the level of significantly improving yields. Echinacea root production, the most important factor for commercial sales, was not significantly affected by soil amendments. Because Echinacea is a native plant, and Iowa soils are rated as sufficiently fertile, additional fertilization does not appear necessary to increase yields. The long-term benefits of compost to the soil-plant system in terms of improving soil structure through the addition of organic matter, soil moisture retention, and soil microbial activity may exceed benefits derived from the supply of plant nutrients alone.

As a consequence of surplus crops of commodity corn and soybeans in the Midwest and resulting low prices, an excellent opportunity exists for organic farmers to plant crops for high-value niche markets. While a number of specialty crops have been explored, the potential for growing crops that provide health benefits, such as the medicinal herbs *Hypericum*, *Echinacea* and catnip, has been little exploited. The European Union currently controls the majority of essential oil products exported throughout the world, even though similar yields for these products can be obtained in the U.S. With prices reaching \$50 per ounce, the essential oil market offers a lucrative option for small- and mid-size growers. Many herbs, including *Echinacea purpurea*, can be sold at a 100% premium if grown organically.

These organic herb projects were established to integrate resources from two research institutions (Iowa State University and the University of Minnesota) and a farmer group (Organic Herb Producers Cooperative) working in organic herb production, processing, quality analysis, market-

ing and education, to address the problems of consistent herbal quality and distribution. The long-range goal of this project is to develop systems for organic medicinal herbs as profitable alternative crops, and to improve our understanding of the beneficial effects of herbs.

Three medicinal herbs—purple coneflower (*Echinacea purpurea*), narrow-leaved purple coneflower (*E. angustifolia*), and lemon balm (*Melissa officinalis*)—were selected for soil amendment research.

Objective

To address the key questions of management of organic medicinal herbs through research and demonstration trials on-farm and at University stations.

Materials and methods

Experimental Design

Plots previously planted to a cover crop of sorghum-sudangrass at the Heenah Mahyah Student Farm (HMSF) at Iowa State University, Ames, were selected. This site qualified for the first year of transition to certified organic in 1999. Soils were sampled at pre-planting on October 15, 1998, and on 19 May 2000. Plots were cultivated for bed preparation on 15 May 1999. *E. purpurea*, *E. angustifolia* and *M. officinalis* seeds were planted in the ISU Horticulture Department greenhouses on January 20, 1999. Transplants were set at 3 in. depth on June 1, 1999. Treatments were applied annually at the beginning of plant growth on June 24, 1999 and on June 5, 2000.

✱ **Treatment 1:** Midwestern Bio-Ag (Blue Mounds, WI), an organic feathermeal-based, pellet fertilizer (approved by the State of Iowa Organic Certification Program) applied at a rate equivalent to 50 lb N/acre;

✱ **Treatment 2:** Midwestern Bio-Ag at 100 lb N/acre;

✱ **Treatment 3:** Midwestern Bio-Ag at 150 lb N/acre;

OFRF project funding: \$5,500 Awarded: Fall 2000

Principle investigator:	Dr. Kathleen Delate, Assistant Professor-Organic Crops Specialist, Depts. of Horticulture & Agronomy, Iowa State University, Ames, IA tel. (515) 294-7069, e-mail: kdelate@iastate.edu
Cooperators:	Lisa Duppong, M.S. Research Assistant, Dept. of Agronomy, ISU.
Project location:	Iowa State University Heenah Mahyah Student Farm, Ames Iowa
Project period:	2 years
Final report:	Submitted October 2002. The complete report is 15 pages, including 4 tables and 7 figures.

Complete project reports are available by mail from OFRF or at www.ofrf.org.

✱ **Treatment 4:** Composted turkey litter (Ultra-Gro®, Ellsworth, IA-approved by the State of Iowa Organic Certification Program) applied at a rate equivalent to 50 lb N/acre;

✱ **Treatment 5:** composted turkey litter at 100 lb N/acre; and

✱ **Treatment 6:** Control (no amendments).

There were 4 replications of 16 plants (in each plot) per 6 treatments for the 3 herb species for a total of 1,152 plants in the experiment.

Weeds were managed through mechanical cultivation between rows until canopy closure, followed by an application of 6 in. organic oat straw mulch on each plot (June 10, 1999 and June 12, 2000) and hand-weeding when needed. Parameters measured for all plants per plot included: plant height, leaf number, flower number and insect number. In 1999, plants were sampled on June 12, 25 and 30, July 6, 13 and 22, August 11, September 11, October 23, and November 13. In 2000, plants were sampled on June 9, 23 and 26, July 7 and 21 and August 4. In the first year, leaves from lemon balm were harvested on November 13, 1999, before frost. Second-year harvest of lemon balm occurred before flowering on June 27-28 and September 21, 2000. *Echinacea* leaves and roots were harvested from all viable plants in each plot on September 21, 2000.

Results and discussion

Pre-plant soil analysis revealed a high level of P and K in the experimental fields, which may be related to the lack of significant differences in plant growth in amended soils. In the first year of growth, plant height in *Echinacea purpurea* increased with the addition of the biological fertilizer at rates = 50 lb N/acre or with compost at rates = 100 lb N/acre, but plant height was not significantly greater than the control plants where no amendments were applied. The 100 lb N/acre fertilizer treatment resulted in the tallest lemon balm plants; however, the differences among treatments were not significant.

In 2000, organic fertilizer or compost inputs did not significantly increase *E. purpurea* leaf dry matter at harvest. This result does not correlate with the soil data which indicated a significantly higher level of soil nitrate and ammonium in the 150 lb N/acre plots. It may suggest that fertilization with 50 lb N/acre may be optimal for plant growth, and the addition of greater levels of N beyond this amount does not result in an increase in yield. Neither the application of the

biological fertilizer nor the compost significantly increased harvested root weight in *Echinacea purpurea*.

In the slower growing *E. angustifolia*, significant treatment effects were found for leaf dry weight at harvest. Leaf dry matter in the 100 lb N/acre fertilizer treatment was significantly greater than all other treatments. This does not correlate with the soil data, where soil nitrate and ammonium were not significantly greater in the 100 lb N/acre fertilizer treatment. No other soil parameters, which could account for the additional growth, were significantly greater in the 100 lb N/acre plots. *E. angustifolia* root dry weight at harvest did not differ among treatments despite the variability in yield. Differences were more readily apparent in above-ground plant parts, perhaps a reflection of differential growth between above and below ground.

Lemon balm plants in the compost and organic fertilizer treatments of 50 lb N/acre, 100 lb N/acre and 150 lb N/acre produced numerically higher dry weight at harvest compared to the control, but differences were not statistically significant. This has important ramifications for farmers when yield benefits are not obtained with additional fertilization.

Conclusions

Because *Echinacea* is a native plant, and Iowa soils are rated as sufficiently fertile, additional fertilization does not appear necessary to increase yields. Because lemon balm is harvested for leaf matter, fertilization effects were more pronounced, but not to the level of significantly improving yields. While compost applications did not increase the yield of the most commercially important plant part (roots) in *Echinacea*, the long-term benefits of compost to the soil-

Fertilization with 50 lb N/acre may be optimal for plant growth; the addition of greater levels of nitrogen beyond this amount does not result in an increase in yield.

plant system in terms of improving soil structure through the addition of organic matter, soil moisture retention, and soil microbial activity may exceed benefits derived from the supply of plant nutrients alone. A study of the long term effects of compost addition and varying rates and types of compost would prove beneficial to organic farmers and gardeners in choosing the optimum conditions for organic vegetable and herb production. In addition, the interaction between cultivar and response to compost appears to be significant and warrants further investigation. ♡

Teaching Organic Farming & Gardening: Resources for Instructors

Summary

In spring of 1999, OFRF awarded funding to The Center for Agroecology & Sustainable Food Systems at the University of California-Santa Cruz (UCSC) to develop a training manual encompassing the basic skills and concepts taught in their Farm & Garden Apprenticeship program. The project's primary objective was to formalize the existing apprenticeship course curriculum and synthesize perspectives and training materials from other organic educators. OFRF seed money helped attract additional funders that resulted in an ambitious project involving six of the Farm & Garden's instructional staff, seven contributing authors, over a dozen reviewers, and almost a hundred apprentices. This training manual is being distributed nationwide, and is for sale in hard copy through UCSC, or downloadable for free from their website.

The Center for Agroecology & Sustainable Food Systems (CASFS) is a research, education, and public service program at the University of California, Santa Cruz, dedicated to increasing ecological sustainability and social justice in the food and agriculture system. On the UCSC campus, the Center operates the 2-acre Alan Chadwick Garden and the 25-acre Farm. Both sites are managed using organic production methods and serve as research, teaching, and training facilities for students, staff, and faculty.

Teaching Organic Farming & Gardening: Resources for Instructors is a 600-page manual that covers practical aspects of organic farming and gardening, applied soil science, and social and environmental issues in agriculture. Units contain lecture outlines for instructors and detailed lecture outlines for students, field and laboratory demonstrations, assessment questions, and annotated resource lists. The training manual is designed for a wide audience of those involved in teaching

farming and gardening. Over the past 35 years, instructors at UCSC have taught organic farming and gardening skills to more than a thousand apprentices through the UCSC Farm & Garden Apprenticeship program. The training manual draws on that 35 years of experience to offer teaching resources based on many of the skills and concepts taught during the six-month Apprenticeship training program.

The manual is designed for a wide audience of those involved in teaching farming and gardening, including colleges and universities with programs in sustainable agriculture, student farms or gardens, and on-farm education programs; urban agriculture, community garden, and farm training programs; farms with internships or apprenticeships; agriculture extension stations; school gardening programs; organizations such as the Peace Corps, US AID, and other groups that provide international training in food growing and ecological growing methods; and master gardener programs. Although much of the material has been developed for field or garden demonstrations and skill building, most of the units can also be tailored to a classroom setting.

"This is an excellent resource for us because of its content, organization and flexibility. The staff instructors who developed this manual have tremendous knowledge of not only the subject matter, but also how to teach it to students and interns," commented Mark Van Horn, director of UC Davis's Student Experimental Farm.

Each unit consists of an introduction to the topic, instructors lecture outlines, detailed lecture outlines for students, assessment questions and key resources. Following is a general description of the training manual contents:

Part 1. Organic Farming and Gardening Skills and Practices

This section emphasizes the "how-to" aspects of organic gardening and farming, including propagation, irrigation, tillage, transplanting, and compost production. This 11-unit

OFRF project funding: \$8,548 Awarded: Spring 1999

Project cooperators:	Albie Miles, Curriculum Project Coordinator; Ann Lindsey, UCSC Farm Apprenticeship Coordinator; Martha Brown, Senior Editor, Dr. Carol Shennan, Director, UCSC CASFS; Jim Leap, Farm Manager; Orin Martin, Garden Manager.
Project location:	University of Santa Cruz Center for Agroecology and Sustainable Food Systems, Santa Cruz, CA
Additional support:	The Richard and Rhoda Goldman Fund, The Arkay Foundation, The Mary A. Crocker Trust, The Foxwhelp Group of the Tides Foundation, The Kellogg Foundation, through the California Food and Fiber Futures (CF3) Project, John Kinder
Project period:	4 years (1999-2003)
Final report:	Submitted June 2002. This project report is the Training Manual itself; 604 pp.

Complete project reports are available by mail from OFRF or at www.ofrf.org.

section also introduces students to critical skills and considerations in the management of soil fertility and agricultural pests (arthropods, diseases, and weeds) in organic systems. The information is based on certified organic production practices that meet or exceed the National Organic Program (NOP) standards. Included throughout is an overview of principles and practices used in NOP-certified production.

Part 2. Applied Soil Science

This section covers basic information on soil chemistry, soil physical properties, and soil biology and ecology, providing a more detailed overview of the underlying scientific principles that inform many of the organic farming practices covered in Part 1.

Part 3. Social and Environmental Issues in Agriculture

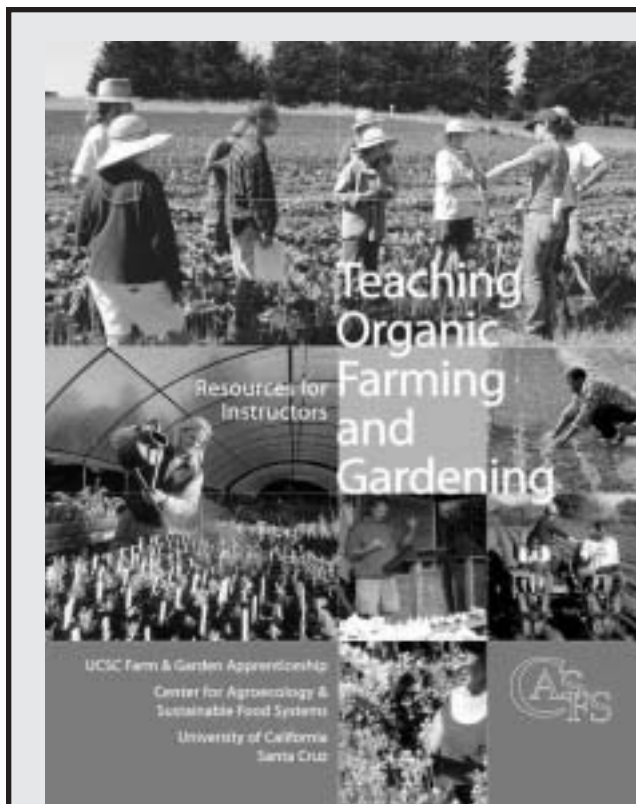
This section first outlines the history and development of agriculture in the U.S. and then introduces students to social and environmental issues associated with conventional agriculture practices and the current organization of the food system. This section also introduces the concept of sustainable agriculture and some of the current obstacles to more sustainable food and agriculture systems. ♻️

Sample UNIT OVERVIEW

Part 1. Organic Farming and Gardening Skills and Practices

Soil Fertility Management

- *"Feed the soil to feed the plant" is a basic principle of organic farming and gardening.*
- *This unit introduces students to the ways that farmers and gardeners develop and maintain soil fertility in certified organic farming systems. Lectures describe the objectives and components of soil fertility management and the various practices used to develop and maintain fertile soil. It should be emphasized throughout the lectures that the overall goal of a fertility management program is to balance nutrient inputs and outputs and ensure a good balance of nutrients for the crop. This balance requires a complex mix of soil management activities including proper tillage, irrigation, crop residue management, weed management, and crop rotation planning. Neglecting any of these components can compromise soil quality, affect crop performance, and create potential pollution problems due to nutrient runoff or leaching.*



How to Order

Teaching Organic Farming & Gardening: Resources for Instructors may be downloaded at:

<http://zzyx.ucsc.edu/casfs/training/manual/contents.html>.

Please note that the text is 604 pages.

Paper copies may be ordered from the Center for Agroecology & Sustainable Food Systems for \$45.00. The manual is designed to be placed in a 2-inch, 3-ring binder so that sections can be easily removed and copied for class use. Price includes tax, shipping, and handling; binder not included.

To order, send a check made payable to UC Regents to: CASFS, 1156 High St., Santa Cruz, CA 95064, attn: Teaching Manual. Please be sure to include your mailing address. If you have questions about the resource guide, or questions about ordering, please send an email to: TrainingManual@ucsc.edu.

Impacts of undersowing clover and arugula on insect abundance in broccoli

Summary

Increasing plant diversity on the farm has been shown to reduce agricultural pest numbers. To examine the effectiveness of undersowing clover and arugula--in homogeneous or mixed stands--at reducing pests, insect numbers were measured on undersown broccoli plants compared to a monocrop alternative. Experimental plots showed large variation in cover crop establishment across both farms and replicated blocks within farms. Only aphid numbers were clearly impacted by the background vegetation. Overall, plots with a clover background had the fewest numbers of aphids per plant, followed by those undersown with arugula. The control treatment, kept weed free, had the largest numbers of aphids per plant. However, yield, measured by average head weight, was significantly reduced for plants undersown with clover, but yield for plants undersown with arugula was equal to that obtained from plants in the clean treatment. Plots undersown with arugula showed increases in ladybug numbers, which appeared to account for a decrease in aphids. These findings indicate that aphid abundance is best explained by the "enemies" hypothesis. Furthermore, establishing mixed background vegetation resulted in similar reductions in aphid abundance relative to homogeneous backgrounds, with less effect on yield.

Diversifying vegetation in farming systems as a pest control measure has received increasing attention since Root's 1973 seminal paper¹. Root hypothesized that increasing plant diversity in a field decreases the abundance of specialist plant pests because it's harder for them to find their resource patch. He called this the "resource concentration" hypothesis. Alternatively, his "enemies" hypothesis states that increased vegetation diversity could attract a greater number and diversity of natural enemies resulting in greater control of plant pests by these natural enemies. The extensive work in this field has received careful review. Broadly speaking, conclusions have been that vegetation diversity is beneficial in reducing pests most of the time, but the specific conditions under which this is true prove elusive.

This study explored how two different undersown plantings (clover and arugula) affect overall pest numbers on organic broccoli, planted in late summer on several diverse farms in Washington's Puget Sound region. I chose to look at Brassicaceae plants as undersowing candidates because of personal observations indicating that flea beetles (*Phyllotreta* sp.) prefer to feed on wild mustards over broccoli plants. While arugula is not a wild plant, it is known to be a preferred host of flea beetles and has a growth form that is less competitive with broccoli for light.

Increasing plant diversity can reduce pest numbers; however, increased plant competition often outweighs the benefits gained as a result of reduced pest numbers. One way to potentially reduce this competitive effect is to add undersown vegetation in strips, rather than evenly throughout the entire field. My experimental design allowed me to test the difference in effect between partial and complete undersowing of a crop. A mixed background was created by undersowing one-half of the area with one of the cover crops, while the other half was planted only to the crop, with no background vegetation.

Methods

Replicated plots were established at two farms: Rent's Due Ranch (RD), an organic farm located near Stanwood, Washington, and a Washington State University extension system farm located near Puyallup (Puy). A block consisted of 5 treatments (4 experimental and 1 control). Treatments consisted of homogeneous backgrounds of either a clover mixture (Cv) (50:50 of *Trifolium repens* and *Trifolium frag-*

¹ Root, R. B. 1973. Organization of a plant-arthropod association in simple and diverse habitats: the fauna of collards (*Brassica oleracea*). Ecol. Monog. 43:95-124.

OFRF project funding: \$8,650 Awarded: Spring 2000

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Cooperators:	Michael and Joanne McIntyre, Rent's Due Ranch, Stanwood, WA
Project locations:	Rent's Due Ranch, Stanwood, Washington (organic); Washington State University extension system farm, Puyallup, WA.
Project period:	1 year (2001)
Final report:	Submitted December 2002. The complete report is 19 pages, including 5 tables, 5 figures and bibliography.

Complete project reports are available by mail from OFRF or at www.ofrf.org.

iferum, broadcast seeded at approximately 62.5 lbs/hectare) or arugula (Br) (*Eruca vesicaria* subsp. *sativa*, direct seeded into 2 rows between each row of broccoli) or a mixed background of half clean and either half clover (CvCn) or half arugula (BrCn) (see Figure 1). The undersown plots were planted in June and July. The control treatment (Cn) was kept weed free by hand hoeing. Cover crops were mowed as needed to keep them below the level of the broccoli crop. Broccoli plants (RD: Southern Comet F1, Puy: Green Valiant F1, West Coast Seeds Ltd.) were transplanted into the fields at ½ m intervals with 1m spacing between rows approximately 5 weeks after undersowing. Each farm had two experimental blocks for a total of four blocks with 5 treatments per plot.

I randomly selected 16 plants from each treatment: eight each from two, three-row groups. In mixed background treatments I chose eight plants from each type of background for a total of 16 for the entire treatment. Selected plants were flagged for repeated sampling.

Entire plants were sampled and recorded for insects and insect damage due to aphids, flea beetle and moth/butterfly pests of broccoli. Also measured were percent of aphids parasitized by wasps (aphid mummies). Broccoli head diameter and marketability based on damage rates were measured. In addition, total yield weights were collected at RD based on background vegetation, not the treatment vegetation, i.e. clover, arugula, or clean.

Results

Insect abundance. Flea beetles were not present in significant numbers at either farm, although at RD flea beetles were present but remained primarily on kale about 300m

away from experimental blocks. In past years, flea beetles were the primary pest of all brassica crops at RD. Flea beetles were present in large numbers at Puy during the establishment of arugula prior to broccoli transplanting. This adult population disappeared shortly after transplanting, either because of within season generational dynamics or because they moved to a newly planted cabbage field next to the research plots.

The virtual absence of flea beetles at both fields and the highly variable pattern of aggregate moth/butterfly numbers resulted in only the mean number of aphids per plot showing a significant difference between treatments along with significant blocking terms (Farm and block within farm). *A priori* contrasts for differences between each treatment compared to the clean treatment (control) were significant for all treatment effects (Figure 2). The pattern indicating that the clean treatment had the most aphids per plant was consistent as an overall effect (averaged across farms) and for each plot within farm.

There was a seasonal pattern of insect abundance in block 1 at RD. At sample number 3 (43 days after transplanting), treatments were indistinguishable from one another in terms of insect abundance. Yet by sample 4 (54 days after transplanting) there was an observable difference between treatments. Moth/butterfly abundance in the homogeneous background treatments (Br and Cv) decreased, while abundance in all treatments containing bare-ground (Cn, BrCn, and CvCn) continued to increase throughout the season. Aphid numbers changed less than moth/butterfly numbers between sample number 3 and sample number 4, and the treatments that experienced a decrease in abundance differed. Aphid abundance decreased

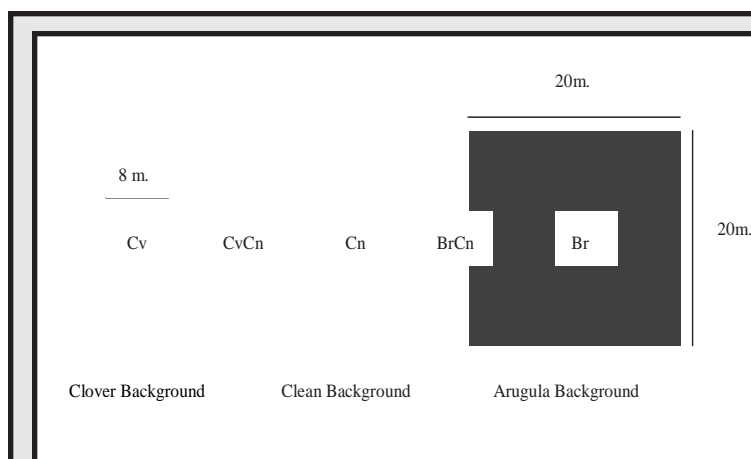


Figure 1. Schematic of how treatments within plots were arranged; with background (i.e. clover, clean or arugula) as a whole plot and treatments as split plots within the whole plots. Treatments are designated by the background vegetation as Cv: clover, CvCn: clover and clean, Cn: clean, BrCn: arugula and clean, and Br: arugula. Plants sampled for insects and yield were randomly selected within the split-plot treatments.

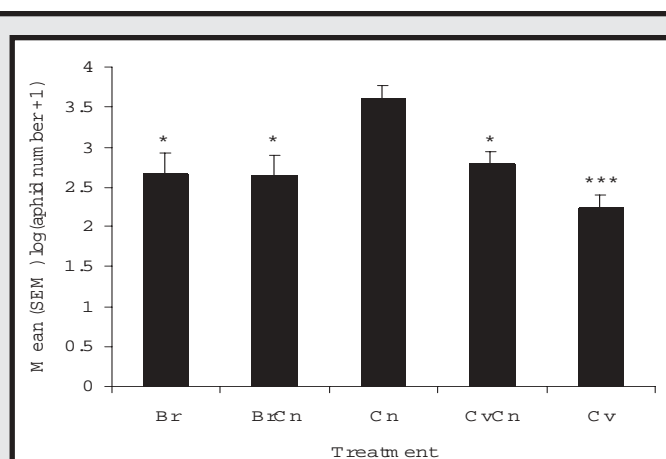


Figure 2. Mean (+1 SEM) aphid number per plant (log(x+1)) averaged across all farms. See Figure 1 for designation of treatment categories. Treatments with an * are significantly different from the control group (Cn) at $p < 0.05$, those with *** at the $p < 0.001$ by Fisher's least significant difference.

the most in the heterogeneous treatments (BrCn and CvCn) with the clean treatment having the greatest abundance.

In a single estimate of ladybug numbers, nearly 60% of the observed individuals were associated with the two arugula treatments (Br and BrCn). The two treatments with the fewest number of ladybugs were Cn and CvCn. Of those observed in the arugula treatments, only 11% occurred on broccoli plants while over half were observed on the arugula plants themselves. If the numbers observed on weeds and arugula are combined to represent non-crop vegetation, then nearly 90% of the observed ladybugs were on this non-crop vegetation. For the two clover treatments (Cv and CvCn), 56% of the observed individuals were on non-crop vegetation and about a third were on broccoli plants.

Yield. Measurements of yield at the RD farm were taken at two levels, the treatment level and background vegetation level (clover, arugula, or clean). The growth differences between plots resulted in vastly different yield patterns between plots (Figure 3). As a result, yield data were analyzed separately by block. At the treatment level, yield represented head weight for each of the repeatedly sampled plants that obtained marketable head size and quality. *A priori* contrasts between the clean treatment and each other treatment revealed that for treatments where clover was the cover crop, average head weight was significantly reduced. Total yield weight by background vegetation (the sum of all harvested heads from a given background treatment), summing across harvest dates, cannot be analyzed statistically, but the data suggest that an undersowing with clover resulted in a decrease in overall yield in block 1, but had no influence on yield in block 2. This lack of influence in block 2 likely was the result of the overall vigorous broccoli growth in all treatments.

Discussion

As the establishment of uniform replicate block treatments proved difficult, results should be interpreted cautious-

ly. One goal of these experiments was to determine whether arugula could serve as an effective trap crop, luring specialist herbivores (especially flea beetles) away from the broccoli crop without attracting additional pests into the crop. The resource concentration hypothesis would predict that there would be an overall increase in specialist pests as a result of the larger, more concentrated resource. Due to the extremely low abundance of flea beetles during the experiment, no conclusions can be drawn. However, aphids, which are generalist herbivores, should have increased in abundance in all treatments with additional vegetation, in accordance with the resource concentration hypothesis. The decrease in aphid abundance and the associated increase in ladybug abundance on plants with undersown vegetation suggest the enemies hypothesis may better explain the results of these experiments. Without knowing rates of immigration and emigration for the predators and the herbivores and actual predation rates, a definitive conclusion cannot be reached.

The pattern of reduced aphid numbers with no measurable decrease in yield for treatments with an arugula background is a tentative indication that arugula may be intercropped with broccoli as a control strategy. In this experiment, arugula was seeded at a relatively high density, two rows between each broccoli row with a 6-inch within-row spacing. Seed and labor costs are relatively high at the rates planted for this experiment (\$16 for seed plus 1 hour labor to plant per block), and since a market for large harvests of arugula does not exist, it is likely to remain a minor secondary crop. For intercropping to be an economically viable control strategy, a lower density of arugula plants would need to be planted with the same control effectiveness or another low-cost or economically profitable plant would need to be substituted in the system.

One way to reduce the costs and competitive effects of undersowing (or intercropping) is to undersow in strips across the field instead of over the entire field. The particular composition of these strips and their arrangement within the field merits further investigation. 🍷

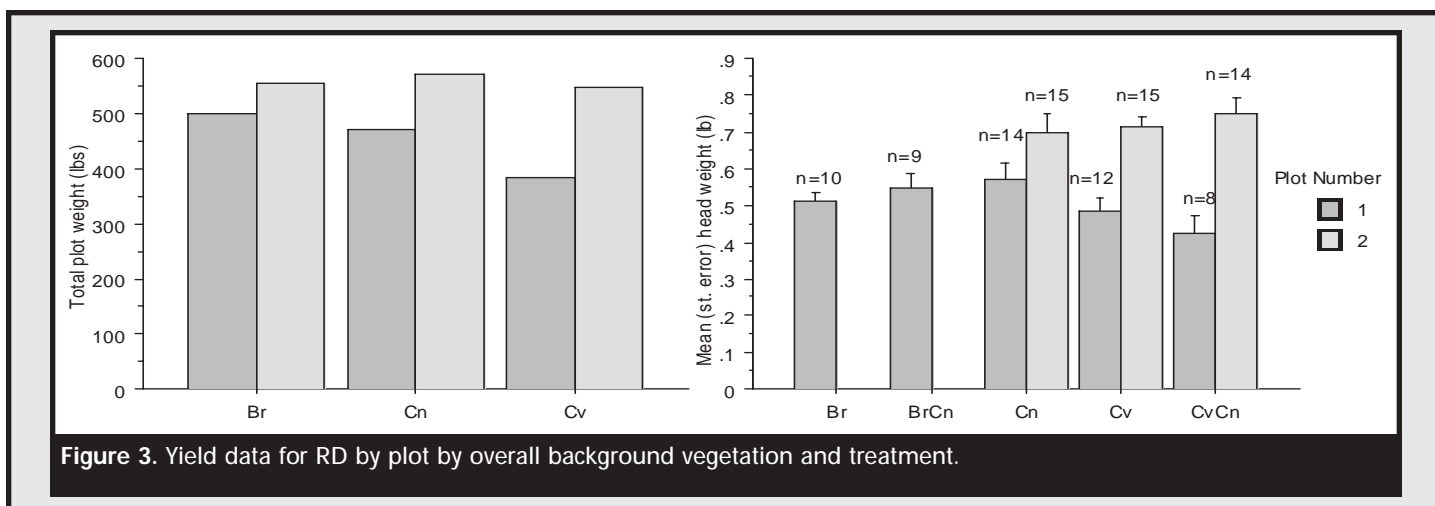


Figure 3. Yield data for RD by plot by overall background vegetation and treatment.

tion selection, although occasional selections for variation may occur. Farmers often lack the skills to select for quantitative characteristics such as disease resistance, cold emergence, etc. They also often lack the necessary resources to support selection and development of any new varietal lines that may emerge.

The participatory breeding model is a combination of formal and farmer breeding. It can take one of two modes: the participation of farmers in formal led research or the participation of science professionals in farmer led research. They often differ as to the stage at which the farmer becomes involved. Do farmers set the end goals? Are they integrated into the process of design, selecting germplasm, collecting data, evaluation, and eventual distribution? The distinct advantages to participatory breeding for organics comes in the ability to adapt varieties to whole farming systems and regional conditions, and that the farmers are involved in shaping the germplasm based on their experiences with both the crops and consumer markets.

A few companies that offer organic seeds, such as Seeds of Change and High Mowing Seed, are beginning to explore farmer-breeder participatory models of breeding for organics. Tom Stearns (owner of High Mowing Seed) and Steve Peters (Seeds of Change) point to the influence of workshops and breeding being conducted by Organic Seed Alliance's Dr. John Navazio. They are working with Navazio on plant improvement projects for each of their companies.

Developing a new model of breeding for organics and whole-farm ecology will require a re-evaluation of our current breeding system and its funding base. Only a generation ago farmers, seed companies and state cooperative extension held a closer relationship and were involved in regional evaluations and development of varieties. Participatory breeding models the greatest promise of directly serving organic growers needs, but will require developing new relationships and exploring novel avenues of collaboration. Concerted participatory efforts to breed for organics will bring quality seed to the organic movement. ♣

***Matthew Dillon** is the Director of Organic Seed Alliance, which supports the ethical development and stewardship of the genetic resources of agricultural seed. The Alliance conducts organic seed research on select crops and trains farmers to grow high quality seed while working with independent breeders and regional seed companies in participatory breeding programs.*

***Micaela Colley** is an organic seed consultant and former Research Farm Manager for Seeds of Change. Seeds of Change offers all open-pollinated organic seed and conducts variety trials of open-pollinated seeds with organic market growers. They work with nearly 50 organic farmers around the country in seed production and development.*

First "Seeds and Breeds" Summit
launches activist breeding network

A "Road Map" to Sustainable Public Breeding

Increased attention to breeding systems appropriate to organic farming is occurring in tandem with renewed concern for sustainability within public breeding programs.

Last fall, a "Summit for Seeds and Breeds for 21st Century Agriculture" was held in Washington, DC. More than seventy farmers, ranchers, land grant university researchers, breeders and non-profit representatives met to discuss the future of public breeding. The Summit was organized by a diverse planning committee that included representatives from Rural Advancement Foundation International (RAFI), The Leopold Institute, Iowa State University, University of Wisconsin, Cornell University and the Land Institute.

The Summit set as its key goal the development of "A road map for reinvigorating public domain plant and animal breeding to meet the needs of a more sustainable agriculture."

The need to restore public trust, increase farmer and rancher participation in breeding work, and provide farmers with seeds and breeds that fit integrated, sustainable and organic systems were recurring Summit themes. As the opening keynote, University of Missouri rural sociologist Mary Hendrickson described most breeding work as geared to fit a consolidated world market

model, and emphasized the need to change this "top down" approach.

Stephen Jones, organic wheat breeder from Washington State University, talked about ownership of intellectual property and the impacts of the Bayh-Dole Act. The Act allows public universities to receive royalties on private products that result from their research. The Bayh-Dole Act was a key topic over the three days, and at the final session a small group of breeders read a "Public Breeder Oath" that they believe will clarify the role of university breeders and help build new trust in the profession.

Michael Sligh, working group organizer from RAFI, was impressed that the group found so much common ground and many practical steps to explore. "People recognized that there is not a single solution—like throwing more money at the land grant system. We've got to look at legal issues, funding issues, farmer involvement, the needs of sustainable systems and basic public perception."

Sligh says the next step will be to convene a working group that will begin the process of putting recommendations into practice, including discussing Farm Bill appropriations with key Senate staff as they begin the 2005 budgeting process in February, 2004.

—Matthew Dillon

For more information about the Summit and upcoming events, visit www.rafiusa.org

debate that followed, as we and our partners in the organic policy world immediately raised red flags. A national Associated Press story noted that "Scowcroft and others have been anything but silent about the Deal measure." With major outlets, such as the *Los Angeles Times* and *New York Times* reporting this as an assault on organic agriculture, many newspapers editorialized against the Deal amendment. In a stunning rebuke reminiscent of the 1998 standards battle that put organic on the policy map, the legislation was successfully repealed in less than 90 days, earning new respect for organic among many DC lawmakers.

OFRF has had a voice in other press reports in 2003 as well, including stories on the economic success of farmers who have transitioned to organic; consolidation in retail and distribution channels in the food economy and its impact on small farmers; and the outstanding work of OFRF's grant recipients.

OFRF President Ron Rosmann eloquently articulated OFRF's perspective in the heartland with a

January 9, 2003 opinion column in the *Des Moines Register* promoting organic farming and highlighting the threats of biotechnology to the growth of organic agriculture. Six months later, the *Register* also carried Bob's Prairie Writers Circle commentary on the need for greater public investment in organic agriculture.

In another round of intensive media work, OFRF released key results of our latest *National Organic Farmers' Survey* and *State of the States 2nd Edition*. Both attracted significant coverage in the general and agricultural media. Our press release on the impacts of GMOs on organic farmers yielded a national AP wire story that was picked up by major and minor outlets across the country, including the *Miami Herald*, *Boston Globe*, *Kansas City Star*, and *Washington Post*.

Administration

Despite challenging economic conditions, strong support from long-time funders as well as new donors has allowed OFRF to move ahead with important administrative initiatives in

2003. In April OFRF welcomed Jonathon Landeck to the staff in the new position of Assistant Executive Director. Jonathon brings a wealth of administrative experience from his work at the Peace Corps and the Rodale Institute, as well as a Masters in Soil Science and a Ph.D. in Agricultural Extension Education. He has already upgraded our financial, human resources, and internal information systems, and we look forward to many more system improvements in the months to come.

Looking ahead to 2004, we face the challenge of a \$1.1 million budget, the policy turbulence of an election year, and the potential arrival of new GMO crops. As we address these issues, we must also maintain focus on our primary mission of developing and disseminating information of use to growers in the field. With your ongoing support, OFRF will keep working to improve organic farming systems as the core of a new farmer-friendly, ecologically sound agriculture for the 21st century. ♪

OFRF Board of Directors Meeting, November 2003

The OFRF Board of Directors meets twice per year to award project grants. OFRF board member Steve Ela hosted our fall meeting at his diversified orchard in Hotchkiss, Colorado.

Photos. **Left:** OFRF Board and staff members receive an afternoon tour of the orchard; **Center:** Steve exhibits the overhead irrigation system; **Right:** Staff members Jonathon Landeck and Juli Chamberlin review a portion of the two-day meeting agenda.



Photos: Jerry DeWitt

Thank you, OFRF donors, for making 2003 a stellar year!

Contributions received from December 2002 through November 2003

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The Arie J Kurtzig Trust
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Grants Awarded

OFRF FALL 2003 GRANTS

The following grants were awarded at the OFRF Board meeting in November 2003. Final acceptance by grant recipients has yet to be confirmed.

Total in competitive grants awarded: \$70,059

Conserving biodiversity through education of organic farmers, certifiers, and NRCS

Jo Ann Baumgartner, Wild Farms, Watsonville, CA \$12,700

Maintaining agroecosystem health in an organic strawberry/vegetable rotation system

Joji Muramoto, Univ. of California-Santa Cruz \$9,385

Funded in partnership with EPA

Aerated compost tea and other alternative treatments for disease control in pumpkins

Sarah Kelley, Earth Pledge, Natick, MA \$10,000

A novel approach for the control of the dreaded plum curculio: biological extermination using guinea fowl

Jim Koan, Almar Orchards, Flushing, MI \$3,094

Economic research on organic citrus production and marketing in Florida

Kevin Athearn, Univ. of Florida, Gainesville, FL \$6,500

Nebraska organically grown grapes

Tim Nissen, Hartington, NE \$5,385

Can sorghum-sudangrass grown as a summer cover crop for organic no-till vegetable production double as a cash crop for the organic hay market?

Denise McKinney, North Carolina State Univ., Raleigh, NC \$6,155

Efficacy of insecticides for the control of flea beetles on organically-grown eggplant and brassicas

Olga Wickerhauser, Rutgers Univ., New Brunswick, NJ \$7,200

Weed suppression using Brassicaceae cover crops in organically grown peppers

Jason Norsworthy, Clemson Univ., Clemson, SC \$9,990

OFRF awards grants for

organic farming research and education projects two times per year. Grant application deadlines are July 15 and December 15. Projects may be farmer initiated, and/or should involve farmers in project design and execution and take place on organic farms whenever possible. OFRF considers funding requests within the range of \$1,000 to \$15,000.



To obtain OFRF's **Procedures for Grant Applications**, please contact our office at: tel. (831) 426-6606, or visit our website at www.ofrf.org.

For additional application support, OFRF publishes an **On-Farm Research Guide**, and OFRF **Technical Program Coordinator Jane Sooby** is available to answer application questions by phone or by e-mail at jane@ofrf.org.



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