The ACAB—USDA’s Sincere Gesture or Stalling Technique?

By Mary Scott

It’s understandable why people might be cynical about the USDA’s newly-formed Advisory Committee on Agricultural Biotechnology (ACAB). Until recently, the USDA and its secretary, Dan Glickman, have attempted to keep a lid on the emerging problems and any negative public perception of agricultural biotechnology and its regulation and management. After all, Glickman’s agency helped to develop and actively promote many of the genetically engineered (GE) crops now on the market. And he’s been quoted as saying that those concerned about GE crops rely on “guerilla tactics of outlandish rhetoric.”

Then there’s the committee’s potentially truncated lifespan. Though the 38-member ACAB was appointed on January 21, 2000 for a two-year period, Glickman vacates his job come year-end.

Next January, will the new administration and USDA secretary carry on with this advisory process? Keith Pitts, a USDA special assistant charged with committee oversight notes, “The ACAB is not congressionally mandated, so it would be up to the next secretary to decide if the committee should continue.” The ACAB’s inaugural meeting was held March 29.

Yet, the ACAB was formed to help Glickman—and possibly his successor—to create an appropriate forum for a dialogue on biotechnology. According to a USDA announcement, the ACAB will advise the secretary on policy related to the creation, application, marketability, trade and use of agricultural biotechnology. Glickman stated, “It is my hope that this group, which brings together people with a range of perspectives and experiences, will engage in the kind of thoughtful and civil debate on biotechnology that our country now needs.” Committee recommendations will be examined by the secretary, who will then determine what goes to the National Academy of Sciences for further review.

However, as committee member Marshall Martin, a professor at Purdue University’s Department of Agricultural Economics, notes, “In general, when someone doesn’t know what to do, they assemble a committee. It’s an age-old stalling technique.”

Is that the case here? “It does appear to be somewhat of a window-dressing committee,” says committee member Michael Hansen, research associate at Consumer Policy Institute, a division of Consumers Union.

That’s if the USDA ignores us.” Margaret Mellon, Director of the Union of Concerned Scientists Agriculture & Biotechnology Program, believes her time on the committee is worth the effort but her expectations are not too high. “The ACAB is a big, unwieldy committee that has been set up at the tail end of an administration. The timing alone suggests that not a lot will come out of it. At the same time, I think it represents an unprecedented opportunity for the organic community to raise their issues in a platform where the highest representatives at the USDA have to listen. In that sense, I think the

Continued on Page 4
OFRF NEWS

MANY HAPPY HELLOS AND SAD SO-LONGS...

Board Transitions
The OFRF board and staff give their heartfelt thanks to outgoing board member Phil Foster, who handed over his role as Treasurer of OFRF to Mary Jane Evans following her election to that position at the spring board meeting in Santa Cruz, California. Phil joined the board in 1994 and has provided invaluable leadership in his role as Treasurer for the last four years. His calm presence and attention to detail have helped the board make thoughtful, informed decisions on all matters, financial and otherwise. Fortunately for OFRF, Phil is as committed as ever to OFRF and the work we do and will continue to lend his experience and insight to the board and staff when called upon. Thanks, Phil!

Continuing as OFRF officers are Woody Deryckx as President, Ron Rosmann as Vice President, and Ingrid Lundberg as Secretary. Woody, Ron, and Ingrid were re-elected to their respective roles at the spring meeting after proving effective leaders in their previous terms. Also serving with them and Mary Jane on the Executive Committee is continuing Research & Education Committee chair Jerry DeWitt.

We’re pleased to welcome two new board members, also elected at the spring meeting: Thomas Dobbs and Betsy Lydon. Tom is a Professor of Agricultural Economics at South Dakota State University who recently returned from sabbatical as a Fulbright Scholar at the University of Essex in England. He has done groundbreaking work in economic analysis of organic farming systems. Betsy is the Program Director for Mothers & Others for a Livable Planet, a consumer and environmental advocacy organization based in New York City, and serves as a consumer representative to the National Organic Standards Board. We look forward to the new energy and fresh perspectives that Tom and Betsy will bring to the board.

Staff Transitions
OFRF Events Coordinator Laura Ridenour has become a part-time member of the staff after managing several events on contract last year. Laura has spent most of her life around farming and natural foods and coordinated fundraising events for the Community Alliance with Family Farmers (CAFF) prior to working with OFRF. In addition to her work here, Laura is helping to develop and manage her family’s farm in Corralitos, CA.

This spring we hailed “fare-well” to our Program Associate Rebecca King, who left the staff after anchoring the office for two and a half years. Becky’s sense of humor and no-nonsense approach to getting things done kept OFRF on course and running smoothly through a period of tremendous growth and change. But she decided it was time to leave the the office and go back to hard physical labor on the farm, this time finding new experiences in far-away Pennsylvania. Becky, we miss you, but we’re happy to see you pursue your dream of farming.

Before leaving, Becky spent two weeks orienting OFRF’s new Program Associate Melissa Matthewson in the ways of the office and the quirks of the rest of the staff. Melissa comes to OFRF as a recent graduate of UC Santa Cruz, where she majored in Environmental Studies with a focus on Agroecology. Her previous work includes administration for a campus cooperative and interning for Ecology Action in Santa Cruz. While still new to the office, Melissa is already becoming information central and resident database guru.

Becky, shown here enjoying one of the few luxuries of her former career (after a swim at the Claremont Resort, during OFRF’s 1999 conference).
Also joining the OFRF team this spring is Don Burgett, who was hired in March for the new position of Development Assistant & Information Services Coordinator. Don brings experience in nonprofit program management, urban agriculture, and community food security. He spent the last three years as an apprentice, trainer, and development coordinator for the Apprenticeship in Ecology Horticulture at the UCSC Center for Agroecology & Sustainable Food Systems. Don will provide long overdue support to Executive Director Bob Scowcroft in the fundraising realm and will manage OFRF’s publications, web site, and emerging information systems.

With Laura, Melissa, and Don on board, OFRF has now grown to a staff of seven, with five full-time and two part-time members, reflecting the tremendous acceleration of our work over the past two years.

**Our gang expands:**

L to R, back row: Mark Lipson, Becky King, Bob Scowcroft, Jane Sooby, Don Burgett.

Front row: Erica Walz, Laura Ridenhour and art consultant Dianne Carter. Newest staff member Melissa Matthewson will take center stage next time!

**Very Sad Goodbyes...**

During these past few weeks, we’ve been saddened by the loss of several people close to our OFRF family: Kathy Barsotti, Mark Mayse, and Allen Shainsky. We want to acknowledge briefly their individual contributions to OFRF, one part of the many endeavors and achievements of each of these exceptional people.

Kathy Barsotti, a farmer of 84 acres of organic fruits and vegetables in California’s Capay Valley, was a founding member of the OFRF Board of Directors (’91-’96). Kathy was among the core farmer-visionaries who helped conceive and develop OFRF as an organization. She is missed by many farming colleagues and others whom she mentored with her energy and progressive vision.

Mark Mayse, also an OFRF Board member (’94-’99), was an entomologist with California State University-Fresno. Mark served as a chief scientist on our grants review committee, and holds a place among our most earnest, engaged and insightful board members, available with a thoughtful and considered evaluation of almost any situation. We are very sad to lose his bright and vital influence to our community.

Allen Shainsky was founder and president of Petaluma Poultry, the producers of Rocky the Range chicken and Rosie certified organic chicken. He was a long-time friend and early supporter of OFRF, making his first contribution in 1991 (to our very first fundraising mailing) and since then never missing an opportunity to generously support our work whenever asked. Allen developed an extraordinary line of poultry products, had many friends in the natural foods world, and worked hard for the development of a certified organic meat label. We’re going to miss his presence as a friend in the industry.

**...And Some Important Thank Yous**

As always, we’re grateful to our many supporters, large and small, for providing the funds that we channel to organic farming research and education projects. Each year, we increase our grantmaking goals, and our supporters have helped us rise to the challenge. We’d like to say a special thank-you to the following foundations for their generous support over this past year:

- Arkay Foundation
- Community Foundation Silicon Valley
- Farm Aid
- Foundation for Sustainability and Innovation
- Gap Inc. Community Relations Program
- Gordon-Lovejoy Foundation
- Hahn Family Foundation
- The Roy Hunt Foundation
- Forrest A. Lattner Foundation
- Magnolia Charitable Trust
- Alida R. Messinger Charitable Lead Trust
- Paul Newman/Newman’s Own Organic
- Jessie Smith Noyes Foundation
- Philanthropic Ventures Foundation
- True North Foundation
- Wallace Foundation

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committee could do some good. It could indeed have an impact on organic issues that the organic community would not have had otherwise.”

ACAB members also include representatives of Monsanto and Cargill, the same companies that announced within weeks of the initial meeting a $50 million public relations campaign aimed at convincing consumers of the value of agricultural biotechnology. Committee members critical of biotechnology could easily feel out-muscled.

Yet, for all the skepticism, the development of open dialogue—and the initiation of this dialogue by the USDA secretary—provide at least two reasons to be guardedly optimistic. The ACAB could indeed impact how the USDA and other governmental agencies proceed on biotech issues in the years and decades ahead. Glickman, who reportedly shops at a Washington, D.C. Fresh Fields natural foods store, may have experienced an awakening as to the perils of agricultural biotechnology, at least on the marketing front. During a trip to Europe, he noted that genetically modified food is “a dominating public policy debate, every day in the newspapers.” Though U.S. consumers have yet to react as negatively as Europeans to GE food, public interest and concern about agricultural biotechnology is growing. Glickman is considered the only U.S. government official to convey his concern that American farmers stand to lose out as they try to sell genetically modified foods in the international marketplace.

Purdue University’s Martin says, “My take is that Glickman is a sincere individual. And he felt the public concern and international controversy so he called for this advisory committee. He is the one government official willing to do so; nothing like this is happening within the FDA or EPA, which is a statement in itself.”

Committee member Rebecca Goldburg, a senior scientist at Environmental Defense, a New York-based non-profit, believes guilt may have played a role. “Glickman is sensitive to the consolidation in agriculture, that producers are being controlled by an increasingly small number of input suppliers. He doesn’t want to be yet another USDA chief guilty for promoting the demise of even more family farmers. He’s feeling the pressure.”

With hundreds of people nominated, the 38 members ostensibly were chosen in an attempt to create an “ideologically balanced” advisory committee. Known biotech advocates include Dale Bauman, a Cornell University nutritional biochemistry professor who is also the developer of rBGH; James Dodson, a sales representative for Pioneer Hi-Bred International; Linda Fisher, Vice President for Government and Public Affairs at Monsanto; and Jerome Slocum, President of the North Mississippi Grain Company.

Committee members critical of or opposed to agricultural biotechnology, while outnumbered, include some strong voices. Among this group are Michael Sligh of Rural Advancement Foundation, Int’l.; David Fredrickson of the Minnesota Farmers Union; Margaret Mellon, Rebecca Goldburg and Michael Hansen. In addition, there is a cluster of organic farming advocates, including Margaret Wittenberg, Vice President of Government and Public Affairs at Whole Foods Market; organic farmer and writer Mary-Howell Martens.

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**Terminator: the Key to GMO Profits?**

Central to the debate over the application of recombinant DNA technologies in agriculture is the emergence of “Gene Expression Control” (GEC), one form of which is now infamously known as “Terminator” technology. The USDA Agricultural Research Service poured millions of public dollars into co-developing this suite of technologies with Delta and Pine Land Company and now jointly holds three patents covering “our” investment. While Terminator’s focus on engineering plants to produce sterile seeds catalyzed a global backlash against GMOs, it has also shed light into some darker corners of agricultural biotechnology.

First, Terminator is merely one form of GEC. Its siblings include various genetic “switches” designed to turn on or off certain activities within an engineered plant in response to applied chemical triggers. These systems are also referred to as “Technology Protection Systems” and “Genetic Use Restriction Technologies,” or GURTS, indicating the primary intent of the designers. Farmers everywhere immediately understood the threat that such technology poses. In addition to worries that cross-pollination could sterilize non-GMO crops and wild species, GURTS put more control in the hands of aggregated seed/chemical companies and promise to increase costs of production. Agribusiness firms will not only recoup their investment (and more) through technology fees on seeds, but also on the sale of the chemical triggers needed to make them useful.

Second, the GEC patents exposed the dysfunction of the USDA as it was caught in the headlights of international condemnation of Terminator. It was the Terminator crisis that led USDA last summer to consider formation of a committee to review the controversial issues it raised. By January 2000 the mandate was broadened to encompass all of agricultural biotechnology with the announcement of the ACAB. While advising USDA on future licensing and commercialization of Terminator and other GEC technologies is not the focus of an ACAB working group, it may be the most important short-term priority of the Committee. What USDA ultimately does, washing its hands of the patents or holding them up as the golden leash to keep GMOs in line, may reveal more about the sincerity behind ACAB’s formation than anything else.

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--Don Burgett
from New York, and Mark Lipson, OFRF’s Policy Program Director.

Lipson says that there are "at least eight members of the 38-member committee who are clearly opposed to current USDA policies on GMOs. This opposition is noticeably weighted with folks who are part of and directly supportive of the organic industry." Lipson believes the role of organic farmers and their allies in criticizing genetic engineering is partly defensive and partly a political circumstance.

"Many organic growers feel that transgenic crops are a direct threat to their way of farming and their livelihood," says Lipson. "That's what has motivated a lot of our concern. But unfortunately that issue did not get us to the table on its own merits. The recognition of our concerns and the profile of organic farming in the overall debate is due mainly to the recent political arrival of the organic movement." He sees this new clout as a result of public comments on USDA's proposed organic regulations, a lot of media attention, and the close identification in Europe of organics with the movement against GMOs. "In any case, organic advocates are now in a position where fighting the proliferation of agricultural biotechnology is a focal point of our professional lives."

Not apparently aligned with a pro- or anti-biotech position, at least right now, are several members who work in academic circles. Jeffrey Burkhardt, professor at the Institute of Food and Agricultural Services at the University of Florida, is a notable presence because he is one of a few people in the U.S. specializing in agricultural ethics. He is impressed by USDA's appointment of such an eclectic group of people. "First of all," he says, "they wanted a 20- to 25-person committee and ended up with 38. The USDA obviously had a harder time narrowing down than they thought they would. Second," he notes, "this is one of the few times a USDA committee includes activists that have gone on record against USDA policies. It's a strong sign they want some real balanced feedback."

While at least one published report said there was so much hostility at the first meeting that facilitators were brought in, participants paint a far more civil picture. Purdue University's Martin says, "We had facilitators because it is a large group, nothing more. There was no name-calling or animosity. People were very polite." Though most of the first two-day session was spent acquainting members with USDA staff and procedures, there was some opportunity to air viewpoints.

For instance, Linda Fisher, the Monsanto vice president, remarked that her company has been "in the eye of the storm" as the biotech conflict escalates. "One of the frustrations we've had is not having a forum where some of these issues can be brought together and discussed. There is nothing a company like Monsanto can do to convince the public of the safety of the products if they don't believe that the government is reviewing them honestly, transparently and fully capably."

---Linda Fisher, Monsanto

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Undoubtedly, members will see the need for more data. Committee member Lorraine Dominique Nakai, an entomologist with the Navajo Agricultural Products Industry, says she believes that calling for more funds for research will be the ACAB's first course of action. "I would like greater access to what data is available, and to see what else needs to be studied," she says.

Agricultural ethicist Burkhardt agrees, saying, "there are a lot of gaps in the available information." He would also welcome a more philosophical discussion. "Beyond talking about risks and benefits, I would like to bring up the basic question of the impacts of messing with nature, transforming the way things were meant to be."

Committee members agree that consensus will be unlikely and they hope for more committee interaction following the second meeting at the end of July. Yet, if there were consensus among participants, notes organic farmer Martens, "there would be no need for this committee in the first place."

Organic defenders will continue to have their work cut out for them as biotechnology remains the dominant force in agricultural research and development. But for the moment, at least, the USDA has opened the door to dialogue.

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Public Comment Process on USDA GMO Policy:

The USDA is accepting public comment regarding USDA policies on agricultural biotechnologies, as part of the ACAB process.

Written comments can be submitted at any time, and should be directed to:

USDA/ACAB
Dr. Schechtman, DFO
Office of the Deputy Sec.
202A Jamie Whitten Federal Building
12th and Independence Ave., SW
Washington, DC 20250
michael.g.schechtman@usda.gov
Technical Program Notes
Jane Sooby, Technical Program Coordinator

Pick Jane’s Brain
In this column, Jane Sooby shares responses to unique and commonly-asked questions she’s received on subjects related to organic farming.

Organic corn rootworm control

Q My brother-in-law farms wheat, soy and corn on about 2,500 acres in northwestern Indiana. He has problems with corn rootworm.

What are the organic alternatives to dealing with these pests? He’s agreed to be open to the options I present. If you don’t have any information on this, would you please refer me to someone who might? This is very important to me.

A Western corn rootworm (WCR), Diabrotica virgifera sp. virgifera, is the most damaging rootworm species in Indiana and other corn-growing states. Until recently, rotating soybeans every other year with corn was an incredibly successful cultural control. This worked by interrupting the rootworm’s preferred host, corn, with a year of a non-host crop, soybeans. It is the larval stage of the pest that does the most damage, though adult beetles are developing a taste for soybean leaves and are beginning to pose a threat to soybean crops as well as corn.

For years, using a corn-soybean rotation was a sure-fire way of virtually eradicating WCR because the larvae would die in the absence of corn roots. However, in recent years, increasing numbers of WCR have been appearing in first-year corn following soybean. Researchers think that the rootworms have developed resistance to the two-year rotation by expanding their host range and laying their eggs in traditionally non-host crops such as alfalfa and soybeans.

Diversification is a good general principle in controlling pests organically. Expanding the length of the rotation to a three- or four-year rotation may be effective in disrupting the WCR’s life cycle. Planting “farmscapes,” or borders, hedgerows, and other vegetative habitats for beneficial insects, is another approach that has not been studied much in the midwest but has shown great promise in milder climates. ATTRA has a useful publication on farmscapes posted on the web at www.attra.org/attra-pub/farmscape.html, or to order a free copy by mail call 1-800-346-9140.

Organic growers control pests by rotating crops, maintaining sanitary field conditions, and using resistant varieties. Very little work is being done to breed corn varieties that are resistant to the corn rootworm. More promising research focuses on identifying corn root exudates that attract rootworm larvae and using these to lure them away from the corn roots. Another line of research involves developing materials that slowly release carbon dioxide in the soil, interfering with the larvae’s perception of a carbon dioxide gradient to locate corn roots.

Irrigation water quality

Q Have any studies been done on the quality of irrigation water used on certified organic farms? I don’t believe many of the certifying agencies address this issue which means contaminated water could be used on certified land.

A The Organic Crop Improvement Association (OCIA) has water quality standards for processing but not for crop production (see sections 5.1.3 and 5.1.4 of OCIA’s International Certification Standards for the processing standards). Specialty crop production (mushrooms and sprouts) does have water quality standards (sections 4.4.5 and 4.5.1).

The California Organic Foods Act of 1990 refers to water in its definition of prohibited materials in this way: “Water, including substances dissolved in water, shall not be a prohibited material, even if it contains incidental contamination from a prohibited material, if the prohibited material was not added by, or under the direction or control of, the producer, handler, processor or retailer.” [110815 (p)(4)] This law also requires growers to document any materials that they add to irrigation water.

The California Certified Organic Farmers (CCOF) standards encourage growers to record the date of application of all materials including irrigation water. The CCOF standards require a 25 foot buffer zone between organic fields and “potentially contaminated adjacent areas,” applicable to “irrigation rights-of-way passing through certified lands” as well as to fields. If irrigation water is contaminated by a neighboring conventional farm or other operation, it is treated by CCOF as a “drift” incident and the affected crops may not be allowed to be sold as organic.

The new federal proposed organic rule in section 205.202, Land requirements, mandates that organic farmland (c) Have distinct, defined boundaries and buffer zones such as runoff diversions to prevent the unintended application of a prohibited substance to the crop or contact with a prohibited substance applied to adjoining land that is not under organic management. However, the new rule does not require that irrigation water be tested, an issue that is specifically addressed in the commentary (under Certification - Changes Requested But Not Made, p. 226).

In my experience, certifiers are aware that irrigation water can potentially compromise the integrity of organic products and will require testing if contamination is suspected.
Policy Program Notes
Mark Lipson, Policy Program Director

Scientific Congress Moves Forward Receives key funding from USDA

OFRF’s newest major, long-term project, the Scientific Congress on Organic Agricultural Research (SCOAR), has taken several big steps forward during the first half of 2000.

In April, we convened the first meeting of SCOAR’s national steering committee for two days of goal-setting and brainstorming about potential activities of the congress. As a result, OFRF and SCOAR joined in a consortium with organic researchers at four universities to submit a $4.9 million, four-year proposal to USDA’s new Initiative for Future Agriculture and Food Systems (IFAFS). The proposal would fund the core implementation of SCOAR and a broad package of organic production and marketing programs at the four schools (Ohio State, Iowa State, North Carolina State and Tufts universities).

As we go to press, we just got news that the consortium proposal was funded for a total of $1.8 million, with an invitation to submit additional proposals in future years!!!

This is, of course, considerably below the $4.9 million requested, but the funding is noteworthy, in part because our consortium proposal represents the only organic-oriented initiative funded by the IAFS program. More important, this is the first publically-funded effort of any magnitude to coordinate multiple university-level and farmer-based programs to develop organic systems information.

What is SCOAR?
SCOAR is a multi-year, nation-wide effort initiated by OFRF to stimulate scientific dialogue about organic agriculture among working organic farmers, research scientists, and agriculture information professionals. The collaborative relationship between growers and scientific professionals is the cornerstone of this project: it is essential to developing scientific information in the context of real organic system management. The commitment to equal participation begins with the composition of the national steering committee that has been formed to guide the project. The initial invitations for the steering committee included 10 certified growers, 11 research professionals, and three information specialists.

Project Mission and Goals
Here is the Mission Statement that the Steering Committee crafted as the overall definition of the project: “SCOAR is a collaboration of producers, scientists, and others. Its mission is to plan and promote research and information exchange for understanding and improving organic agricultural systems.”

The group established a set of main goals for the congress:

1. Cultivate a peer-level process of mutual learning and democratic collaboration among a diverse community of organic farmers & ranchers, scientists, extensionists, consultants, consumers and others for pursuit of the project mission;
2. Create a shared understanding of organic agriculture as an ecological approach to managing agricultural systems;
3. Identify and characterize research and information-exchange priorities pertaining to the mission, through various activities and documentation of those activities;
4. Advance the state-of-the-art of organic systems research, including on-farm, participatory, whole systems, and multi-farm studies;
5. Increase access to the knowledge, skills, and practices of successful organic producers by developing and implementing models for networking and information sharing among organic producers and scientists;
6. Encourage the use and implementation of SCOAR’s results.

Project Activities
The Steering Committee developed dozens of suggestions for potential activities to fulfill the project’s goals. We are in the process of developing a detailed activity plan from those suggestions. Among the initial efforts are two “baseline” studies of organic farming research and education, extending the work of our 1997 report, Searching for the ‘O-Word’. The first is a report on current organic research and education within 68 of the nation’s Land Grant Universities. In preparing this report, OFRF Technical Program Coordinator Jane Sooby has so far identified ten organic research sites around the country. We expect to release the report this fall, and use it as a basis for tracking the evolution of organic research in the universities.

The second study, in cooperation with Dr. Kathleen Delate at Iowa State University, will be a review of all the organic farming research projects that have been funded by USDA’s SARE program over the last ten years. This project has been commissioned by SARE to evaluate their “organic portfolio” for its impact, and to recommend directions for future support of organic research and education by the SARE grant programs.

Over the next several years, we will schedule a series of regional and national SCOAR meetings with growers and scientists. These meetings will address the various goals of the project including building research agendas and developing new models for information exchange. We are just putting together plans for this winter. Potential SCOAR meetings may be held in conjunction with the Ecological Farming Conference in California, the Upper Midwest Organic Farming Conference in Wisconsin, and the Southern SARE Professional Development Program Conference in Tennesee.

Participation and Updates
Periodic updates about the SCOAR project can be found on the OFRF web site at www.ofrf.org, along with a sign-up form for participating. You can also contact Mark Lipson by phone at 831-426-6606 or by email at mark@ofrf.org.
1997 Organic Acreage Figures Released by USDA

A recent report from USDA's Economic Research Service contains the most up-to-date acreage-based information available on certified organic agriculture across the country. Researcher Cathy Greene found that certified organic farmland in the United States increased by 44% between 1992 and 1997.

Based on information gathered from 40 state and private certifiers, Greene's report provides certified organic acreage figures for each of the 50 states. The data show some expected and some surprising trends.

Sadly, Mississippi had no certified organic acres reported. Colorado topped the list of total certified organic crop and grazing lands with 258,873 acres, most of which are were pasture and rangeland (223,746 acres).

North Dakota ranked highest in organic grain acreage with 53,306 certified acres. Top grains grown in North Dakota included oats (15,466 acres), rye (1,745 acres), and millet (3,388 acres). North Dakota also dominated in the organic oilseeds category, growing 7,149 acres of flax and 4,536 acres of sunflowers.

Montana had the highest wheat acreage (31,729), while Idaho came first in barley acreage (14,456). Minnesota had the most corn acres (10,002—compare with Iowa at 8,895 acres!). Minnesota was also the largest buckwheat producer with 3,656 acres. Iowa had the highest soybean acreage, with 13,247 acres certified organic.

Idaho produced the bulk of the nation's certified organic alfalfa hay, with 30,264 acres in production. California dominated all vegetable production categories, having 47% of the total acreage and the highest number of acres in organic tomato, lettuce, and carrot production. California also ranked highest in all fruit production categories except for one notable exception: Arizona had the largest number of certified organic apple acres with 3,178 acres (compared with California's 1,883 and Washington's 1,707 acres).

Texas showed the largest organic cotton and peanut acreages, with 8,134 and 1,780 certified organic acres, respectively. New Mexico followed Texas closely in organic peanut production with 1,189 acres. California was the number one organic potato producing state with 1,091 acres. Arkansas ranked highest in organic mushroom production while Idaho had the largest area of wildcrafted herbs. Vermont had 278,710 ft² of certified organic greenhouse space, the largest of any state, making it possible for 24% of the total vegetable production in that state to be certified organic. Vermont also had the largest acreage of organic maple syrup trees.

Pennsylvania stood out as having the greatest number of certified organic sheep and lambs (200) as well as the largest number of organic broilers (29,000).

California led the nation with 350,000 organic layer hens, while Hawaii led in the category of “other animals” which includes goats. Michigan was the top organic beef cow producer and New York the number one organic dairy cow state.


—JS

Neil Hamilton has put together a nice little gem. The Legal Guide for Direct Farm Marketing (1999, 235 pp) is a guide to what you need to know if you direct-market your farm products, or want to in the future.

Not an alternative to direct legal advice, instead, the guide "tries to summarize how the legal system typically will address an issue," and direct you to how to get the best information.

Dense, yet very readable, it's jam packed with useful advice like, “The six phone calls to make before you begin direct farm marketing.”

Neil is a farmer and an attorney and has 18 years' experience writing, advising and teaching agricultural law. This is a lot of legal expertise in a handbook. --EW

Available from:
Drake University Agricultural Law Center, 27th & Carpenter, Des Moines, IA 50311. tel. 515-271-2065.

Cost: $20 plus $3 shipping. (Checks payable to Drake University.)

Guess who’s publishing about organic? The University of California Department of Agriculture and Natural Resources has a new Organic Apple Production Manual (2000, 72 pp).

Based on over 20 years of research within the UC system, the manual includes a review of the organic apple industry, trends in production and markets, state and federal regulation and certification.

Chapters include orchard management, disease and pest management, harvest and postharvest operations, marketing considerations, and economic performance. Though largely based on production and market conditions in California, it is a good primer for growers anywhere and has uniquely helpful data such as charts outlining operations costs. A good example of organically-oriented Extension services. --EW

Available from:
UC-DANR Communications Services, 6701 San Pablo Ave., Oakland, CA 94608. tel. 1-800-994-8849.

Cost: $18 plus $3.50 shipping (Checks payable to UC Regents.)
Evaluating trap crops for controlling flea beetle in brassicas, and an organic pesticide trial

Richard Smith

Organic growers can experience significant stand and yield losses in broccoli, cabbage and cauliflower due to flea beetle outbreaks. Flea beetles feed ravenously on emerging seedlings or transplants and can kill or severely stunt the developing plant. On California's Central Coast, the potential for damage is greatest on mid- to late-season crops. Our interest in trap crops to control flea beetle damage was spurred by the results of a Canadian study suggesting that flea beetles could be lured from cole crops by cruciferous trap crops that are more attractive to this insect.

The attractiveness of crops in the mustard family to certain species of flea beetles is evidently due to the presence of various volatile mustard oils.

Flea beetle biology in California is not well understood, although we know that they overwinter as adults in the soil, in protected places and along ditch banks. Flea beetles emerge in spring and begin feeding on crops and weeds. Eggs are laid on the soil around plants, and the larvae spend their lives feeding on the underground portions of host plants. Larval feeding generally does not damage host ground portions of host plants. Larval spew their lives feeding on the under

### Table 1. Design and results of trap crop screening trials for flea beetle, 1997.

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<thead>
<tr>
<th>Trial #</th>
<th>Trap Crops Tested</th>
<th>Planting Date</th>
<th>Evaluation Date</th>
<th>Trial Design</th>
<th>Trial Results</th>
</tr>
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<tbody>
<tr>
<td>1 &amp; 2</td>
<td>Mustards: Southern giant, Red giant, Green wave</td>
<td>Mid Jun</td>
<td>Late Jul</td>
<td>20 ft. strips of each of the trap crops were direct seeded in the corner of a broccoli field in an area with known flea beetle populations. Each variety was replicated twice. Vacuum samples were taken from the entire 20 ft. of row.</td>
<td>No improvement was shown in the broccoli stands interplanted with either trap crop, although more flea beetles appeared on the trap crop than the broccoli. Results suggest flea beetles should be killed on the trap crop to keep them from moving back onto the cash crop.</td>
</tr>
<tr>
<td>3 &amp; 4</td>
<td>White mustard: Martigena, Weiber</td>
<td>Mid Jun</td>
<td>Late Jul</td>
<td>100 ft. x 40 in. trap crop strips were planted in four-row sets in arugula, mizuna and tato. Trap-cropped strips were alternated with non-trap-cropped strips, replicated three times. Vacuum samples were taken from 60 ft. of row.</td>
<td>There were dramatic differences in the numbers of flea beetles attracted to green wave mustard and cabbage (P=0.05). Flea beetles were not controlled in this trial and damage to the cabbage not measured; but results suggest if flea beetles were controlled on the trap crop, some reduction of flea beetle populations may be possible. (Fig. 1).</td>
</tr>
<tr>
<td>5 &amp; 6</td>
<td>Green wave mustard</td>
<td>Mid Jun</td>
<td>Mid Jul</td>
<td>70 ft. by 40 in. strips were planted with a single row of green wave transplanted cabbage. Two blocks, eight strips wide were established. Three areas were monitored by vacuum sampling 60 row ft. of: 1) cabbage in immediate proximity to the trap crop; 2) cabbage 100 ft. away from the trap crop; and 3) the trap crop.</td>
<td>Trials were established in broccoli fields with severe flea beetle infestations. No improvement was shown in the broccoli stands interplanted with either trap crop, although more flea beetles appeared on the trap crop than the broccoli. Results suggest flea beetles should be killed on the trap crop to keep them from moving back onto the cash crop.</td>
</tr>
<tr>
<td>7</td>
<td>Mizuna, Green wave mustard</td>
<td>Early Aug</td>
<td>Mid Sep</td>
<td>The following varieties were direct seeded in two strips, 7 ft. x 15 ft.: red giant mustard, green wave mustard, mustard spinach, black mustard, white mustard, canola, tato, mizuna, kale, radishes (white gem, cherry belle and minowase), white lady tupin, Chinese cabbage and pak choi.</td>
<td>In Trial 9, green wave mustard, white mustard, black mustard and red giant attracted the most flea beetles. However, this did not correlate well with visual rating of foliar damage to the trap crop (R2 = 0.004) indicating that vacuuming the flea beetles gives a better measure of the attractiveness of the trap crop to flea beetles. (Fig. 2).</td>
</tr>
</tbody>
</table>

### Project leader:
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### Co-investigator:
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### Cooperaing growers:
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Pat Herbert, Hollister, California
Phil Foster, Hollister, California
Javier Ledesma, Hollister, California

### Project period: 1997-1998

### OFRF support: $2,470
plants. Adults feed on foliage, with feeding damage consisting of round holes 1/16th to 1/8th in. diameter, which, if extensive, give foliage the appearance of being blasted by a shotgun. The damage takes on two forms: 1) severe damage to stands of emerging or transplanted cole crops such as broccoli and cabbage, and; 2) cosmetic damage to closely related crops such as arugula, tatsoi, mustards and mizuna. Depending on environmental conditions and the particular flea beetle species, there may be 1-3 generations per year.

We performed two years of trials evaluating the potential of trap crops to reduce flea beetle damage on organically produced cole crops. In 1997, high flea beetle populations provided an excellent opportunity to evaluate the relative attractiveness of various trap crops. In 1998, using the varieties identified in 1997, trials were conducted to evaluate the potential of trap crops to lure flea beetles from broccoli. An additional trial was established evaluating several organically acceptable chemicals (based on 1997 CCOF standards) for controlling flea beetles: Plant Wash, Trilogy 90 EC, Pyrethrin concentrate: 0.6% pyrethrins, 0.5% oil) and Pyrellin EC (pyrethrin/rotenone fatty acid insecticide), Trilogy 90EC (neem fatty acid insecticide), Plant Wash, Trilogy 90 EC.

1997 Trap Crop Screening Trials

We established nine trials to examine various aspects of using trap crops to attract flea beetles (Phyllotreta sp.) away from cole crops (Brassica oleracea). Each trial was evaluated by vacuuming the trap crop and counting the number of flea beetles in a predetermined length of row. Trial designs and results are shown in Table 1. Green wave and southern giant mustards (Brassica juncea) were highly attractive to flea beetles, and in one trial, were significantly more attractive than cabbage. Cash crops such as arugula (Eruca sativa), mizuna (Brassica rapa ssp. Japonica) and tatsoi (Brassica rapa ssp. Narinosa) were nearly as attractive as green wave and southern giant mustards and therefore trap crops would not be useful to provide them protection.

1998 Trials

Six trials were established in organic broccoli fields. Each trial consisted of trap cropped areas eight 40-in. beds wide by 90 feet long, direct-seeded at the same time as the broccoli. The trap crop, green wave mustard (Brassica juncea), which was selected from the 1997 trials as a highly attractive variety, was planted as a third seed line between the two broccoli seed rows. Trap-cropped areas alternated with 90 ft. of non trap-cropped areas. There were four replications of trap-cropped and non trap-cropped areas. Once the trap crops were large enough, flea beetles were controlled in the trap crop by vacuuming daily with a hand held bug vacuum equipped with a screen to capture flea beetles for subsequent counting and disposal. Our first three trials, planted June 19, July 3 and July 20, did not have sufficient flea beetle populations to warrant vacuuming and damage evaluations. The last three trials (represented as trials 10, 11 and 12 in Table 2) had sufficient flea beetle populations for evaluation. Broccoli seedlings were evaluated in the middle two rows of the trap-cropped area, 2, 4, 8 and 16 rows away from the trap crop. Thirty plants were evaluated at each location, according to the following scale: 1=no holes in the leaves; 2=fewer than 10 holes in the leaves; 3=10-20 holes in the leaves; 4=more than 20 holes in the leaves, and 5=seedling dead from flea beetle feeding. The results from these trials were inconclusive. Slight protection of the broccoli seedlings was seen in one trial and no control was seen in two other trials.

An additional trial was conducted evaluating the efficacy of Plant Wash (a fatty acid insecticide), Trilogy 90EC (neem oil) and Pyrellin EC (pyrethrin/rotenone concentrate: 0.6% pyrethrins, 0.5%...
The trial was established on a commercial organic cabbage field when the plants had 8-10 true leaves, on September 14. Plots were six 40-inch beds wide by 40 feet long. Each treatment was replicated four times and arranged in a randomized complete block design.

Materials were applied at the following rates: Plant wash at 1 gal/acre; Trilogy 90 at 1% v/v; and Pyrellin EC at 2 pts/acre. The materials were applied in 89 gallons of water per acre with a CO2 backpack sprayer. The materials were sprayed on September 14 and reapplied on September 17.

The trial was evaluated by vacuuming flea beetles from the cabbage in a 20 foot strip from the middle two rows on September 15, 17, and 18. All of the materials tested provided some control of flea beetles. Trilogy 90 provided the greatest control of flea beetles (P = 0.05) (Fig. 4).

**Summary**

The trap crop species identified and utilized in these studies appear to be more attractive than broccoli and cabbage to flea beetles (Phyllotreta sp.). However, we did not observe reductions in flea beetle damage in either cabbage or broccoli in trap cropped plots where flea beetles were trapped and removed daily. Evidently, the trap crops are not sufficiently attractive and flea beetle populations are high enough that significant damage occurs to the cash crops in spite of the presence of the trap crop. Similar disappointing results were observed with trap crops in cole crops with other insects. At this point, a mustard trap crop would not be a cost-effective method for controlling flea beetles in broccoli and cabbage in California.

**References**


Flea beetles and brassicas, or...
"please pass the mustard oil."

In his project report, Richard Smith refers to “volatile mustard oils” as the mechanism that attracts flea beetles to brassicas. As it turns out, only certain flea beetle species are attracted to these crops, and the following information about flea beetle species, their behavior, the means of attraction to plants and trap crop management may facilitate experiments with flea beetle trap cropping.

According to Kim Stoner of the Connecticut Agricultural Experiment Station, “The number one misconception about flea beetles is that there is only one kind of flea beetle and that it feeds on many different host plants. This is not true at all. Specifically, the flea beetles that feed on eggplant or tomatoes or potatoes are completely different species from the flea beetles that feed on plants in the cabbage family. Thus, keeping your cabbage family plants far away from your nightshade family plants is not going to improve the management of flea beetles”.

Out of the some 4,000 flea beetle species in the world, perhaps a few dozen are agricultural pests in North America. Most will feed on plants of more than one family, although flea beetle species are fairly host-specific in their feeding habits, and as pests are associated with certain plants or plant families. Table A list some of the most common flea beetle pests in North America, including (limited) information about their geographic distribution, and their known food preferences.

Specialization, a.k.a. “Goldilocks syndrome”?
For those flea beetle species, largely members of the genus Phyllostreta, that are attracted to Brassica crops, how does mustard oil work as an attractant, and how might this attraction be used as a pest management tool?

Mustard oils are isothiocyanates, which are part of a complex mixture of chemicals produced by the breakdown of sulfur-containing compounds called glucosinolates, which are characteristic of plants in the family Brassicaceae. During active plant growth (i.e. in young plants), mustard oil levels may be especially high, as much as 0.7% of plant growth in milligrams dry weight per day, and as insects chew, feeding activity is stimulated further as the oils are released.

There are about seventy known glucosinolate compounds, and their concentrations vary within and between different species and subspecies of *Brassica*. A recent discussion about glucosinolates in *Midwest Biological Control News* by John Masiusas and Catherine Eastman at the University of Illinois refers to a study in which glucosinolate levels were examined in five subspecies of broccoli grown under the same cultural conditions. Among commercial broccoli cultivars, “Brigadier” contained 3.5- and 6.4-fold higher total glucosinolates than ‘Packman’ and ‘Baccus’.

It is thought that glucosinolates act at low concentrations as defences against generalist plant-feeders and as attractants to specialist feeders. But even from a specialist’s perspective more isn’t necessarily better. For example, maximum feeding on naturalized mustards, *Brassica rapa*, by two crucifer insect specialists, the flea beetle *Phyllotreta cruciferae* and the diamondback moth, occurred at intermediate glucosinolate levels.

Eastman and other members of the University of Illinois Entomology team are examining the role of glucosinolates as possible pest management tools. They believe the specific glucosinolates and their concentrations present in certain Brassica cultivars, in combination with correlated resistance factors, might be used to affect populations of some insect pests specializing on crucifer crops. This two-year project, *Glucosinolate-rich crucifer cultivars and mulches as replacements for pesticides*, begins this year and is funded by USDA-CSREES.

To make matters more complex, glucosinolates probably interact with other feeding stimulants or deterrents. For example, the horseradish flea beetle, which feeds only on horseradish (*Armoracia rusticana*), is apparently attracted to glucosinolates in combination with other chemicals found only in that plant. Meanwhile, other flea beetles in the genus *Phyllostreta* are attracted to a particular range of Brassica-family plants, while avoiding others completely. Thus, as J.B. Harborne points out in *Introduction to Ecological Biochemistry*, “These interactions between flea beetles and their host plants recall the hackneyed aphorism: one man’s meat is another man’s poison...while all [brassica-loving] flea beetles enjoy mustard with their meat, they clearly discriminate very precisely between one bitter taste and another.”

**Keys to success with trap crops**

The Ontario Ministry of Agriculture has information on their website about Canadian studies with trap crops in brassicas, based in part on the work (cited by Richard Smith) of Alan McKeown. Canadian researchers have determined that the “best and most practical” trap crop for luring flea beetles from cole crops—based on their growing conditions—is ‘Chinese Southern Giant Mustard’, *Brassica juncea* var. crispifolia.

Some keys to success with this trap crop include the following: “When...
Table A: Common flea beetle pests of North America

<table>
<thead>
<tr>
<th>Order: Coleoptera (beetles) Family: Chrysomelidae (leaf beetles) Subfamily: Alticinae (flea beetles)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common and scientific names</strong></td>
</tr>
<tr>
<td>Western cabbage flea beetle</td>
</tr>
<tr>
<td>W. black flea beetle</td>
</tr>
<tr>
<td><em>Phyllotreta</em> pusilla</td>
</tr>
<tr>
<td>Bronze-colored flea beetle</td>
</tr>
<tr>
<td><em>Phyllotreta</em> albonica</td>
</tr>
<tr>
<td>Crucifer flea beetle</td>
</tr>
<tr>
<td><em>Phyllotreta</em> crucifera</td>
</tr>
<tr>
<td>Striped flea beetle</td>
</tr>
<tr>
<td><em>Phyllotreta</em> striolata</td>
</tr>
<tr>
<td>Tuber flea beetle</td>
</tr>
<tr>
<td><em>Epitrix tuberis</em></td>
</tr>
<tr>
<td>Eggplant flea beetle</td>
</tr>
<tr>
<td><em>Epitrix fuscula</em></td>
</tr>
<tr>
<td>Tobacco flea beetle</td>
</tr>
<tr>
<td><em>Epitrix hirtipennis</em></td>
</tr>
<tr>
<td>Potato flea beetle</td>
</tr>
<tr>
<td><em>Epitrix cucumeris</em></td>
</tr>
<tr>
<td>Palestriped flea beetle</td>
</tr>
<tr>
<td><em>Systena blanda</em></td>
</tr>
<tr>
<td>Sweet potato flea beetle</td>
</tr>
<tr>
<td><em>Chaetocnema confinis</em></td>
</tr>
<tr>
<td>Corn flea beetle</td>
</tr>
<tr>
<td><em>Chaetocnema pulicaria</em></td>
</tr>
<tr>
<td>Grape flea beetle</td>
</tr>
<tr>
<td><em>Altica chalybea</em></td>
</tr>
<tr>
<td>Spinach flea beetle</td>
</tr>
<tr>
<td><em>Disonycha xanthomelaena</em></td>
</tr>
</tbody>
</table>

Sources: Cranshaw, W. Pests of the West; North Carolina State University IPM Website; Kansas State University IPM Website; USDA 1952 Yearbook of Agriculture; Organic Gardener's Handbook of Natural Insect and Disease Control (Rodale); Alternatives to Insecticides for Managing Vegetable Insects; USDA-ARS Palaeartic Flea Beetle website and research team; Kim Stoner, CT Agricultural Experiment Station.

It's worth noting flea beetles identified in the Canadian research are different from the flea beetle pests studied in Richard Smith's California-based project. In the Canadian study, flea beetles represented were mostly crucifer flea beetle (*Phyllotreta crucifera*) and to a lesser degree the striped flea beetle (*Phyllotreta striolata*). Flea beetles present in the California study were probably western cabbage flea beetle (*Phyllotreta pusilla*) and the bronze-colored flea beetle, *Phyllotreta albonica*. Also, the Canadian research group experienced their worst flea beetle problems in early spring, while in the California study damage was greatest in mid- to late-summer. Does the relative attractiveness of different cash and trap crops vary among Brassica-loving flea beetle species? What influence might regional climate and cropping conditions have on the effectiveness and management of trap cropping systems?

Generally, flea beetles are poorly known in this country and it is very difficult to identify them to species. If you'd like to be certain of your flea beetle species, the Systematic Entomology Laboratory at USDA-ARS provides a free insect identification service. They ask that you first try to get an i.d. from your local insect experts, but if you can't be helped locally you can send specimens directly to the SEL. Specimens MUST be prepared correctly. To get an identification request form with instructions, go to www.sel.barc.usda.gov/selhome/requests.htm, or contact Pete Tuohy, USDA-ARS, Systematic Entomology Laboratory, ptouhey@sel.barc.usda.gov, tel. 301-504-7041. —EW, with thanks to Woody Dreyer, Kim Stoner and Helen Athouse for their contributions.

References


Livestock management on organic farms: A survey of issues and farm-tested solutions

Anne Macey & Susan Grace

This survey was undertaken to obtain information for a publication on organic livestock management: The Organic Livestock Handbook. As much as possible, Canadian Organic Growers wanted to base the book on farmers’ experience, to make sure it addressed the issues being faced by organic producers in Canada as well as providing useful practical information for those who want to convert from a conventional to an organic livestock operation. The main purpose of the survey was to identify the constraints to organic livestock production and the methods used successfully to overcome these problems.

In January 1998 questionnaires were sent to a total of 280 producers—238 in Canada and 42 in the northern U.S.—including both certified livestock producers and certified producers who had a non-certified livestock component on their farm. Producers were asked to rate different constraints or problems, as well as various management practices. We also invited producers to elaborate on their responses to encourage them to describe key elements of their production systems.

We also conducted in-depth telephone or in-person interviews with selected farmers representing the various types of livestock production and several of these are documented as case studies in the Organic Livestock Handbook.

Survey Results

The response rate was 26%, with 73 questionnaires returned, 14 of these from the U.S. (a higher rate of return than received from Canadian farmers). Though sample sizes for each type of enterprise were relatively small, useful information was obtained. A wide range of informative comments were received in response to open ended questions.

Beef. We received 39 responses from beef producers, 20 certified organic. Herd size ranged from 4 to 340 with an average of 77. Nine different breeds were represented. There was also one bison herd. Reasons for not certifying included “no or limited market for organic beef,” “organic standards too stringent,” “no known alternatives for dealing with lice and pneumonia,” and “can make more money selling grain than feeding it to our cows.”

Considered less serious constraints were herd health and cost of production. Of the health problems, external parasites were a serious problem for three producers, and less of a problem for 13 (33%); mineral deficiency problems affected nine producers. Rotational grazing is important for parasite control for 28 (72%) producers. Diatomaceous earth is used often by 13 (33%) and occasionally by eight (20%). Vaccinations are used regularly by 14 producers, antibiotics occasionally by 10 and as a last resort by 12. Very few producers use alternative health care methods. One that does wrote, “We have used homeopathy with a great deal of suc-

---

**Dairy - Organic production constraints**

<table>
<thead>
<tr>
<th>Identify the following as...</th>
<th>(%) of producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>...A serious constraint:</td>
<td></td>
</tr>
<tr>
<td>Lack of supporting vet</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>Lack of processing facility</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>Marketing</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>Marketing regulations</td>
<td>4 (27%)</td>
</tr>
<tr>
<td>...A modest constraint:</td>
<td></td>
</tr>
<tr>
<td>Feed availability</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>Lack of information</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>Cost of production</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>...Serious health problems:</td>
<td></td>
</tr>
<tr>
<td>Mastitis</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>...Moderate health problems:</td>
<td></td>
</tr>
<tr>
<td>Milk fever</td>
<td>5 (33%)</td>
</tr>
<tr>
<td>Fertility</td>
<td>5 (33%)</td>
</tr>
</tbody>
</table>
There appear to be few health problems in poultry layer operations, although coccidiosis, external parasites and cannibalism were each rated as a serious concern by one producer. Coccidiosis is a serious problem for two broiler producers, with cannibalism and leg problems being moderate problems for five producers. Access to the outside, increased use of pasture, good air circulation, deep bedding, clean water and balanced rations were all mentioned as key factors for good health. Diatomaceous earth is regularly used for parasite control by six producers, and for cannibalism one producer suggested hanging a net bag filled with high protein alfalfa/clover hay for birds to peck.

**Other livestock enterprises.** Eleven farmers, three of them certified, raised pigs, and herd size ranged from six to 400. The main constraints were the supply of organically raised feeder pigs, lack of a local, certified abattoir and “consumers are unwilling to pay a premium for organic pork.” Internal parasites seemed to be a slight problem for several producers, mineral deficiencies and diarrhea more serious problems for one farm each.

Information on goats was supplied by seven farmers but none claimed organic certification. Availability and suitability of organic feed seemed to be the main constraint. Internal parasites, clostridial disease, foot rot, and mineral deficiencies were all serious problems for at least one producer. Three producers relied on conventional dewormers and two on botanicals.

**Beef - organic production constraints**

<table>
<thead>
<tr>
<th>Identify as a major constraint:</th>
<th># (% of respondents who are:</th>
<th>Considering organic</th>
<th>In transition</th>
<th>In ongoing organic production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of information</td>
<td>10 (26%)</td>
<td>7 (18%)</td>
<td>4 (10%)</td>
<td></td>
</tr>
<tr>
<td>Incomplete standards</td>
<td>10 (26%)</td>
<td>8 (20%)</td>
<td>6 (15%)</td>
<td></td>
</tr>
<tr>
<td>Feed availability</td>
<td>10 (26%)</td>
<td>7 (18%)</td>
<td>6 (15%)</td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>9 (23%)</td>
<td>5 (13%)</td>
<td>14 (36%)</td>
<td></td>
</tr>
<tr>
<td>Lack of processing/slaughter facilities</td>
<td>11 (28%)</td>
<td>9 (23%)</td>
<td>16 (41%)</td>
<td></td>
</tr>
</tbody>
</table>

**Sheep - organic production constraints**

<table>
<thead>
<tr>
<th>Identify as a major constraint:</th>
<th># (% of respondents who are:</th>
<th>In</th>
<th>In ongoing organic production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic feed availability</td>
<td>7 (32%)</td>
<td>8  (36%)</td>
<td>8 (36%)</td>
</tr>
<tr>
<td>Lack of processing facilities</td>
<td>6 (27%)</td>
<td>8  (36%)</td>
<td>8 (36%)</td>
</tr>
<tr>
<td>Lack of information</td>
<td>5 (23%)</td>
<td>2 (11%)</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Health problems</td>
<td>--</td>
<td>3 (14%)</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Cost of production</td>
<td>--</td>
<td>3 (14%)</td>
<td>1 (5%)</td>
</tr>
</tbody>
</table>

**Poultry - organic production constraints**

<table>
<thead>
<tr>
<th>Identify as a major constraint:</th>
<th># (% of respondents who are:</th>
<th>Layers</th>
<th>Broilers</th>
<th>Layers</th>
<th>Broilers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed availability</td>
<td>5 (28%)</td>
<td>5 (25%)</td>
<td>3 (17%)</td>
<td>7 (35%)</td>
<td></td>
</tr>
<tr>
<td>Lack of information</td>
<td>3 (17%)</td>
<td>4 (20%)</td>
<td>--</td>
<td>1 (5%)</td>
<td></td>
</tr>
<tr>
<td>Incomplete standards</td>
<td>--</td>
<td>3 (15%)</td>
<td>--</td>
<td>5 (25%)</td>
<td></td>
</tr>
<tr>
<td>Cost of production</td>
<td>2 (11%)</td>
<td>3 (15%)</td>
<td>--</td>
<td>3 (15%)</td>
<td></td>
</tr>
<tr>
<td>Flock Health</td>
<td>3 (17%)</td>
<td>--</td>
<td>1 (5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing regulations</td>
<td>2 (11%)</td>
<td>2 (10%)</td>
<td>3 (17%)</td>
<td>6 (30%)</td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>2 (11%)</td>
<td>--</td>
<td>3 (17%)</td>
<td>2 (10%)</td>
<td></td>
</tr>
<tr>
<td>Lack of processing facility</td>
<td>--</td>
<td>4 (20%)</td>
<td>--</td>
<td>7 (35%)</td>
<td></td>
</tr>
<tr>
<td>Vermin</td>
<td>3 (17%)</td>
<td>2 (10%)</td>
<td>2 (11%)</td>
<td>5 (25%)</td>
<td></td>
</tr>
<tr>
<td>Ration formulation</td>
<td>--</td>
<td>2 (11%)</td>
<td>2 (10%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Research Reviews**

**Sheep.** Only 6 of the 22 flocks were certified, with expense, direct marketing, parasite problems and feed availability being cited as reasons for not certifying. Sixteen different breeds were represented, with Dorsets being the most common. Common concerns were the “lack of good alternative health care information” and “unreasonable standards.” Health problems were rated as a major constraint by two producers with large flocks; internal parasites were rated as a serious problem by 41% of producers with large flocks; internal parasites were rated as a major constraint by two producers with large flocks; internal parasites, clostridial disease, and 36% relied on colostrum to stimulate immortality. Herbal remedies were used occasionally by 32%, antibiotics occasionally by 27% and as a last resort by 41%. Use of homeopathic remedies is uncommon with only four producers reporting occasional use.

**Poultry.** For layers we received 18 responses, with eight of those certified organic. Two flocks were reported with over 2000 birds and 10 with fewer than 100. Of the 20 broiler producers who responded, six were certified and production levels range from 50 to 60,000 birds/year. Giant Cornish was the most common breed.

Feed quality, cost and size seem to be the major reasons poultry growers choose not to certify their flocks. “Demand for organic grain outstrips the supply.” Other constraints are the quota system and lack of availability of organically raised pullets which means flocks have to go through a 3- or 4-month transition before eggs can be certified. While certification standards of some organizations make allowances for the limitations of the Canadian climate, others are more restrictive, causing producers to state, “standards stating that birds must have access to the outdoors are unreasonable for those wanting to raise birds year round to meet market demands.”
Sources of information

One of the final questions in the survey asked farmers where they get information related to organic production. Dairy and beef farmers were more likely to get their information from other farmers, either directly or through farm tours, whereas sheep farmers were the most likely to get information from books and magazines. It would appear that very few farmers are using the internet and that consultants and government extension are the least likely sources of information.

Conclusions

Results of this survey indicate that it is the marketing problems (marketing board regulations, lack of processing facilities, lack of markets, “consumers aren’t willing to pay the real price of organic production,” etc.) which are perceived as the major constraints to further development of the organic livestock sector. Availability of certified feed is also a significant factor, particularly for poultry and dairy operations. As regards husbandry methods, the biggest challenge is dealing with internal parasite problems in sheep flocks; otherwise, producers appeared to be confident that health problems were minimal if one followed organic principles.

Preventing health problems - all livestock

<table>
<thead>
<tr>
<th>Enterprise</th>
<th>Nutrition</th>
<th>Pasture access/management</th>
<th>Stress prevention</th>
<th>Housing</th>
<th>Closed flock/herd</th>
<th>Stocking rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>14 (93%)</td>
<td>13 (87%)/10 (66%)</td>
<td>12 (80%)</td>
<td>11 (73%)</td>
<td>7 (46%)</td>
<td>6 (40%)</td>
</tr>
<tr>
<td>Sheep</td>
<td>20 (95%)</td>
<td>18 (86%)/20 (95%)</td>
<td>17 (81%)</td>
<td>15 (71%)</td>
<td>8 (38%)</td>
<td>15 (71%)</td>
</tr>
<tr>
<td>Beef</td>
<td>35 (89%)</td>
<td>27 (69%)/33 (85%)</td>
<td>27 (69%)</td>
<td>23 (59%)</td>
<td>21 (54%)</td>
<td>23 (77%)</td>
</tr>
<tr>
<td>Poultry</td>
<td>14 (77%)</td>
<td>10 (55%)</td>
<td>10 (55%)</td>
<td>14 (77%)</td>
<td>--</td>
<td>8 (44%)</td>
</tr>
<tr>
<td>Broilers</td>
<td>16 (80%)</td>
<td>11 (55%)</td>
<td>14 (70%)</td>
<td>15 (75%)</td>
<td>--</td>
<td>12 (60%)</td>
</tr>
</tbody>
</table>

The Organics Livestock Handbook is much more than a compilation of survey results. Based in part on the results of Anne Macey’s livestock producers’ survey, it is a reality-based guide to organic livestock production in North America. Well organized and honest in approach, the Handbook doesn’t attempt to provide “all the answers,” choosing to present organic production challenges at face-value and offering experience-based solutions. The Handbook is thoughtful, well conceived and executed, and loaded with anecdotes, resource lists, photos and supplemental figures. It is a good introduction to producing livestock organically—a welcome addition to available resource materials dedicated to organic farming practices.—EW

Section 1 covers the principles underlying organic management practices and includes chapters on animal welfare, nutrition, health care and converting to organic methods.

Section 2 introduces management tools: health care alternatives, methods to control internal parasites, management intensive grazing, manure management, fly control, handling to minimize stress, marketing, certification and record keeping.

Section 3 provides case studies from Canada and the northern U.S. to illustrate the various types of organic livestock enterprises that exist today—from dairy cows to honey bees.

Appendix materials include a comparison of various organic livestock standards and information on where to find supplies and services. 179 pages, the handbook is spiral bound with a durable cover similar to its companion volume produced by Canadian Organic Growers, the Organic Field Crop Handbook.

Copies are available from:
Canadian Organic Growers
P.O. Box 6408, Station J
Ottawa, Ontario, Canada K2A3YC

Costs and shipping
To the US: $29.45 (US currency, includes postage, personal checks in US funds are OK)
To Canada: $25.95 (Canadian currency), or $22.95 to COG members, plus $3.50 postage.
Mass trapping western spotted cucumber beetles

William Olkowski, Ph.D.

Cucumber beetles in the genera Diabrotica and Acalymma are major world-wide pest problems. In California the principle species is the western spotted cucumber beetle (WSCB), Diabrotica undecimpunctata. WSCB develops in wild grasses and in the spring adults migrate to near-by fields, causing damage to cucurbits (cucumber, melon, squash and pumpkin) and other crops. On most farms, WSCB are only severe in certain years. The reasons for population fluctuations are not well understood, and levels for any given year are difficult to predict. For most organic farms these beetles are tolerable in most years, however in certain seasons beetle damage to seedlings essentially destroys the crop, and some help in reducing beetle numbers may mean the survival of a crop. Examples are beans and early season cucumbers. For organic growers, no biological commercial products are available to adequately prevent intolerable WSCB damage.

Trapping WSCB has the potential to reduce adult beetle populations significantly. However, all sticky traps currently on the market have a limited trapping capacity and are costly. These characteristics make growers unlikely to try mass trapping. However, a low-cost trap with a high catch capacity could bring mass trapping within the reach of many growers.

After two years of research on effectiveness of mass trapping WSCB in cucumbers, we conclude that the best control for this insect involves an integrated management program. Optimum management designs have yet to be developed, but will probably include scouting, using alfalfa strips as a trap crop and as a resource for beneficial insects, mass trapping, and perhaps selective vacuuming.

Two years of studies were done in 1997 and 1998 to evaluate the effectiveness of mass trapping WSCB in cucumbers and melons. This report focuses on trap design, effectiveness, and cost efficiency. The first year, seven trap types were evaluated. The second year, a refinement of the best trap design was studied.

This research was conducted at James Durst’s Hungry Hollow Farms in Esparto, CA. The farm has about 500 certified organic acres. The most critical WSCB problems are damage to early cucumbers and fall pumpkins and squash. In 1996, WSCB destroyed about one-third of the total cucumber crop and contributed to the abandonment of approximately 80 acres of beans.

**YEAR ONE: 1997**

During the 1997 season, we examined seven trapping arrangements: two types of commercially available frame traps, three strip trap arrangements, and two types of non-commercial frame traps. The non-commercial frame traps were handmade; the “Durst” trap was constructed by the grower of iron rebar, and the “BIRC” trap was constructed by employees of the Bio-Integral Resource Center, mainly of 2”x4” lumber and electrical conduit. All trapping systems use some form of 6-in. yellow double-sided sticky tape as a trapping surface (some 3-in. strips were also tested), which is dispensed on spools. Key elements to each system are the means to keep tape under tension, and the mechanics of rolling up used tape onto the take-up spool.

As an additional experiment, two 100-ft. long, transparent, colorless plastic strips were coated with Seabright’s proprietary sticky material, Hi-Tack™, were tested to determine whether a clear material attracts fewer beneficial insects than yellow strips. This material was tested with the non-commercial Durst frame trap.

The following discussion is based on trap designs and tests summarized in Table 1, which took place in cucumber and melon fields.

**Discussion**

**Insect-A-Peel.** This trap was easy to set up, and trapping efficiency was comparably good, but the total number of beetles trapped was low due to the small surface area. The trap was difficult to service—spools fell off easily. Traps were hard for equipment operators to see in the field and were easily damaged during cultivation. These traps were particularly attractive to honeybees. Cost per beetle trapped (see Table 3) is based on the cost of the sticky ribbon. Initially, frame cost ($40.00) should be factored in, and amortized over projected trap life. The high cost of the cylindrical sticky ribbon (especially without an apparent increase in trapping efficiency), makes this trap less cost-effective in an agricultural setting.

**Western Farm Service trap.** Due to its high initial cost, only one trap was deployed. Trapping efficiency was comparable to the other traps, but uneconomical for large-scale settings. Even using the least expensive Hopperfinder™ ribbon would not substantially offset the high cost of this trap. When set at a 45-degree angle with the lower end of the trap at plant canopy height, and the upper trap end about 5 ft. above plant canopy, only the lower 1-2 feet caught beetles, while the upper portion caught lacewing adults.

**Strip traps.** The strip traps were efficient, with a high trapping capacity. Approximately 3,000 beetles were trapped in 30 days in an area about 0.02 acres in size (Table 2). The traps proved easy to deploy but required a minimum of two people. An advantage of the
Hopperfinder™ tape is that it comes on 1,500-ft. rolls. However, it is significantly less sticky and less thick than the Seabright™ strips, making it necessary to stake it at more frequent intervals. The high cost per beetle trapped on Hopperfinder™ is due to the lack of stickiness that allowed beetles to escape. For these reasons, the Hopperfinder™ strip was discontinued and the remainder of the test was conducted with the Seabright™ strips. But Hopperfinder™ may have some economic advantages because it is the least expensive of all the ribbon traps. The Seabright strips were coated with a “Hi-Tack” formulation which is stickier and more expensive than their standard Stikem Special™ coating. We did not test the standard formulation to determine whether it would adequately trap and hold cucumber beetles.

In general, tape surfaces remained adequately sticky for an average of 10 days but this figure could be as high as 14 days or as low as 7 depending on environmental factors such as dust, rain, and catch. Because of the large surface area, many beneficials were also caught. 367 ladybird beetles and 162 lacewings were caught on the various sticky traps. Other beneficials that were caught included very small numbers of parasitic wasps, syrphid and tachinid flies. There was approximately one beneficial caught for every six cucumber beetles caught on all the traps.

Strip trap WSCB trap counts indicate that catches of this magnitude would protect plants from damage. The number of beetles found on plants was low both in and near the trapping area. This fact in conjunction with the lack of fruit damage suggests that the population of beetles was impacted by the traps.

The greatest numbers of WSCB were caught on the side of the sticky ribbon closest to the plants, independent of the north or south orientation of the surface. Beetles might first be keying on the green plant and then on the yellow, which is about the same color as the blossom. If this phenomenon holds true in subsequent testing, it could influence trap design.

**Durst traps.** This trap was designed for mobility and easy deployment in areas of high beetle activity. The traps were placed June 26 and serviced weekly from July 2 to Aug. 8. At each service date, the beetles and beneficials were counted and the sticky ribbons were advanced to reveal new sticky surfaces.

Between June 26 and August 8, 5,227 beetles were trapped. Uniformly, the highest catches were on traps in the west and northwest positions, located downstream of alfalfa fields. With three exceptions, the
Table 2. Trap catches of western spotted cucumber beetle in cucumbers, 1997.

<table>
<thead>
<tr>
<th>Trap</th>
<th>Total # beetles</th>
<th># beetles/ft²</th>
<th>Low/High catch/ft²</th>
<th>Total trapping area (ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insect-A-Peel™</td>
<td>220</td>
<td>10.5</td>
<td>1.5/11.5</td>
<td>22</td>
</tr>
<tr>
<td>Western Farm Service w/Seabright™ tape</td>
<td>45</td>
<td>9.8</td>
<td>--</td>
<td>5</td>
</tr>
<tr>
<td>Hopperfinder™</td>
<td>8</td>
<td>0.2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Seabright™ double row</td>
<td>804</td>
<td>11.5</td>
<td>0.5/18</td>
<td>70</td>
</tr>
<tr>
<td>Seabright™ single row</td>
<td>1,954</td>
<td>6.6</td>
<td>3.0/11.7</td>
<td>298</td>
</tr>
<tr>
<td>Total</td>
<td>3,031</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Comparative cost efficiency of traps and sticky tapes, 1997.

<table>
<thead>
<tr>
<th>Trap</th>
<th>Cost/trap ($)</th>
<th>Cost/sticky ribbon ($)</th>
<th>Cost/ft² surface area ($)</th>
<th>Cost/beetle trapped ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seabright™</td>
<td>--</td>
<td>15.00</td>
<td>0.15</td>
<td>0.022</td>
</tr>
<tr>
<td>Hopperfinder™</td>
<td>--</td>
<td>40.00</td>
<td>0.03</td>
<td>0.145</td>
</tr>
<tr>
<td>Insect-A-Peel™</td>
<td>40.00</td>
<td>30.00</td>
<td>0.60</td>
<td>0.061</td>
</tr>
<tr>
<td>Durst trap</td>
<td>12.00</td>
<td>15.00</td>
<td>0.15</td>
<td>0.012</td>
</tr>
<tr>
<td>BIRC trap (1997)</td>
<td>9.00</td>
<td>15.00</td>
<td>0.15</td>
<td>--</td>
</tr>
<tr>
<td>Western Farm Service</td>
<td>150.00</td>
<td>15.00</td>
<td>0.15</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 4. Trap catches of WSCB on clear vs. yellow sticky tape, 1997.

<table>
<thead>
<tr>
<th>Trap catches</th>
<th>Clear</th>
<th>Yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper WSCB catch</td>
<td>304</td>
<td>161</td>
</tr>
<tr>
<td>Lower WSCB catch</td>
<td>102</td>
<td>268</td>
</tr>
<tr>
<td>Total WSCB catch</td>
<td>406</td>
<td>429</td>
</tr>
<tr>
<td>Ladybird beetle catch</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td>Lacewing catch</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Parasitic wasp catch</td>
<td>3</td>
<td>14</td>
</tr>
</tbody>
</table>

upper ribbons trapped more beetles than the lower ribbons. The bottom of the upper ribbons (6 in. wide) was 10 in. above the plant canopy. The highest catch was recorded on July 31 for the previous 7 days. From July 31 to Aug. 8, the number of beetles trapped declined rapidly. This was in part due to large numbers of alfalfa butterflies that very quickly occupied all of the sticky surfaces of the traps. At the same time, the traps began to catch enormous numbers of leafhoppers. To make a sticky surface area available to trap beetles under these conditions, the traps would require servicing 1-2 times each day. The traps were easy to move and service, but could be made more serviceable with the addition of a crank.

If Hopperfinder™ ribbon could obtain comparable catch counts with the Durst trap at $0.03/ft², the cost per beetle trapped would drop to $0.0024, the lowest of all materials tested (Table 3).

**BIRC trap.** This trap provided the greatest trapping surface area of any of the moveable traps (including the two commercial traps) and was the easiest to change and move. Evaluating catches was difficult, however. The trap was deployed when alfalfa butterflies were in great abundance and was quickly filled to the extent that it was impossible to accurately evaluate the number of cucumber beetles caught. The BIRC trap was set up too late to do an accurate economic assessment, but initially we knew its initial cost is less and ease of use is greater. It is the most cost efficient for the following reasons: 1) it provides the greatest surface area per unit cost (materials and labor); 2) to move an equivalent surface area with the other traps requires more time and labor; and 3) it could be easily adapted for mechanized (solar-powered), automatic winding of the strips.

**Clear versus yellow sticky tape.** To determine whether clear strips would be less attractive to natural enemies than the yellow tape, a side-by-side comparison was conducted on the Durst frame. Two traps were set up: trap 1 had a clear strip in the upper position and a yellow strip in the lower position, while trap 2 had a yellow strip in the upper position and a clear strip in the lower position. The traps were also placed in the NW corner of the melon field on June 26. Table 4 shows the catch of cucumber beetles and beneficials on the clear and yellow strips.

These results indicate that while more cucumber beetles were caught on the yellow strips, fewer natural enemies were caught on the clear strips. This phenomenon might be greatly enhanced by the addition of a feeding or sex lure to the clear strips. At present, there is no effective lure for the Western cucumber beetle. (BIRC conducted studies using extracts of red-rooted pigweed [Amaranthus retroflexus], but found that while the plant was highly attractive to the cucumber beetle, the extract was not.)

**Conclusions**

The cost of pre-coated yellow sticky tape in general is quite high. Depending on a number of factors, the traps remain sticky for 10-14 days before they must be renewed. There is no current technology to clean and recoat traps in the field. To replace traps several times in the season would quickly become economically unfeasible. The 1997 data suggested that if the moveable, grower-constructed traps are placed strategically early in the season, it would be possible to trap enough beetles to prevent significant crop damage. This configuration would cost $60/acre for materials. The economic feasibility of trapping beetles depends on the cost of materials and labor relative to the value of the crop.

There are also biological factors that influence feasibility, the most important of which appears to be the proximity of alfalfa that can harbor both beetles and butterflies, which in great numbers drastically decrease the life of sticky tape. Alfalfa management could reduce the importance of this factor.

**YEAR 2: 1998**

In 1998 BIRC tested a refinement of the BIRC trap design, which proved most promising in the previous year’s trap comparison. The 1998 BIRC trap design is inexpensive to build and operate, and has a virtually unlimited catch capacity. The low cost means many traps can be used in a particular setting. This trap also has the potential for use against other insects if...
the proper lure or attractant is available. The trap is drawn as it was used in 1998 (Fig. 1). Ten traps were deployed, at a cost of $200.00. The cost per trap was $20, plus 4.2 hours construction time. With some practice the construction time could be reduced to two hours per trap.

**Trap description.** Each trap consists of a 10-ft. length of 2x4 lumber, with 3-in. pieces of 4x4 lumber attached to each end. Aluminum legs are attached to the 4x4 pieces with two carriage bolts. Holes (9/16 in.) were drilled into the 2x4, seven inches from each end. 1/2-in. steel rods were inserted through these holes so as to leave about 1/2 the length extended from both sides.

**Mounting rods & reels.** Each trap held two 1,000 foot rolls of Hopperfinder plastic yellow sticky tape (about $40 per roll—bulk purchases could significantly reduce this cost) and two empty take-up reels—one set above the wood 2x4 frame, one below. Placed over the threaded steel rod, the reels are held in place with a washer and nut (Fig. 2B).

Take-up reels (Fig. 2D) were smooth steel rods, over which 1/2-in. aluminum conduit was placed. The conduit was held down with a cotter pin inserted through the steel rod. (Threaded rod would be an improvement in place of this design, as it would allow for firm mounting, although it would increase the cost somewhat.)

**Guide rods and tape guide units.** Three 1-1/4 in. holes were drilled through the 2x4 for the tape guide units. These units were composed of two 16-in.-long steel rods (not threaded) held 1/2 in. apart for passage of the sticky tape. Holding them in place apart is a piece of hardwood, (1/2 in. thick, 6 in. long by 2 in. wide), through which two 1/2-in. holes were drilled, 1/4 in. apart (Fig. 2C). The rods were hammered through while mounted on a vise. One side is installed first, then assembled onto the 2x4, then the other wood piece may be installed. A piece of plastic or baling wire may be used to hold the two rods together. This detail is important, as these guides hold the tape against the wind over a stretch of five feet.

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**Fig. 1. The BIRC sticky trap, 1998.**

**Fig. 2. Design details.**

**Fig. 3. Suggested design changes**
After the tape is passed between the rods, the rod units are turned to hold the tape under tension. Applying this tension allows the tape to be held at a distance of five feet between rod units. Without this guidance under tension, the tape could not effectively span the ten-foot distance. The guide units are held against the 2x4 with large 1-in. butterfly (binder) clips, available in any office supply store.

While a 10-ft. 2x4 was used in this study, other longer lengths are possible, but a maximum sticky-tape length of five feet between guide units is recommended. Aluminum conduit was selected for the legs because it is readily available as recycled scrap and is inexpensive. Wooden legs could be substituted.

**Design limitations and suggested improvements**

The trap was originally designed with a pivoting function so that the entire 2x4 frame could turn on its attachment-bolt. The objectives of a turnable trap were: 1) to test various angles of the trapping surface for beetle catch; and 2) to facilitate servicing, because the lower spools are difficult to access. The trap could be spun so that the lower reels were upright, and then returned to its original—or an adjusted—catch position. This is an excellent arrangement, however twice during the trapping period a trap was found blown over by the wind. Options to alleviate this problem include: 1) development of solid plywood legs (Fig. 3A); or 2) development of a modified aluminum leg system, with wood support pieces (Fig. 3B). These options would not allow the frame to pivot, but could prevent the trap frame from twisting and falling over.

Near the end of the season we experimented with handles attached to both the dispenser and take-up reels, to facilitate the unwinding/winding process to expose new tape (Fig. 3C). With the handles it is much easier to service the tape—and though it is easier with two people, can be accomplished with some additional effort by one person. Without the handles it is a very sticky job of grabbing and pulling the tape by hand—latex gloves made this as tolerable as possible.

Other improvements might include making the overall trap height adjustable so both upper and lower reels could produce efficient catches—in particular getting the lower reel up higher so its lower edge is at canopy height. If the entire trap were adjustable it could be changed as the crop grew or as the traps moved to different crops. Best trap catches would occur just above the plant canopy and maybe one foot higher. Any higher trap placement would catch more lacewings than beetles.

Although both the western spotted and striped cucumber beetle were caught in this trap, the spotted predominated at the Durst Farm and would probably do so throughout the state. Apparently the yellow color of the sticky tape is the attractive element. Previously, considerable effort was expended to evaluate an attractant chemical provided by Consept (Oregon) in 1997, to no avail. It seems that the western spotted cucumber beetle is not attracted to a lure that appears to work for eastern species. Consequently, trap development proceeded without a chemical lure or attractant. If and when such an attractant became available, it would make this trap much more effective.

**1998 Beetle Catches**

The 1998 season in Yolo County where the field tests were conducted was not a heavy year for cucumber beetles. The traps were placed around a squash field, and although the traps performed well, the level of damage to squash blossoms was not serious enough to determine the efficacy of the traps as a protective management tool. The placement of the ten traps are shown in Fig. 4, and catches of each of the ten traps are summarized Table 5. The most important findings from the 1998 trapping season are: 1) the trap worked to capture a large number of beetles and provided some important observations on the biology of the beetles; 2) certain trap design features need to be changed to improve serviceability; and 3) trap location is critical to improving trap catches.

**Table 5. Cucumber beetle catches at Durst Farm, 23-Jul to 16-Sep, 1998.**

<table>
<thead>
<tr>
<th>Trap #</th>
<th>Total WSCB catch, by trap</th>
<th>Avg. catch per wk, over 7 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>608</td>
<td>87</td>
</tr>
<tr>
<td>2</td>
<td>303</td>
<td>43</td>
</tr>
<tr>
<td>3</td>
<td>1346</td>
<td>224</td>
</tr>
<tr>
<td>4</td>
<td>710</td>
<td>101</td>
</tr>
<tr>
<td>5</td>
<td>762</td>
<td>127</td>
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<td>6</td>
<td>597</td>
<td>85</td>
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<td>7</td>
<td>619</td>
<td>103</td>
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<tr>
<td>8</td>
<td>475</td>
<td>68</td>
</tr>
<tr>
<td>9</td>
<td>632</td>
<td>158</td>
</tr>
<tr>
<td>10</td>
<td>680</td>
<td>113</td>
</tr>
<tr>
<td>Total</td>
<td>6,732</td>
<td></td>
</tr>
</tbody>
</table>

**Interpreting beetle captures.** In 1998 the BIRC trap was tested for effect of WSCB flight direction and height of beetle flight on trap catch. For the first two trapping periods, both the upper and lower spools of sticky tape were operated. Afterwards the lower spool was discontinued because it caught significantly fewer
beetles and because it was difficult to service due to its inaccessibility. (Catch figures in Table 5 are adjusted in the first two trapping periods to include only data from the upper spool.)

Almost 7,000 beetles were captured during the WSCB flight season, which started about the first week in July and ended by the second week in September. The greatest number of beetles were captured by the upper roll, at a distance of 20- to 26-in. above the soil. The melon crop grew to approximately 6 in., thus the trapping surface was about two feet above the crop. A maximum capture of 512 beetles on Aug. 27 indicates that 51.2 beetles were caught per square foot (10ft.² of ribbon—including both sides). The highest catch in 1997 when different traps were compared was 11.5 beetles/ft². Based on these figures, trap efficiency was improved five-fold over 1997.

**Flight direction and peaks in beetle capture.** The direction of beetle movement toward the trapping surface tells an important story about trap location and the source of beetles. There were two peaks in catches per active trap, July 30 and Aug. 27. The Aug. 27 peak is associated with a large alfalfa field being cut to the west of the main line of traps.

Overall, the traps closely adjacent to the alfalfa field caught the most beetles. The migration from alfalfa into cucumber and squash fields was most pronounced during periods of alfalfa cutting. Corn is another source of adult beetles, but it was difficult to compare alfalfa and corn as beetle sources in this study. However, it is likely that each operated as a source, corn being a source from which the beetles migrate out and alfalfa a source where beetles migrate in until it is cut, when they migrate out. Alfalfa is cut about every 4-6 weeks, so the peaks could be related to alfalfa cutting or generation times and emergence of adults. This possibly indicates the existence of two generations. These capture figures alone cannot distinguish amongst these possibilities.

**Natural enemy captures.** The down side of this trap is that the yellow sticky surface catches natural enemies as well as the beetle pests. The most common natural enemies captured are lady beetles, especially *Hippodamia convergens*. Green lacewings, *Chrysoperla carnea*, are the next most captured species. Others observed include brown lacewings, various Tachinids, Ichneumonids and Braconids, among the more obvious of those captured.

In general, the loss of natural enemies should not be tolerated nor recommended. Methods to enhance natural enemies ought to be a priority. However, in specific cases and with careful use, the loss of trapped natural enemies may be tolerable compared to insecticide use, which would kill many more natural enemies. In our studies, the ratio of pests trapped to natural enemies was low and may be an acceptable tradeoff. For example, the trap catches listed for Aug. 27 when the highest number of WSCB was captured (1669, or 185 per trap), 43 ladybeetles were captured, mostly *H. convergens*. The ratio of pests to beneficials captured is 39:1.

On the Durst ranch there is no problem with aphids, the principle prey of *H. convergens*. Besides WSCB and squash bugs, this farm has no other important pest problems. Minor pests include flea beetles on eggplant and *Blapstinus* beetles which attack seeds and small seedlings in the larval and adult stages. All the surrounding farms are treated with conventional materials. Alfalfa is the principle source of most of the natural enemies on this farm. The total alfalfa acreage is 100-200 acres each year. So, the loss of a very small number of ladybeetles and a smaller number of other natural enemies is tolerable.

**Conclusions**

The trap design has been shown to be effective at catching large numbers of beetles, up to 50 per ft². Higher numbers and greater efficiency in beetle capture may be possible in years when beetle numbers are much higher. In 1998, beetle populations were not high, judging by farmer observations and our own field work in Yolo County between 1994 and 1998. Design changes could make the BIRC trap more effective. The trap is useful in study of beetle flights and sources and possibly in adult beetle population reduction. Further study is needed to determine whether mass trapping could be useful in various settings. The most important finding of this work is the influence of alfalfa on beetle concentrations. Alfalfa harbors large numbers of WSCB. Alfalfa is not known to be a source of developing WSCB populations (i.e. a place of larval development), but is a food source for adults. The feeding damage to alfalfa leaves by adult beetles is evident but just how much loss is uncompensated by alfalfa plants is unknown.

Work by Everett Dietrick in Santa Barbara County shows that strips of alfalfa between various commercial vegetable crops could be used as a resource for beneficial insects and as a trap crop for WSCB¹. The significance of our observations based on working with this trap need to be further elaborated into an overall control program for adult beetles. Alfalfa strips and vacuuming can both offer control of adult beetles and a source of natural enemies for overall biological control on the farm. When alfalfa is cut and the cucumber beetles migrate out into surrounding crops, use of BIRC traps offers an opportunity to capture these pests. This would be most valuable when adjacent susceptible crops are in the most sensitive periods of growth, such as emergence and blooming.


Dr. Olkowski submitted separate reports for his first and second year results, which may be obtained from OFRF. The first year report (#97-11) is 13 pp, including 7 figures. Year-two results (#98-10) are 14 pages, including 4 figures.
Comparison of nitrate content in leafy vegetables from organic and conventional farms in California

Joji Muramoto

The potential health hazards of human nitrate intake are well studied. Leafy vegetables are the main source of dietary nitrate, and in 1997, the European Union established maximum levels (limits) for nitrate content in lettuce and spinach (Table 1). Though studies on this issue were conducted in the U.S. from the late 1960’s to early 1980’s, regulations have yet to be introduced. Moreover, the relative nitrate content of organic versus conventionally produced leafy vegetables has not previously been studied in California.

**Project Objectives**
The goals of this project were:
1) To demonstrate ranges and variability of the nitrate content of lettuce and spinach sold as “organically grown” and “conventionally grown" in Santa Cruz County; 2) To assess the relative safety of “conventionally grown” in Santa Cruz County; and 3) To examine relationships between farming practices and nitrate content in leafy vegetables on certified organic farms in California.

**Results**

**Market Sampling Survey.** Organic and conventionally produced iceberg lettuce, Romaine lettuce, and spinach were sampled in winter and summer from supermarkets (conventional), farmers market (organic), and organic food markets (organic) in Santa Cruz County, California.

The averages of nitrate content in samples for each practice and season are shown in Table 2 (lettuce) and Table 3 (spinach) on a fresh and a dry weight basis, along with their minimum and maximum values. It should be noted that even in the same season and with the same practice, there was a wide range of nitrate content in spinach samples. In particular, the ranges of nitrate content tended to be greater in organic spinach than in conventional samples. For instance, in summer organic spinach, maximum nitrate content (3,000 mg/kg fresh weight) was as high as five times that of the minimum (600 mg/kg FW) (Table 3).

Only iceberg lettuce showed a significant seasonal difference in nitrate content; on average, winter samples contained 52% higher nitrate than summer. The effect of management practice on nitrate content was significant only in spinach. That is, conventionally grown spinach contained significantly higher levels of nitrate than organically grown samples.

Seasonal differences in nitrate content were significant only for iceberg lettuce (higher in winter). Conventionally produced spinach had higher nitrate levels than organic spinach, but conventional and organic lettuce nitrate levels were similar. Nitrate content (NO₃ mg/kg fresh weight) was highest in spinach (average 2,170), followed by Romaine lettuce (average 1,080) and iceberg lettuce (average 792). Nitrate content was more variable in spinach than in lettuce. Observed ranges were similar to those in previous US studies.

Though nitrate levels in lettuce samples never exceeded EU limits, 83% and 33% of our conventional and organic summer spinach samples exceeded EU limits, respectively, while no winter spinach exceeded EU limits regardless of practice.

**Farmer’s Field Survey.** Five farms in Santa Cruz and Monterey Counties were surveyed for nitrate content in leafy vegeta-

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**Center for Agroecology and Sustainable Food Systems, University of California-Santa Cruz**

**Project period:** Nov 1997 - June 1999

**OFRF support:** $4,545

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**Table 1. Summary of the maximum nitrate levels in European Commission Regulation (EC) No. 194/97.**

<table>
<thead>
<tr>
<th>Product</th>
<th>Harvest Period</th>
<th>Max. nitrate levels (mg/kg fresh product)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinach (fresh)</td>
<td>1 November to 31 March</td>
<td>3,000</td>
</tr>
<tr>
<td></td>
<td>1 April to 31 October</td>
<td>2,500</td>
</tr>
<tr>
<td>Spinach (canned and frozen)</td>
<td>1 November to 31 March</td>
<td>2,000</td>
</tr>
<tr>
<td>Lettuce*</td>
<td>1 October to 31 March</td>
<td>4,500</td>
</tr>
<tr>
<td></td>
<td>1 April to 30 September</td>
<td>3,500</td>
</tr>
<tr>
<td>Lettuce, with the exception of outdoor lettuce</td>
<td>1 May to 31 August</td>
<td>2,500</td>
</tr>
</tbody>
</table>

*No separate limits have been established for different types of lettuces such as leaf type and head type.

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In the US, the US Public Health Service (1962) suggested limits of 3600 and 50 ppm nitrate (dry weight) for spinach and asparagus, respectively. Between the late 1960s and, early 1980s, many studies on the nitrate issue were conducted in the US, including reports by the National Research Council in 1972, 1978, and 1981. However, no nitrate standards for vegetables have been introduced in the US.
veyed for their practices, nitrate content in spinach, soils, and irrigation water.

Table 4 shows the outline of the farms and their practices. The surveyed organic farms consisted of three different types of fertility practices: compost only (farm 01 [first and second harvest] and farm 02), compost + commercial organic nitrogen fertilizers (farm 03), and commercial organic nitrogen fertilizers only (farm 05). Farms 03 and 05 were selected because of the low-nitrate content and high-nitrate content of their market-sampled summer spinach, respectively. The number of years these fields had been managed with organic practices ranged from 4 to 13. Although the growers grew different varieties, all of the spinach was the smooth leaf type.

Organic spinach grown using guano tended to have higher nitrate contents than those grown using compost only. Nitrate content in spinach of farm 03 (2,200mg/kg) and farm 05 (2,700mg/kg), both grown using guano, were considerably higher than those of farm 01 (1,300mg/kg) and farm 02 (470mg/kg), where only compost was used. However, spinach grown using guano on fields with sandy soil contained the lowest nitrate contents.

This trend coincided with the high nitrate content in market-sampled summer spinach from farm 05. A grower interview confirmed that both the market- and the field-sampled spinach from farm 05 were grown in the same field, but on different dates. The fresh weight of spinach grown at farm 05 was one of the lowest among all spinach sampled at both markets and fields, showing a tendency by the grower to harvest prematurely. Nitrogen application rate at the field was as low as one third of the others (26 lbs N/acre). According to information produced by the farmer, they were cutting back nitrogen application rates to eliminate heavy accumulation of nitrate in the soil, which occurred early in the season of the sampling year. No data were available on the degree of nitrate accumulation in the soil at pre-plant.

The high nitrate content in field-sampled spinach at farm 03 was completely opposite the trend found in the market survey, in which the lowest nitrate content was found in summer organic spinach. In addition, fresh weight of field-sampled spinach was also much higher than that of the market samples.

Field Experiments. A field study of fertilizer management factors affecting spinach nitrate content was conducted at the Farm at the Center for Agroecology and Sustainable Food Systems, University of California, Santa Cruz. The study compared different rates of compost, compost with Chilean nitrate, and commercial organic fertilizer applications. We used regression analysis to estimate the maximum safe yield of each fertilizer practice, defined as “the maximum yield that contained nitrate lower than the EU limit (2,500 mg/kg FW).”

There was no significant difference in average yield or nitrate content of spinach
grown in compost or compost with Chilean nitrate plots, but nitrate content was more variable in the compost with Chilean nitrate plots. Thus, the maximum safe yield of compost plots (0.70 kg/m²) was higher than compost with Chilean nitrate plots (0.58 kg/m²). Nitrate content in spinach was positively correlated with yield, though commercial organic fertilizer produced lower yields at the same nitrogen rates than other treatments because of slower nitrification in the soil.

In conducting these experiments, we also observed that spinach harvested in the afternoon had significantly lower nitrate levels than morning harvests.

### Conclusions

1. Conventional spinach nitrate levels exceed the maximum levels specified by European Commission Regulation (Table 1) much more often than organic spinach;
2. Organic spinach grown using guano and Chilean nitrate tends toward higher nitrate levels than spinach grown using compost;
3. Spinach nitrate levels are affected by the rate and type of nitrogen fertilizers applied, and also by soil nitrification activity, soil texture, and harvest time;
4. Organic growers may reduce nitrate concentration in spinach using methods such as pre-plant soil nitrate testing, compost-based fertility management, afternoon to evening harvest, and petiole removal.
5. California-sampled iceberg and Romaine lettuce have safe nitrate levels regardless of season and farming practice.

Joji Muramoto’s full project report (#97-36) is 64 pages, and includes numerous tables, figures, and list of references. A copy may be obtained from OFRF upon request, or may be obtained in PDF format from the UCSC Agroecology website, www.agroecology.org/people/joji/research/nitrate.htm.
Evaluation of mulching materials and limestone rates for management of fusarium wilt of sweet basil

Jeanine M. Davis and Una J. Harrison

In 1991, a devastating basil wilt disease caused by the fungus *Fusarium oxysporum* f. sp. *basilicum* was first discovered in the U.S. It has since spread throughout the northeast, California, and the southern U.S. Symptoms of the disease include wilting and stunting of plants, defoliation, stem necrosis, vascular discoloration, and death. The pathogen is being introduced into fields in the U.S. primarily through contaminated seed.

Disease control measures available to organic growers are limited. Crop rotation is unfeasible because propagules that cause infection may persist in soil for 8-12 years. The first basil cultivar resistant to the basil wilt pathogen was made available for the 1999 growing season. Its level of resistance under field conditions and acceptability for commercial production is not yet known.

Previous studies with cyclamen and carnation have shown that organic mulches can suppress diseases caused by *Fusarium* spp. Indeed, in 1994, at the Mountain Horticultural Crops Research Station, NC, we found plant survival to be highest in the organic mulch treatments in a comparison of different mulches for fresh-market basil production. We proposed to examine the effect of high and low limestone rates on basil wilt, for previous reports have shown that amending with lime to increase soil pH may help to reduce the harmful effects of fusarium wilt on other host plants, i.e., tomato, carnation and watermelon. The goal of our study was to provide useful disease management strategies for organic growers.

Methods

In early May, basil seeds (Johnny’s Genovese variety, certified fusarium free) were started in the greenhouse at the Research Station. The biocontrol treatment, Rootshield, was applied to a portion of the plants 10 days later as a wettable powder drench. All basil transplants were thinned after emergence and trimmed one month after seeding to encourage branching.

Basil wilt inoculum was isolated from diseased basil, grown on potato dextrose agar plates, and then mixed with autoclaved fescue seed. The infested seed was allowed to incubate for 3 weeks, and was shaken daily to evenly distribute the fungus. The inoculum was then air dried in paper bags, ground in a coffee grinder, and stored in the refrigerator until used for the test.

The experiment was a split plot with a randomized complete block design. Each of 4 blocks consisted of two lime rates as main plots with mulch and the biological control treatment as subplots within each main plot. We were anxious to spread lime as quickly as possible, but because of a change in test location, it was the first week of May before we were able to prepare the soil. Lime treatments were calculated as the amount of ground limestone needed to raise the existing soil pH (5.9) to low (6.5) and high (7.5) levels. One week before transplanting, a 4-5-4 composted poultry waste product was spread and incorporated into the soil at the rate of 100 lb N/acre. The plants were also side-dressed once late in the season at the rate of 20 lb N/acre.

The test area was infested with the basil wilt pathogen by incorporating the dried, ground inoculum into the soil to a depth of 8-10 inches. Basil transplants were set 8 inches apart in rows 1.5 feet apart. Ten basil plants were planted in each subplot and mulched with one of the following mulch treatments: wheat straw, composted hardwood bark, or composted pine bark. Control subplots were left unmulched. Rootshield-treated basil transplants were not mulched.

Our weather in the summer of 1998 was extremely hot and dry. Once the basil was transplanted, frequent visits were made to keep the plots watered. Plants were hand watered until August, when an irrigation system was set in place.

Four times during the season, the disease severity was determined of every plant in the test. Petioles were collected from diseased plants located randomly throughout each block, and were plated onto Komada’s selective medium for isolation into pure culture. The identity of the cultures was confirmed to be *F. oxysporum* f. sp. *basilicum*, as inoculation of basil seedlings with the isolates in the greenhouse produced typical basil wilt symptoms.

Basil was harvested four times throughout the season (3, 7, 11 and 15 weeks after transplanting) by trimming plants to the first pair of new leaves on the lower stems. The data recorded consisted of the combined fresh weight of leaves, stems and petioles from all plants in each subplot.

Results

**High Lime vs. Low Lime Rates.** Soil samples were collected from the unmulched (control) subplots before transplanting to determine how the pH levels had been affected by the two lime rates. The average soil pH of the high rate plots was 6.5, and of the low rate plots was 6.0. This was well below the intended pH levels of 7.5 and 6.5, yet was not surprising due to the late date of limestone application.

Overall, the weight of basil harvested and the severity of basil wilt were not affected by lime rate. The average weight of basil per subplot (10 plants) at the low rate was 566 g and at the high rate was 574 g. The mean disease severity rating in the low rate treatment was 2.5, while in the high rate treatment it was 2.6. The absence of any effect by lime rate is probably due to the small difference (.5) in actual soil pH between plots treated with the two lime treatments. The late lime application and drought conditions delayed the soil reactions necessary for soil pH to be increased by the lime.

**Mulch Material Comparison.** At the first harvest, the subplots mulched with wheat straw and hardwood bark compost had greater yields than the other treatments.
By the second harvest, however, yields from the wheat straw and hardwood bark treatments were significantly lower. In fact, the lowest overall mean yield for the season came from the wheat straw mulched plots, with the hardwood bark mulched plots yielding slightly better (Table 1). Of the three mulches tested, the pine bark mulch treatment had the highest total yield for the season, though it was not significantly different from the unmulched control treatment.

Basil plants in the pine bark mulched plots were the least affected by the basil wilt pathogen. Disease incidence and severity ratings (data not shown) during the season were lower for this treatment than for other treatments. Overall, there were fewer diseased plants and disease was less severe in the pine bark mulched plots than any other treatments. These results are encouraging, for they suggest that use of pine bark mulch in an infested field may allow production of substantial basil yields, while also reducing the potential for *F. oxysporum f.sp. basilicum* to produce inoculum for subsequent growing seasons.

An interesting observation in the pine bark treatment was that the transplants were stunted and yellow early in the season, yet recovery and subsequent growth occurred to the extent that at the final harvest, yields were greater than other treatments. It is possible that the early stunting was due to immobilization of nitrogen, or to the small sized mulch particles which appeared to limit the percolation of water into the soil early in the growing season. (The pine bark product used in our test, “Nature’s Helper” is a composted organic soil conditioner with a particle size of 1/2 in. screen.) The 1998 growing season was one of the driest on record in western North Carolina, and much of the water applied to the pine bark treatment rolled off the mulch instead of percolating through.

Our results indicate that development of basil wilt was suppressed in this treatment. We do not know what role the amount of soil moisture under the pine bark mulch played in this test. We can only speculate that the drier conditions created by the fine mulch particles would have made a less optimal situation for pathogen development. However, the fact that disease was significantly lower in the pine bark mulched plots than in the unmulched control plots indicates that other factors, such as suppressiveness of pine bark to *Fusarium* disease, may be involved.

**Rootshield.** Basil harvest weights (Table 1), disease incidence, and disease severity ratings from the Rootshield treatment did not differ from the control subplots. We do not know whether this product is ineffective against the basil wilt pathogen, or whether survival of the biocontrol organism, *Trichoderma harzianum*, was adversely affected by the hot and dry conditions it was exposed to through much of the season. Studies involving tomato disease caused by *F. oxysporum* suggest that *T. harzianum* may proliferate in the soil when added along with a suitable food base such as a wheat bran/peat preparation. Perhaps use of the Rootshield product with a mulch would be effective against basil wilt.

**Interactions.** Although there was no effect of lime rate alone on basil yields or wilt severity in this test, significant interactions occurred between lime rate and two other treatments. In the hardwood bark mulch treatment, there was less damage due to basil wilt and total basil yields were higher when amended with the high rate of lime, indicating that a higher soil lime concentration had a suppressive effect on disease development. In the Rootshield treated subplots, the opposite effect occurred, where basil yields were significantly higher and basil wilt was less severe when amended with the low lime rate than with the high lime rate. We do not know why these interactions occurred, although it is interesting to consider their outcome in light of the fact that the soil pH did not vary considerably over the growing season.

**Conclusions**

We are encouraged by the results from this year’s test, for we feel that mulching basil with composted pine bark could be a useful disease control strategy for organic production of basil in an infested field. Some questions still remain about its use however.

Would a larger particle size of pine bark allow more water to percolate, thus giving transplants a better start early in the season (particularly in dry years), and yet still be as effective in disease suppression? Or would the material be more suppressive to disease if incorporated into the soil? This strategy would more closely mimic the pine bark media that is currently used to successfully suppress *Fusarium* disease in commercial nursery operations.

The Rootshield investigation in our test was inconclusive, yet we feel that a more fair comparison of this product might be to incorporate it with a food base to allow the biocontrol agent to proliferate as has been suggested in the literature. Perhaps treatment of basil transplants with Rootshield followed by mulching with pine bark mulch, or planting into soil incorporated with pine bark mulch, could be a successful wilt control strategy for organic basil growers.

Based on the results from this study, we cannot make recommendations about lime rate as a management tool for basil wilt. In such a dry year, lime amendments should have been made several months before planting in order to make a comparison of soil pH effects. The hardwood bark mulch treatment was more suppressive at the high lime rate, yet when yields and disease severity ratings were compared with other mulch treatments, use of hardwood bark was inferior.

**Table 1. Effect of mulching materials and Rootshield on mean harvest weight of sweet basil from a field infested with *Fusarium oxysporum* f.sp. *basilicum***

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean harvest wt/subplot (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (no mulch)</td>
<td>703 A</td>
</tr>
<tr>
<td>Pine bark</td>
<td>677 A</td>
</tr>
<tr>
<td>Rootshield</td>
<td>615 A</td>
</tr>
<tr>
<td>Hardwood</td>
<td>482 A</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>374 C</td>
</tr>
</tbody>
</table>

Mean g weight of 8 subplots, 10 plants/subplot harvested 4 times over the season. Means followed by the same letter are not significantly different at P=0.05 using Duncan’s Multiple Range Test.

Jeantine Davis’ full project report (6 pp, including 4 figures and references) is available from OFRF upon request.
OFRF Grants

OFRF Grantmaking at Record Pace

OFRF awards grants for organic farming research and education projects two times per year. Grant application deadlines are January 15 and July 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 $10,000.

This spring, the OFRF board approved $68,451 in new grants for eleven organic research and education projects, from among twenty-eight proposals requesting total funds of $185,000. OFRF has funded 124 grants totaling nearly $700,000 since 1990. With the board’s decision last fall to fund $150,000 in grants in 2000, we will have more than $80,000 for projects in the fall funding cycle.

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

Spring 2000 Grants:

Cover crops for weed management on organic farms.
Carol Miles, Washington State Cooperative Extension, Chehalis, WA $7,500

Pediobius foveolatus as a biological control agent for Mexican bean beetle in snap beans.
Kimberly Stoner, Connecticut Agricultural Experiment Station, New Haven, CT $7,500

Soil nutrient balancing in sustainable vegetable production.
Mark Schonbeck, Virginia Assoc. for Biological Farming, Floyd, VA $6,000

Use of cover crops to control insect pests in Brassica crop production.
Joel Kingsolver, University of Washington, Seattle, WA $8,650

Producing echinacea in diverse agroecosystems.
Erica Renaud, Frontier Organic Research Farm, Norway, IA $4,950

Effectiveness of compost extracts as disease suppressants in fresh market crops.
Sylvia Welke, Wild Flight Farm Mara, British Columbia $2,900

Cultural control of Sparganothis fruitworm through the use of flooding.
Monika Weldon and Peter Belanger, Spring Meadow Farm, Mattapoisett, MA $3,100

Maintaining nutrient balances in systems utilizing soluble organic fertilizers.
Mary Peet, North Carolina State University, Raleigh, NC $8,673

Development of a commercial organic apple production system for New York.
Terence Robinson, Cornell University, Geneva, NY $10,000

Biological control of Delia sp. in cole crops with rove beetles, Aleochara sp.
Renée Prasad & Deborah Henderson, E.S. Crop Consulting Vancouver, B.C., Canada $3,157

Conservation tillage and cover crop systems for organic processing tomato production.
Michael Cahn, UC Extension, Sutter/Yuba Counties, Yuba City, CA $6,021