The CENTER for AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS
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inside this issue:

Variety Trials Play a Key Role in Organic Farming

If variety is the spice of life, then variety trials can not only spice up a grower's routine, they can be a critical element in any successful farming business or gardening venture. Pinpointing the crop varieties that respond best to a site's particular climate, soil type, water quality, and other local conditions should be an integral part of a grower's yearly production plan, not only for farmers looking to improve their bottom line, but for gardeners who want to get the most out of their home-grown crops.

"In my opinion, finding the right varieties is the key to success for the small farmer," says Terry Allan, vegetable trials manager for Johnny's Selected Seeds in Albion, Maine. "Small-scale growers need productive, hardy varieties to make the best use of their available space."

ON-SITE TRIALS CRITICAL

For organic growers, who rely on plant vigor and pest resistance to help hold the line against pests and diseases, identifying varieties with these traits is especially important. Although seed catalogue descriptions can help, growers must often conduct their own trials to find varieties that perform best on their farms. "Cooperative extension programs and seed companies are constantly trialing varieties for conventional production, but there are fewer formal trials on California's Central Coast for organic systems," says Jim Leap, farm manager at the Center for Agroecology & Sustainable Food Systems.

Fortunately, that situation is beginning to change. Leap is currently taking part in a strawberry variety trial in cooperation with researchers from the US Department of Agriculture and UC Cooperative Extension (see *Research Updates,* page 18). Still, most organic farmers rely on each other for information on successful varieties. "Most of the information we get is anecdotal and shared from grower to grower," says Leap.

Yet even a grower across the fence may have conditions different enough that some crops or varieties will flourish on one site and fail next door. "I could grow beautiful broccoli on my farm in the Central Valley," says Leap, "but my neighbor couldn't grow broccoli at all. My soil was heavy and his

> *continues on page 2*

7 Keys to Variety Trials

> Start all seeds at the same time under similar conditions

> Plant crops near each other for easier comparisons

> Choose average conditions, rather than the best or worst sites

> Label seedling flats and in-field plantings

> Keep accurate records of:
– seedling vigor
– pest and disease resistance
– hardiness
– heat and cold tolerance
– bolting rates
– yield
– taste

> Don't trial too many varieties or too many crops the same year, especially if space and time are limited

> Make trials a regular part of your farming routine, even after you've found varieties that work for you

"BEING THE FIRST ONE TO GROW A NEW ALL-AMERICA WINNER OR THE OLDEST CHILE DISCOVERED AT SOME MAYAN RUIN CAN HAVE MARKET (AND BRAGGING) POTENTIAL IN ITSELF," SAYS KRUPNICK.

was light. That's why it's important to trial things on your own ground."

Besides identifying varieties that do well on their site, trials can also help a grower expand the farm's offerings. "One goal of variety trials is to try things that are totally new to you," says Wendy Krupnick, formerly the trial garden manager for Shepherd's Seeds. Krupnick now coordinates Santa Rosa Junior College's Shone Farm Garden in Northern California. "For example, trying several types of unusual Asian greens or Italian chickories to see if they grow well, if you like any of them, and if they fit into your production and marketing plans."

Trials are a way to evaluate such characteristics as seasonal range, to expand the market potential of a crop by adding more colors, shapes, and flavors, and to focus interest on something new or novel. "Being the first one to grow a new All-America winner or the oldest chile discovered at some Mayan ruin can have market (and bragging) potential in itself," says Krupnick.

Trials can also help a grower find out whether a crop will be practical to produce — sometimes with unexpected results. When Leap moved from the heat of California's Central Valley to the cool, foggy climate of the Central Coast, he thought he'd have to give up growing heat-loving crops. "I didn't think we could grow good-quality cantaloupes or eggplants on the coast," recalls Leap, "but I wanted to try, so we started trialing a lot of varieties that were described by the seed catalogues as performing well in cooler climates."

Leap and his staff planted out a number of melon and eggplant varieties, watched how they yielded, evaluated disease resistance, and tasted the results. "It really surprised me, but we found a fairly productive cantaloupe that gets very sweet in this climate, and an eggplant — Agora — that performs well. Now they're both a regular part of our cropping plan," says Leap.

SETTING UP AND EVALUATING TRIALS

Variety trials can be complex, replicated projects with many varieties and factors being evaluated and strict assessment techniques applied. "Right now we're trialing ten different varieties of strawberries as part of a study to see which ones perform best under organic conditions," says Leap. "We're collecting yield data and soil samples, evaluating the percent of roots colonized by mycorrhizal fungi [a beneficial fungus that facilitates nutrient uptake], and evaluating plant health. It's fascinating to see how the different varieties perform all in one block, to look at which ones tend to have aphid damage, which tend to make runners, which fruit early, which hold up in storage, and of course how they taste."

Most on-farm trials don't need to be this formal. Often, a grower plants two or three varieties of the same crop and visually assesses the results. Leap recalls the advice of Denesse Willey, a long-time organic farmer from Fresno. "Denesse used to say that the best statistics are the differences you see with your own eyes." Whether formal or informal, the goal of all variety trials is basically the same: to evaluate the performance and taste of different varieties grown under similar conditions.

There are several key steps to keep in mind when setting up any type of trial. "Try to obtain fresh seed of all the varieties you're trialing and start all the seeds at the same time under the same conditions," says Krupnick. She also recommends that plants be grown in close proximity so that they can be compared side by side, with enough individuals to see the variety well. "The amount you grow out will vary depending on what you're growing," says Krupnick. "For instance, when growing 'heirloom' varieties it's a good idea to grow out a large stand to check varietal uniformity." Leap notes that you don't need to use a lot of space for most vegetable trials. "You can do trials with ten feet of row," he says.

Terry Allan warns that growers shouldn't choose the prime or extreme sites for variety trials. "Try to pick average conditions, not the best or worst soil. Put the test variety in the middle of a bed to avoid edge effects. The plants on the edges will get more sunlight and air circulation, so may be bigger or less subject to disease and not really represent how that variety performs in a standard planting."

Good record keeping is also vital to any variety trial. "You have to keep accurate records and label everything," says Krupnick. "This may seem obvious, but it's amazing how easy it is to loose track of which variety was which or neglect to write down that one variety was more vigorous as a seedling when they all look the same a month later."

Krupnick keeps a notebook and records dates of sowing, transplant, and first harvest, as well as comments on vigor, yield, and decline. "I've found that this last characteristic is particularly important," she says. "Don't pull out the plants when you've just seen the main crop — watching how they die, or perhaps rebound, or their bolting rates can be very telling."

Which characteristics a grower evaluates will depend in part on the crop. "Each crop type has its own unique features that growers are looking for," says Allan. "They include leaf and fruit shape and form, color, flavor, yield, disease resistance, and resistance to bolting." Leap notes that flavor can't always be the bottom line when judging varieties. "Some varieties have exceptional flavor and eating quality, but have too many production and disease problems to make them worth the effort."

For commercial growers, shelf life quality can often be a concern. "It may sound industrial, but shelf life is important," say Allan. "At Johnny's we did a tomato trial to try and find flavorful varieties that won't turn to mush by the time they get to market. I had to wade through a lot of 'styrofoam' tomatoes to find any with taste — of the 80–100 we tried, only 3 or 4 had flavor and stayed firm."

Both Krupnick and Allan caution against trying to evaluate too many crops at once. "It's probably better to plan on doing variety trials on a few crops for two or three years and not try to trial all your crops in one season, as it gets hard to keep track," says Krupnick. "Also, the most accurate trials are repeated more than once. Although each season's results are valid, weather conditions can vary and affect the way varieties perform."

Allan recommends that a grower focus on just a few varieties during a trial. "Say a grower is having trouble with disease in their Romaine lettuce. They should ask for recommendations from seed companies, then put in enough plants of several varieties to have a good sample and grow it next to the varieties they're familiar with. And be sure to label everything so that you can keep track!"

Once a grower identifies key characteristics, such as disease resistance, seed catalogues and seed company personnel are one place to go for recommendations of varieties to trial. "We keep an eye out for descriptions of warm-season crops that are well suited to cooler climates. In cool season crops, we might look for varieties that mature early," says Leap. As to seed companies he uses, "We rely heavily on Johnny's. Their seeds are untreated, which we need for organic certification, and they conduct their trials under organic conditions."

Krupnick recommends that farmers and gardeners looking for new varieties attend as many garden and farm tours as possible, making sure to ask questions and take notes on the varieties being grown. Home gardeners and small market gardeners should review journals like *Growing for Market, Organic Gardening,* and *National Gardening* (especially their January issues). "Talking with local Master Gardeners is another good way to compile lists of varieties to try," she says.

Leap also notes the importance of continuing to do trials, even when you've found crops that perform well for you. "The growers that I work with trial constantly — it's probably a mistake to settle on one thing and stop trialing others. There might be a variety out there that's even better, and there are always new things coming along." Leap also notes the risk of relying on too few varieties. "The eggplant variety that did so well for us isn't available anymore, so we've had to start over again with trials."

Jim Leap

Melanie Okamoto harvests strawberries from a research site on the Center's Farm to be analyzed in a variety trial.

MARKETING CHALLENGES AND OPPORTUNITIES

Identifying a variety that performs well is only half the battle. Getting retailers and consumers to try something new or out of the ordinary poses its own challenges. "An unfamiliar variety can be problematic," says Leap. "If it looks good and performs well you can probably sell it, but if it's a little different you may have to overcome some initial resistance. Fortunately, most specialty retail and organic retail outlets are open to new varieties."

Community supported agriculture projects are an excellent outlet for new crops and varieties. "With a CSA, you don't have to convince people to try something new or slightly different," says Leap. "They're committed to supporting the farm and its crops. Our CSA members have learned to tell the subtle differencess in varieties and many have discovered how much they like a crop that they were never willing to try before. We've made some real converts to less mainstream vegetables like beets and chard."

Because most CSA projects offer picked-that-morning produce, growers can select varieties based on flavor rather than shippability and shelf life. Member newsletters can educate shareholders about varietal characteristics and the various factors, such as weather and pests, that can affect flavor and appearance.

For growers selling at farmers markets and other direct-sale outlets, new varieties can be a conversation starter. "It's interesting to explain why you have orange cauliflower or strange bitter greens. Ask customers what they think and make their evaluation part of your trial," says Krupnick. Leap agrees, but cautions, "People at farmers markets are interested in trying and buying new things, but you have to promote and push."

> *continues on page 19*

from the
director

We are nearing the end of what Jim Leap, our farm manager, has referred to as the first "typical" spring he's seen in over 10 years. Cover crops were turned in, crops planted on time, and we have already had a tremendous yield of strawberries to sample thanks to the variety trial being conducted with Dr. Carolee Bull and others from the US Department of Agriculture's Agricultural Research Service (USDA/ARS) lab in Salinas. The year 2000 apprentices are settled in and our Community Supported Agriculture program, which has grown to nearly 100 shares, is well underway.

While some activities slow down over the summer others are just beginning. Notably a number of Center researchers are embarking upon an exciting new collaborative effort to expand our research and extension activities in the Central Coast region. As described on page 15, we received a USDA special grant to work with regional partners (including regionally based NGOs, UC Cooperative Extension, USDA/ARS, Natural Resources Conservation Service, Santa Cruz County Farm Bureau) to develop biologically-based row crop management systems, and assess impacts of agricultural management on watershed health. In addition, this program will examine key socioeconomic questions that affect the potential for increased adoption, viability, and equitability of sustainable agriculture and food systems for the region. This grant represents a significant expansion of Center programs and will increase our visibility as an important partner in addressing agriculture and resource management issues affecting the Central Coast.

Other articles in this issue illustrate how Center efforts also focus on international applications of agroecological approaches to improve agricultural sustainability. The research by Eric Holt-Giménez (a graduate student with past Center director and Environmental Studies professor, Stephen Gliessman) in the aftermath of hurricane Mitch *(page 9)* is a fascinating and innovative evaluation of the ability of sustainable systems to resist major ecological disturbance. The work being done abroad by apprentices trained in the Center's six-month Apprenticeship in Ecological Horticulture program *(page 13)* demonstrates the growing worldwide demand for sustainable farming and gardening knowledge.

Finally, a word on *The Cultivar's* new look. The updated design is part of a new-millennium makeover of our publications and other outreach material. We hope you enjoy it.

- Dr. Carol Shennan

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The Center for Agroecology & Sustainable Food Systems is located at the University of California, Santa Cruz. Through our research and educational efforts we seek to increase understanding of the social, economic, political, and ethical foundations of agricultural sustainability; to establish the ecological and agronomic basis for sustainable production systems; and to demonstrate and facilitate the use of information critical to the adoption of these systems.

On the UCSC campus, the Center manages the 25-acre Farm and 2-acre Alan Chadwick Garden, both open daily to the public. For more information about the Center and its activities, please contact us at:

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New CSA Web Site Links Farmers and Consumers

In the past ten years consumers have become increasingly aware of farming and the strong connection between people and their food supply. This change is no accident — in order to survive, many farmers have found it necessary to adopt sophisticated marketing skills to promote their products. Farmers are using a variety of direct-marketing outlets to reach consumers, and new technologies, including the Internet, to advertise their farms.

A new web site, www.LocalHarvest.org, is designed to help direct-market farmers reach local consumers. It allows farmers to create a profile of their operations on-line and consumers all over the country to search for Community Supported Agriculture (CSA) projects, farmers' markets, and U-pick farms in their areas.

This new Internet site is the brainchild of a group of farmers and others from the Monterey Bay region who were looking for a way to cooperatively advertise their CSA projects. The group included Nancy Vail, coordinator of the Center for Agroecology & Sustainable Food Systems' CSA project, John Fisher, the Center's community outreach coordinator, and Cathy Carlson, formerly a research assistant with the Center. Ocean Group, an activist-minded Internet software engineering company in Santa Cruz, was invited to develop the site on a pro bono basis.

The idea behind the Local Harvest site is simple, yet multifunctional. It provides consumers all over the country with the ability to easily locate direct-marketing sites by clicking on a map of the U.S. and 'zooming in' on their city or state (or search by zip code). Each farm matching the search criteria appears as a 'pinpoint' on the map, and the consumer can view a complete, extensive profile — including location, hours of operation, crops available by season, cost of CSA shares, farmers' markets attended, etc. — for any farm of interest.

For farmers, the Local Harvest site include a 'Farmers Only' area where farmers create and update their profiles, maintain customer mailing lists, and respond to consumer feedback *(see below for details on adding a farm to the site)*. Farmers can also participate in bulletin board discussions with other direct-market farmers, nationally and regionally.

Using the internet to promote small-scale farmers is a great use of technology and marketing know-how. Most farmers would rather spend their time farming than marketing, and sites such as Local Harvest take over some of the marketing burden. Rather than having to develop their own web sites, farmers can tap into an existing Internet resource that allows them to promote their farm. With the large numbers of people searching the web, and the links to numerous food and farming organizations that an established web site can offer, farmers are provided with an even broader reach to their potential customers.

"By letting people know what is being grown locally, and who is growing it, consumers and farmers can actually make a connection," explains Erin Barnett, Project Manager for the LocalHarvest.org site. "It's simple... consumers can search a national database of direct market farmers, and farmers can create, for free, an extensive listing about their farm – communicating to consumers just about everything they would put in a printed brochure. What's more, it only takes about 45 minutes to do, and the farmers can update or change their listing at any time by simply going to the website."

ADDING A FARM

Ocean Group is waiving the membership fee for the first year for farms that add their profile to the Local Harvest site in 2000. Next year, the annual fee to be listed on the site will be $20 for Community Alliance with Family Farmers (CAFF) members, and $40 for others.

HERE'S HOW TO LIST YOUR FARM

Go to the Farmers Only area of the www.LocalHarvest .org site and register to create your own user name and password. Then you are free to create a profile of your farm.

If you prefer not to complete your listing on-line, you can call CAFF at 800/852-3832 to have your listing information taken over the phone. Or contact CAFF for a form which you can fill out and mail to the CAFF office. If you have any questions about the site, call CAFF at the above number or the Ocean Group at 831/466-0700.

- Lila Purinton and Martha Brown

Strawberry Research Project Enters Second Season

The strawberry harvest is in full swing on California's Central Coast, where more than 40% of the nation's strawberries are grown. While consumers enjoy the crop, researchers and growers are continuing a project to identify low-impact farming and erosion control techniques that will keep farmers in business while minimizing impacts on the environment.

Methyl bromide, an ozone-depleting soil fumigant used to prepare strawberry beds, will be phased out beginning in 2001, with cancellation scheduled for 2005. Staff of the Center for Agroecology & Sustainable Food Systems (the Center) are part of a collaborative study to find alternative pest, disease, and weed control tools that growers can use to maintain strawberry yields once methyl bromide is no longer available. In addition, the study is working to improve techniques for growers who already use organic methods or are interested in making the transition to organic production.

The research project, known as BASIS (Biological Agriculture Systems in Strawberries)–OASIS (Organic Agriculture Systems in Strawberries), teams scientists from the Center, the US Department of Agriculture/Agricultural Research Service (USDA/ARS), and UC Cooperative Extension (UCCE), with education specialists from the Community Alliance with Family Farmers, local growers, members of the California Strawberry Commission, and Soil Technology, an industry partner.

The BASIS-OASIS project examines both below-ground management options for soil fertility, plant health, and disease and weed control, as well as above-ground techniques for limiting pests, weeds, and erosion. Due to the study's size and complexity, not all of the techniques are being tested at every ranch. However, the long-term goal is to develop both conventional and organic "templates" of below- and above-ground biological controls that can be combined and serve as models for local strawberry growers.

Results of the first six months of the study appeared in the last issue of *The Cultivar* (Vol. 17, #2, pp. 7-8). Here we summarize results from the study's first full year(1998-1999 season), along with initial results from the 1999-2000 season. (Note: Ranches are referred to by numbers assigned by the researchers.)

YEAR ONE: 1998-1999 SEASON

BELOW-GROUND TREATMENTS COMPARED

During the 1998-1999 season, researchers Carolee Bull of the USDA/ARS, and Steve Fennimore and Steven Koike, both of UCCE, established plots at three ranches to test a variety of below-ground alternatives to methyl bromide. These included a combination of microbial inoculants, thought to stimulate plant growth and control soilborne diseases; corn gluten, which has been shown to control weeds; organic acids, thought to stimulate root growth; amended compost, which may provide some nutrients for beneficial microorganisms; and enzymes and plant extracts, thought to help break down composts for use by microbes. Taken together, these inputs are referred to as the BASIS treatment.

EFFECTS OF BASIS TREATMENT COMPARED TO METHYL BROMIDE FUMIGATION

Ranch 1: The researchers established the BASIS treatment of biological inputs at a site that had not been fumigated with methyl bromide and chloropicrin for a year. This treatment was compared with fields where methyl bromide was shank injected to fumigate strawberry beds just prior to planting. A non-treated control that received neither the BASIS inputs nor methyl bromide fumigation was also established. Disease occurrence, fruit yield, and colonization of plant roots by mycorrhizal fungi (beneficial fungi that help plants take up nutrients) was measured in each of the three treatments.

There was no impact on yields in the BASIS treatment, and in fact overall yields from plots receiving BASIS inputs were higher than those in plots that had been treated with methyl bromide, with significantly higher yields during weeks 9 through 11 of the harvest period. The researchers speculate that fumigation from the previous year had a carry-over effect on the BASIS treatment plots, although such an effect does not explain why the BASIS plots outperformed the plots that had been treated with methyl bromide just prior to planting. There were no differences in plant survival or plant diseases among the three treatments, which might also indicate that previous fumigation treatments were suppressing disease organisms such as Verticillium.

Differences in the percent of roots colonized by mycorrhizal fungi did occur at this site. Although one set of plants in the BASIS treatment was inoculated with mycorrhizae prior to planting, colonization by the fungi was lower in the BASIS plots than in either the methyl bromide-treated plots or the non-treated control. This may be due to the bacterial treatments that were one of the BASIS inputs; according to the researchers, some bacteria which suppress plant disease have been shown to inhibit mycorrhizal colonization.

Researchers are repeating this study at Ranch 1 during the the 1999-2000 growing season, and are tracking populations of beneficial soil microorganisms in the various treatments to see how methyl bromide affects their abundance. They are also experimenting with ozone and soil solarization as potential weed controls *(see below)*.

Sean Swezey

An annual trap crop of alfalfa, daikon, radish, and sweet alyssum blooms between rows of strawberry beds.

Ranch 8: The BASIS system was established on ground free of methyl bromide treatments for the two previous seasons. Again, the performance of the BASIS system was compared to another section of the ranch where strawberry beds were treated with methyl bromide prior to planting, and to a control plot where neither BASIS nor methyl bromide were used. Yields were significantly lower from plants in the BASIS plots compared to plants in plots fumigated with methyl bromide. As with the first ranch, BASIS plots had significantly higher yields than the untreated control.

In addition to the above treatments, a study of various weed suppression techniques was added to an organic plot at this ranch for the 1999-2000 season *(see below)*.

MYCORRHIZAL INOCULANT TESTED IN AN ORGANIC SYSTEM

Ranch 5: At this site, a mycorrhizal inoculant was tested for its ability to increase root colonization by the beneficial fungi and boost strawberry yields in an organic setting. Thirty inoculated plants (Seascape cultivar) were compared to thirty plants that did not receive inoculation prior to planting. Both accumulative fresh market and total yields were higher from plots with inoculated plants, becoming significantly higher after the 12th harvest week. The percent of roots colonized by mycorrhizae was higher in the inoculated plants, although this difference was not significant.

Based on the potential for mycorrhizal inoculants to improve yields and plant vigor, researchers are evaluating a number of commercially available mycorrhizal inoculants at this ranch during the 1999-2000 season to identify those that would optimize the inoculation of strawberries in the BASIS and OASIS treatments.

ABOVE-GROUND PEST MANAGEMENT ALTERNATIVES

In the study's first season, Center researchers Sean Swezey, Polly Goldman, Janet Bryer, John Bailey, and Amanda Lewis tested both annual and perennial plantings of non-crop vegetation, known as farmscapes, at five ranches. The annual farmscapes were established as in-field strips, bed ends and field borders; perennials were planted as field borders. The researchers assessed the farmscapes for their ability to concentrate strawberry pest species, attract beneficial insects, and influence pest and beneficial populations in adjacent strawberry plantings (referred to as farmscaped strawberry plots). A non-farmscaped control was also monitored at each site.

The research group chose the annual farmscape species based on their potential to attract beneficial insects and lygus bugs *(Lygus hesperus)*, a strawberry pest. They maximized the "trap crop" function of the annual plantings by focusing on species known to attract lygus. In theory, trap crops will draw pests away from the strawberry crop, concentrating them in a single area where they can be controlled either by mowing or, in conventional systems, by spraying with insecticides. Trap crops can thus limit or eliminate the need to spray the crop itself. The trap crop mix included semi- and non-dormant alfalfa, daikon and culinary radishes, and sweet alyssum.

Perennial plantings emphasized yarrow *(Achillea millefolium)* and coast buckwheat *(Eriogonum latifolium)*, both known to establish rapidly and attract natural enemies. Other habitat-appropriate perennial species were also included in smaller proportions.

FARMSCAPE MANAGEMENT MAY INFLUENCE EFFECTIVENESS

In the study's first season, the Center team found that when results from all of the sites were averaged, total numbers of lygus were more abundant in the trap crop than in the control, and on average were lower in the farmscaped strawberry plantings. However, this differed from site to site — when compared to control berries, lygus numbers in farmscaped berries were higher at three ranches, lower at

Sean Swezey

A perennial border of yarrow, buckwheat, California sagebrush, lizard tail, gum plant, and seaside daisy offers habitat for beneficial insects on a strawberry ranch in Santa Cruz County.

one, and no different at one. At two of the three ranches where lygus numbers were higher in farmscaped berries, the trap crops were planted in weedy areas away from the strawberry beds and were not kept well irrigated, which may have limited their effectiveness.

Although generalist predators (mostly minute pirate bugs, bigeyed bugs, lacewings, damsel bugs, and ladybeetles) were on average more abundant in the trap crop and the perennial plants than in the controls during most of the season, this difference did not translate to higher numbers of predators in the farmscaped strawberries. Again, abundance patterns varied among the sites; for instance, predators were more abundant in farmscaped berries than in the control at one site, less abundant at another, and no different at three sites.

Parasitic wasps were also more abundant in the trap crop than in the control, but this did not lead to higher wasp numbers in the adjacent strawberry plantings. Spiders and parasitic wasps showed a pattern of variability among sites similar to that of lygus and generalist predators.

At the one ranch where control of lygus and spider mite populations was higher in the farmscaped berries than in the non-farmscaped control, two factors appear to be at work. First, overall in-season lygus populations at this ranch were higher than at other sites, perhaps indicating that when lygus numbers are high, the trap crop may attract the majority of lygus and prevent them from spilling over into the adjacent fields. In addition, these trap crops were the best-managed in the study. They germinated well, were watered and weeded in a timely way, and were mowed and sprayed in accordance with observed and predicted lygus population increases. The farmscaped berries at this ranch also had the largest increase in generalist predator, spider, and parasitic wasp populations compared to the control berries.

Based on these observations, Center research staff are monitoring and managing trap crops more closely in the current season *(see below)*, and are applying pest control methods (mowing and spraying) based on more exact timing of lygus hatch dates using degree-day based calculations. By observing when the first adult lygus appear in the trap crop, the researchers can use these calculations to project when the next generation of lygus will hatch, and recommend to growers when to apply control methods.

YEAR TWO: 1999-2000 SEASON – INITIAL RESULTS

With interest in alternative strawberry production techniques on the rise, the BASIS-OASIS project has attracted new growers, new ranch sites, and new collaborators. Conventional acreage enrolled in the study's 1999-2000 season has doubled and the amount of organic acreage is also up significantly. Thirteen ranches are enrolled in the BASIS-OASIS research this season.

Besides repeating BASIS and OASIS treatments used in the study's first year, new projects, such as alternative weed controls, have been initiated based on ideas generated during the 1998-1999 cropping season. Some interesting results have already emerged, both at ranches involved in the study's first year and at sites added for the 1999-2000 season. A sample of preliminary results is presented below.

BELOW-GROUND STUDIES

NEW WEED CONTROL TECHNIQUES TESTED

Ranch 1. At one of the BASIS test sites, soil solarization and ozone treatments were applied in the fall to determine their effect both on weed growth and on populations of beneficial and disease-causing microbes. The test plots were covered with a clear plastic tarp that was left in place from early September until late October. Ozone was applied at 88 and 356 pound per acre in early November.

While the clear tarp was in place, it controlled germination of common groundsel *(Senecio vulgaris)* and suppressed annual sow thistle *(Sonchus oleracea)*, but did not control annual bluegrass *(Poa annua)*, which germinated under the tarp. In mid December, following strawberry transplanting, researchers found that the treatments had reduced annual bluegrass densities and suppressed common groundsel densities. Although soil solarization did not control annual bluegrass initially, it may have created ideal germination conditions and depleted the seedbank of viable bluegrass seed, thus suppressing its growth later in the season.

Ranch 8: At an organic plot on this ranch, a test block was established to compare three weed control options: soil solarization using a clear tarp; solarization with a clear tarp plus 5.6 kg/m^2 of broccoli residue worked into the soil; and a black plastic tarp laid on the ground and covered by a clear tarp, with an air space between them. The tarps were left in place from early September until late October. Re-

> *continues on page 18*

Hurricane Mitch Reveals Benefits of Sustainable Farming Techniques

In October 1998, Hurricane Mitch slammed into Central America. One of the five most powerful Caribbean hurricanes in the twentieth century, Mitch caused US $6.7 billion dollars in damage to infrastructure and industry (primarily agriculture) — an amount approximately equal to 13.3% of Central America's gross national product.

Honduras, Nicaragua and Guatemala were hardest hit by the storm. Mudslides and landslides washed away crops, animals, buildings, roads and bridges. Topsoil lost from hillside farms silted rivers that overflowed their banks, flooding fields and urban areas. Over 10,000 people died and 3 million were displaced or left homeless. The environmental damages were incalculable.

Most observers agree that the unprecedented magnitude of the disaster is the consequence of decades of deforestation, non-sustainable agricultural practices and other forms of environmental degradation that left the region exceptionally vulnerable to erosion.

While first reports regarding agricultural damage simply indicated that the levels of destruction were massive, subsequent on-site observations began to reveal a more subtle, differentiated pattern. Farms using what are commonly understood to be "sustainable" practices appeared to have suffered less damage than their "conventional" neighbors. These farms belonged to smallholders working within a multi-institutional, regional movement for sustainable agriculture known in Central America as Campesino a Campesino (Farmer to Farmer).

ROOTS OF THE CAMPESINO A CAMPESINO MOVEMENT

Although less intensive or dramatic than Hurricane Mitch, ecological disasters have been occurring ever since northern agriculture was introduced to tropical ecosystems. Subsistence smallholders have been continually displaced from valleys to hillsides and forests by larger, export-oriented farms and ranches. Even as they adopted fertilizers, herbicides and pesticides, farmers on these fragile, marginal lands have battled falling productivity, soil erosion, ecosystem degradation, economic ruin, and the lack of effective agricultural services.

Eric Holt-Giménez

Don Ernesto Herrera, a longtime member of the Campesino a Campesino movement, demonstrates garden bed preparation as part of a workshop for women in Nicaragua.

Nearly thirty years ago in the highlands of Guatemala, working with a simple set of principles based on local innovation and solidarity between farmers, a small movement for "people-centered development" began. Through small-scale experimentation, farmer-to-farmer training, and mutual aid, smallholders learned to adjust their agricultural practices to maintain the fertility and general health of their ecosystem. The results were not only evident in dramatic increases in productivity, but in terms of improved ecosystem functions. Long before mainline development agencies introduced "sustainable agriculture" into their project portfolios, these farmers were developing it, slowly, on the ground, farm by farm, hillside by hillside, county by county.

Development agencies such as World Neighbors, OXFAM, and Servicio de Desarrollo y Paz de Mexico were instrumental in bringing farmers from different areas and countries together to learn and share experiences. What began to emerge was an agriculture that did not simply replace natural ecological processes, but mimicked them. What also emerged was a methodology that did not replace good agricultural extension, but challenged it to address sustainability as well as productivity.

After implementing soil and water conservation techniques *(see below)* in an attempt to maintain fertility, an astounding "discovery" was made: Volatile essential nutrients, costly in time and labor to apply to soils, could be

Eric Holt-Giménez

Juan Aguirre shows how a velvet bean intercrop creates a soil-protecting groundcover to control weeds and conserve moisture in a banana crop.

produced and saved in the biomass of leguminous cover crops and intercrops. Crops such as velvet bean *(Mucuna prurien)*, for example, could be planted to protect soils from the impact of intensive tropical storms, and create the valuable mulch layer so critical to nutrient cycling in the tropics.

With the help of a handful of non-governmental organizations (NGOs), velvet bean and other leguminous cover crops were distributed, along with the knowledge of their management, from farmer-to-farmer, throughout Central America. Within five years their use became a common practice. This adaptation is an example not only of a biomass-based strategy for fertility, but of a farmer-to-farmer strategy for development that effected a major change in regional agricultural practices in a relatively short period of time. This was not simply a "technological fix"; it was the hard work and creativity of a network of farmers dedicated to improving agriculture in their communities.

The dramatic social-political convulsions of the Central American wars resulted in the Diaspora of many of these original farmer-to-farmer organizations in Guatemala. Non-governmental organizations help relocate them in Mexico and Honduras, often in the villages of old "students." During the same period, with support from Catholic Relief Services and the Ford Foundation, The Nicaraguan Farmers and Ranchers Union (UNAG) was instrumental in incorporating knowledge and techniques from Mexico and Guatemala into its national network of smallholders and cooperatives. Farmers began calling themselves the Campesino a Campesino movement. Then, with the help of OXFAM, UNAG promoted local, national and international farmer-to-farmer trainings, symposiums, gatherings and meetings, feeding the knowledge back into the region.

Over the last ten years, what began as a localized effort by poor Guatemalan farmers has exploded into a regionwide movement with thousands of active farmer-teacher innovators called "promotores." Campesino a Campesino works with dozens of NGOs from Mexico to Panama, and has introduced farmer-led processes for sustainable agriculture to the villages of well over ten thousand farmers in the region.

PRACTICES PROMOTE SOIL AND WATER CONSERVATION

The farming practices commonly encountered in Campesino a Campesino include a wide range of sustainable agriculture methods, tested and promoted by smallholders for nearly thirty years. Some of the most common practices include soil and water conservation techniques such as contour plowing and the creation of barriers, ditches and terraces using rocks, live grasses, trees, and other plant species to help minimize soil loss, especially on sloping farmland.

Campesino a Campesino farmers also use a variety of management strategies to reduce or eliminate synthetic chemical herbicides, pesticides, and fertilizers. In place of these inputs, farmers use:

- cover crops and inter crops, leguminous and other plant species grown with or between crop cycles to fix nitrogen, provide organic matter and "green manure" for fertility, and/or control weeds, conserve water and protect exposed soil;
- agroforestry to produce fuel, food, fodder, timber, fruit, and compost material, and to reduce soil runoff;
- intensive, in-row tillage, a practice of cultivating only the areas immediately around the seeds or plants in order to reduce erosion and concentrate nutrients;
- organic fertilizers created from composted organic matter or using vermiculture, to increase soil fertility and water retention;
- Integrated Pest Management, using traps and beneficial plants and insects cultivated in the field as well as the application of Neem extracts, Bt, and locally produced organic repellents, crop rotations, timed plantings, etc.

In general, farms using these sustainable practices exist as islands and archipelagos within a greater, conventional "sea." Therefore, while often localized and geographically fragmented, they provided an excellent opportunity to compare sustainable and conventional farms' agroecological resistance to Hurricane Mitch's damage.

The presence of Campesino a Campesino, made up of farmers and technicians experienced in farm experimentation and farmer to farmer training, also provided the opportunity to carry out an extensive, participatory, action-oriented research project in the low, medium and high impact areas of Hurricane Mitch. Several researchers with years of experience working in the Campesino a Campesino movement designed a study and wrote a proposal. World Neighbors, a non-governmentalorganization (NGO) working in the region, agreed to sponsor the project, helped to find funding from the Ford, Summit, Rockefeller and Inter-American Foundations, and provided administrative support.

FARMERS AND TECHNICIANS TEAM UP FOR STUDY

From February through May of 1999, 40 different NGOs with sustainable agricultural research and development (SARD) projects trained and mobilized 100 farmer-technician teams and 1,743 farmers to carry out paired observations of specific agroecological indicators on 1,804 neighboring sustainable and conventional farms. The study spanned 360 communities and 24 departments in Nicaragua, Honduras, and Guatemala.

The primary motivations for participating in the study were threefold: First, farmer-promoters and NGOs in the Campesino a Campesino Movement were eager to compare their farms to conventional farms because demonstrating a higher level of agroecological resistance would imply a higher level of sustainability. After years of being told that sustainable agriculture was not "viable" or "economical," they were anxious to dispel doubts about the importance and effectiveness of their practices.

Secondly, NGOs were very interested in evaluating the effectiveness of years of support for farmer to farmer SARD. Commonly, these projects are evaluated on the basis of the level of implementation (number of workshops, participants, terraces, compost heaps, etc.) However, the study gave them an opportunity to evaluate the level of their agroecological impact.

Finally, all participants were interested in influencing the agenda for agricultural reconstruction after the hurricane. If farmers could show that sustainable farms were more resistant than conventional farms, then a strong argument could be made for a participatory, sustainable agricultural reconstruction strategy.

An intensive period of organizing, training, data collection and field monitoring began in February of 1999. It was crucial that field data be collected before the rainy season began in late April. Each team had one technician and two farmer-promoters. They carried out observations on the ten best examples of sustainable farms and on the ten neighboring, conventional farms. Paired observations had to be located in close proximity, in the same position and cardinal orientation in the watershed, have the same general slope and similar environmental surroundings (fields, trees, infrastructure, etc.)

Agroecological indicators included topsoil depth, rill and gully erosion, percent vegetation, crop losses and structural damage. Each team member specialized in specific steps and measurements of the field procedure to reduce and standardize observational errors. The owners of both farms in the paired observations accompanied the team on both sustainable and conventional plots, then signed off on the field sheet indicating measurements and observations had been free of bias. Technicians interviewed farmers regarding their observations of the hurricane, the damage patterns, and the different reasons for any agroecosystem failures. National research coordinators in each country held periodic sessions with teams for feedback, troubleshooting and the correction of field errors.

Eric Holt-Giménez

Mamerto Medoza (right), a promotore with the Campesino a Campesino movement, discusses data collected on an agroecology farm in Nicaragua.

SUSTAINABLE PLOTS MORE RESILIENT

The field data from the farmer-technician teams was entered into an interactive database for each country. Initial results (averages) were processed for distribution among participants. While there was some local variation, overall the results indicated an overwhelming trend of higher agroecological resistance on the sustainable farms. Sustainable plots had 20% to 40% more topsoil, greater soil moisture, less erosion, and experienced lower economic losses than their conventional neighbors. Statistical tests later showed that some of these differences were highly significant (only a 0.0001 probability that these differences were due to chance) and most were acceptably significant (0.02 to 0.05).

Fifteen different workshops were held in the countryside to share the results of the field research with participants and key local and municipal actors. Farmers, promoters, technicians, and project coordinators collectively analyzed the results and gave feedback. Many placed different monetary values on the topsoil conserved (109 T/ha to 258 T/ha). Others valued the importance in times of drought of retaining from 1,500 to 9,000 liters/ha more water. Sustainable farms had fewer and smaller gullies and areas of rill erosion.

All of these indicators were seen as contributing to both productivity and to the conservation of the watershed. Further, because of crop diversification, sustainable farms averaged lower economic losses, and in Nicaragua even showed profits, despite the hurricane. However, when correlated to steep slopes (>50%), high storm intensity and other extreme environmental factors, some of the differences between sustainable and conventional farms "collapsed," indicating that the sustainable techniques have thresholds of effectiveness.

Finally, participants themselves indicated what may be

the most impressive result of all: over 90% of conventional farmers participating in the study indicated their desire to adopt their neighbor's sustainable practices. Participants enthusiastically claimed that the study had been a highly successful learning experience, and had established new bonds of trust between farmers, promoters, and technicians. For most farmers, it was their first experience with research, and for others, the first time the results of on-farm research had been returned and shared with them.

SUSTAINABLE AGRICULTURE'S FUTURE — GOALS AND OBSTACLES

With the aid of drawings, clay models, and skits prepared by the participants, farmers then described how their fields and villages should look in three, five, and ten years if agricultural reconstruction were implemented using farmer to farmer, SARD techniques. Then farmers analyzed the obstacles to the scaling up and scaling out of SARD, and suggested projects and policy ideas for participatory, sustainable agricultural recovery.

In general, technology and training methodologies were not seen as limiting to SARD. After all, farmer experimentation, cross visits and farmer to farmer training are the pillars of the Campesino a Campesino Movement. However, it was strongly felt that national credit, market, agrarian and research policies favored Green Revolution technologies rather than SARD. While NGOs had been instrumental in establishing SARD alternatives, if SARD was to scale out nationally, and scale up institutionally, proactive national policies were required to push it beyond the NGOs' local, "micro-project" sphere of influence.

The findings from these workshops were synthesized and presented by the participants at national meetings in the capital cities of Honduras, Guatemala, and Nicaragua. Key actors in government, relief, development, and research institutions were invited. Farmers and technicians presented their findings; the national research coordinators, the methodologist and the principal investigator gave their reports. In-country researchers in agricultural economics and disaster prevention gave topical presentations. Notable figures such as Nobel Prize winner Rigoberta Menchu, several government ministers, and representatives from the United Nations gave keynote addresses. A video of the research project was shown and distributed.

The Campesino a Campesino Movement in Central America has demonstrated the social, environmental and agricultural advantages not only of SARD, but of farmer-led approaches to sustainable agriculture. The study itself also demonstrates the tremendous potential for research and development within farmers' movements. While farmer-promoters within the Campesino a Campesino Movement have carried out on-farm experiments and have shared their knowledge across borders for thirty years, this was the first time farmers had ever collaborated on a regional research project. Participants have expressed their desire to establish national and regional farmer research networks to continue their agroecological research.

Will the results from the study influence national policies for recovery and reconstruction? Much depends on the ability of the institutions within Central American civil society, e.g., NGOs, municipal associations, and agricultural producers unions, to give voice to the farmers who have successfully demonstrated how to reduce the regions' vulnerability and improve its sustainability.

— Eric Holt-Giménez, Principal Investigator

— Pascal Chaput, Anasonia Recinos Montes, Gonzálo (Pepe) Rodriguez Manuel Camposeco, Maritza Zuleta, Nicolás Arróliga (GeoDigital) los y las técnicos, promotores y campesinos de los equipos de investigación de campo en Guatemala, Honduras y Nicaragua

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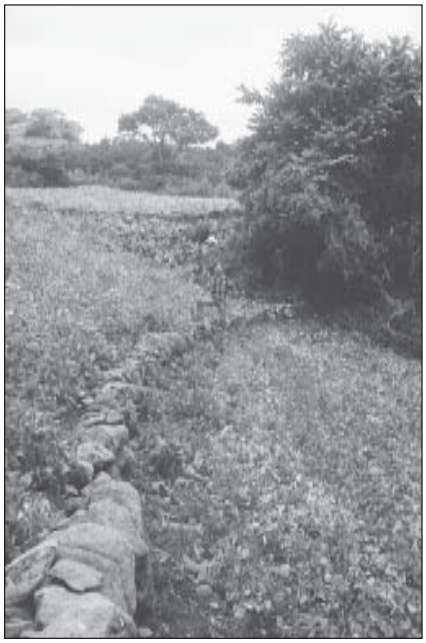
Eric Holt-Giménez



Terraced fields and legume cover crops are components of a soil conservation effort on sloping fields in Nicaragua.

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Apprentices Abroad — Graduates Develop International Agriculture Programs

Each year the Center for Agroecology & Sustainable Food Systems attracts an international group of participants to its six-month training program, the *Apprenticeship in Ecological Horticulture*. Course members come from overseas to learn the practical skills of organic farming and gardening in order to share them with others in their home countries. Many U.S. students also take part in the course with the goal of joining international training efforts.

Last year's class was no exception. Edwin Marty is one of several American participants who found opportunities to work abroad. Kasozi Godfrey, who came from Uganda to take part in the training, is now back home developing a sustainable agriculture program for the Uganda's farmers. Marty and Godfrey join graduates like Bill Martin (class of 1990), who teaches organic farming in Christchurch, New Zealand, as part of a growing cadre of international apprentices training others to produce crops using organic techniques.

With its emphasis on intensive, small-scale production, the apprenticeship's principles translate well to a variety of settings. Course members learn the basics of soil science and soil fertility management, propagation, irrigation, pest and disease control, crop planning, and marketing. They apply these lessons to a wide variety of food and ornamental crops grown at the Center's 25-acre Farm and 2-acre Alan Chadwick Garden. The full-time course includes classroom instruction, readings, and demonstrations, with approximately two-thirds of the time spent in hands-on training in the greenhouses, fields, orchards and gardens.

Marty was drawn to this combination of classroom learning and on-the-ground application. "I became interested in the apprenticeship program because of the unique combination of practical and theoretical agricultural skills it teaches," he says, noting that it's difficult to find a program in Western educational systems that encourages students to practice the skills they learn. "The apprenticeship program introduced me to a broad range of sustainable practices and offered in-depth study into the fields I wanted to focus on, specifically small-scale intensive vegetable production and long-term soil fertility."

Jim Leap

Elizabeth Mukunga, an agricultural extensionist from Kerugoya, Kenya, is a member of the 2000 Apprenticeship course.

Those interests meshed well with the challenge Marty's now facing — teaching Mongolian families to grow their own food. "Our project works in conjunction with a Mongolian government initiative to promote vegetable production by families and communities," he says. "This is a reaction to the agricultural changes that occurred in 1990, which were brought on by the post-Soviet economy. Overnight the entire agricultural infrastructure collapsed as imports of chemical inputs from the Soviet Union stopped and all the Soviet agronomists went home. Food production in Mongolia dropped by three-quarters in less than five years, mainly in wheat and potatoes. Although there isn't a current food shortage, Mongolia has gone from a food exporting to a food importing country, with almost all vegetables brought in from China."

According to Marty, this level of imports has put tremendous pressure on Mongolia's already overloaded infrastructure and driven up food prices. The majority of Mongolians spend 40%-50 % of their income on basic food items, putting the cost of vegetables nearly out of reach for many. Vegetable consumption is now a fraction of what it was during the Soviet-supported era. "After 1990, many Mongolians simply stopped eating vegetables. And the malnutrition surveys by Unicef document the unfortunate results," he says.

The government hopes to counter this trend by training families to grow their own vegetables using sustainable practices. It has asked non-governmental organizations to contribute by focusing on small-scale vegetable production to relieve skyrocketing unemployment and malnutrition. Marty is now creating a training program in small-scale, biointensive agriculture, including such techniques as composting, double digging beds, crop rotation, and seed saving. "This year we're working in three sites around Mongolia, training 150 families to grow their own food. We plan to expand this project to train 750 families next year in six sites, in both the rural and urban sectors."

With its short growing season and erratic weather, farming conditions in Mongolia are dramatically different from those on California's Central Coast. "Fortunately, the Apprenticeship Program does an excellent job of teaching the fundamentals of food production and these remain true wherever you are," says Marty, who's found an enthusiastic audience for the training program. "Wherever we go there is widespread interest in these skills and in becoming more self-reliant. The Mongolian people have many challenges to face in producing their own food but all seem more than willing to put forth the effort and give it a try."

ORGANIC AGRICULTURE IN NEW ZEALAND

New Zealand native Bill Martin grew up on a conventional farm, but his interest in sustainable agriculture meant leaving the country for training. "When I got interested in organics a decade ago, it was still a relatively small-scale movement in New Zealand. The country had wholeheartedly adopted the tools of conventional agriculture. There was nowhere in the country to learn about organic farming in a program like the Apprenticeship, so I came to Santa Cruz."

Sustainable agriculture and organic farming have made inroads in the past decade. Martin was able to apply his apprenticeship training at home, where he teaches at Christchurch Polytechnic on New Zealand's South Island as part of a program that prepares students for careers in organic agriculture and horticulture. "It's the only program of its kind in the country," he says. Twice a week, he also works with clients of a local mission for the homeless and unemployed, teaching organic gardening and orchard skills at a city-sponsored garden.

Like Marty's experience in Mongolia, Martin has found that the techniques he learned during the Apprenticeship training have broad applications. "Handworked gardening methods can be applied nearly anywhere, and the skills you learn can be translated to a larger, mechanized scale as well. I particularly found the Apprenticeship's holistic approach to management valuable, in that it looks at the whole system of soil, pests, predators, and plants. These are basic principles that can be used in all types of settings."

In addition to his teaching work, Martin also runs a 100-member Community Supported Agriculture project with two partners on the outskirts of Christchurch. Here too he sees increased interest in organically grown food. "Organics are definitely getting more popular, especially in reaction to the controversy over genetically modified organisms. Now even mainstream mums are beginning to seek out organic produce."

TRAINING FARMERS IN UGANDA

Two years ago, Kasozi Godfrey went in search of a training program that emphasized sustainable agriculture and organic techniques. "I was already involved in organic farming, but was seeking a place where I could attain more knowledge in order to help as many farmers as possible," says Godfrey. His search led him from his home in Uganda to Nairobi, Kenya and the offices of the UN's Environmental Program. In a directory of programs related to the environment, Godfrey found a listing for the Center's Apprenticeship course. "It was just what I was looking for," he says.

With support from a Margoes Foundation scholarship *(see next page),* Godfrey completed the training course and is now program director for Uganda's Center for Environmental Technology and Rural Development. Part of his work includes running Training and Extension services for farmers in western Uganda. "I am transferring what I learned at the Apprenticeship to establish a small Demonstration Center where we can teach other trainers as well as farmers. All the study materials I brought from the course are being used by our staff and others in Uganda's sustainable agriculture network."

Godfrey acknowledges that the Apprenticeship helped fill in many of the blanks in his own farming background, especially in areas such as pest control, tree pruning, and cultivation of medicinal plants. "In fact, I am helping a

Sueta Patel

Kasozi Godfrey, pictured during the 1999 apprenticeship course, is now home in Uganda developing a sustainable agriculture program for small-scale farmers.

women's group to establish gardens for medicinal plants," he says. Still, some of the lessons are more difficult to apply in a subsistence setting. "I must say that some of the technology like irrigation is still very expensive for many of our local farmers, but they need it if they are going to produce crops during the dry season."

Much of Godfrey's time is spent lobbying the Ugandan government for changes to support small-scale organic farmers. These farmers face policy and funding constraints that will sound distressingly familiar to others working in sustainable agriculture. "There is a lot of hindrance to organic farming in that our government still strongly supports the use of chemicals and fertilizers," says Godfrey. "So many farmers are still going in for the use of chemicals as it is the only way they can get loans from banks and other big institutions. I have not seen any bank that is interested in supporting farmers who are involved in organic farming."

Still, Godfrey is hopeful, "Though our efforts in creating awareness, advocating for organic farming and lobbying the Ugandan government and donors, we hope we shall see a big change soon."

As future graduating apprentices become involved in training projects both internationally and in the U.S., they'll be equipped with a new tool: the *Training Manual for Intensive Organic Production in the Garden and Small Farm*. Currently being developed by Center staff for 2001 publication (see *Center Notes,* page 16), the manual will include information on how to teach many of the core classes offered as part of the Apprenticeship.

- Martha Brown

Applications for the 2001 apprenticeship course are now available. See page 16 for details.

Margoes Foundation Extends Scholarship Program

For the past three years, the Margoes Foundation of San Francisco has sponsored scholarships for participants from Africa to take part in the Apprenticeship in Ecological Horticulture. The Foundation recently granted additional funding for African scholarships. A total of $62,520 will be made available over the next three years to support two African participants a year in the six-month training program. The scholarships cover travel, tuition, books, tools, supplies, insurance, food and living expenses, and other program costs.

Applications for the Margoes Foundation scholarships are due September 1 along with the other international application materials for the 2001 Apprenticeship. Contact the Apprenticeship office at 831/459-2321 or annemari@zzyx.ucsc.edu for information and application materials.

Center
Notes

Center to Head New Consortium

Thanks to the efforts of Representative Sam Farr, the Center for Agroecology & Sustainable Food Systems (the Center) has received funds from the US Department of Agriculture (USDA) that will be used to help develop and maintain a consortium of research and education groups in the Monterey Bay region to promote sustainable agriculture (see also *From the Director,* page 4). The Center will coordinate the consortium, with the goal of combining research, extension, and education to protect the area's sensitive watersheds, provide acceptable income for growers and farmworkers, and explore potential markets for agricultural commodities.

The interdisciplinary consortium will include staff and affiliated faculty from the Center, along with personnel from UC Cooperative Extension, UC Sustainable Research and Education Program, USDA-Agricultural Research Service, the Natural Resources Conservation Service, Santa Cruz County Farm Bureau, and regional non-governmental organizations such as the Community Alliance with Family Farmers.

Water and soil quality are of particular importance in the Monterey Bay region, where agricultural lands adjoin sensitive natural areas and wetlands, and where water quality has been affected by agricultural inputs and erosion. Goals of the consortium project include developing strawberry and vegetable crop management systems that emphasize crop health and biological pest control, reduce off-farm environmental impacts, and conserve the region's biodiversity while remaining economically viable for growers.

In addition, the consortium will link efforts currently underway to track changes in ecosystem function, biodiversity, and socio-economic measures in the region's multiple use watersheds. These watersheds are home to housing, agriculture, and wildland conservation and restoration programs, all of which have impacts on the region's natural resources.

Finally, the consortium plans to assess how feasible it is for different types of producers to adopt new, sustainable technologies. The group will evaluate the cost of resource-conserving practices and look at alternative marketing strategies, as well as developing ways to encourage consumers to support integrative farming. Details of the consortium's ongoing efforts will be reported as this project develops.

Tracy Chapman Gives Benefit Concert

Singer-songwriter Tracy Chapman, a strong supporter of organic and sustainable agriculture, has offered her August 30th concert at the San Jose Center for the Performing Arts as a benefit for organic farming research and education. Proceeds from the sale of special benefit seating will support the Apprenticeship's scholarship program and the Organic Farming Research Foundation (OFRF). Check our website (http://zzyx.ucsc.edu/casfs) for more information on benefit tickets and hear a great concert while supporting the Center!

Curriculum Project Underway

Work is now underway on the Center's curriculum development project, which will result in a training manual encompassing the basic skills and concepts taught in the Center's six-month Apprenticeship in Ecological Horticulture course *(see below)*. The project's primary goal is to formalize the existing Apprenticeship course curriculum, drawing on the course's 30-year history of training and incorporating educational materials from other sustainable agriculture educators. The manual is intended for organizations and individuals involved in sustainable agriculture education, urban gardening, organic farm internships, overseas food projects, and other training programs.

Participants in the current Apprenticeship course are pilot testing the manual by evaluating classes, demonstrations, exercises, and written materials. Reviewers from other institutions and organizations have been solicited to give feedback on the units and to add materials from their own classes and trainings. The manual is scheduled for publication in early 2001.

Grant Supports Center's CSA Program

This winter the Center received a $10,000 grant from The True North Foundation, a small private foundation based in Fort Collins, Colorado that provides funding for environmental and conservation activities, as well as social service programs. The grant will support the Center's Community Supported Agriculture (CSA) Training and Demonstration Project.

The CSA effort has become an integral part of the Center's education and production efforts. This winter, Nancy Vail was hired to coordinate the Center's 90-member CSA project and teach classes in CSA crop planning and the history and current status of the CSA movement to members of the Apprenticeship in Ecological Horticulture course. Vail will also train apprentices in propagation, bed preparation, pest and weed control, post-harvest handling, and other skills needed to run a successful CSA project.

Vail's background includes a stint at Hawthorn Valley Farm in upstate New York, where she and her husband David Oretsky grew crops that they sold at the Green Market in New York City's Union Square. They were apprentice course members in 1997, and stayed on to work with Center farm manager Jim Leap and help run the CSA project through 1999. The new CSA Coordinator position brings added stability to the Center's CSA effort and will allow us to develop an even more effective training program.

Center Faculty Affiliate Wins Outstanding Teaching Award

Professor Steve Gliessman, the Center's founding director and current faculty affiliate, has been honored with an Excellence in Teaching Award from UC Santa Cruz's Academic Senate. Gliessman was one of 13 faculty to receive the 1999-2000 award.

Besides his popular classes in agroecology, Gliessman also teaches courses in the Natural History of California "Field Quarter" series, which includes travel to natural areas throughout the state. Three years ago he also initiated a course in ethnobotany which has drawn capacity classes in the spring.

Gliessman received a $500 honorarium and a certificate with the following wording: "For a commitment to developing students who will grapple with the world's problems in new, creative, integrative, and collaborative ways as they make the link between knowledge and experience, information and action, and inquiry and learning."

2001 Apprenticeship Course

The Center offers a six-month training course in organic gardening and farming called the Apprenticeship in Ecological Horticulture. The course, based at the Center's on-campus 25-acre Farm and 2-acre Alan Chadwick Garden, emphasizes hands-on learning, working side-by-side with instructors, and classes in organic horticultural methods. Cultural requirements for vegetable, herb, flower, and fruit cultivars are covered, including the specifics of soil preparation, composting, sowing, cultivation, propagation, irrigation, and pest and disease control. Marketing efforts include an on-site Community Supported Agriculture (CSA) project. This is a full-time program involving strenuous field and garden work five days a week. There are several full and partial tuition waivers available for minorities and for economically disadvantaged individuals. Tuition for the 2001 program is $3,000 with additional costs for books, tools, and food. Dates for the program are April 10, 2000 - October 13, 2000. Application deadlines are November 1, 2000 (US and Canadian citizens); September 1, 2000 (international applicants).

For an informational brochure and application, please write, call, or visit our Web site:

Apprenticeship Information
CASFS
UC Santa Cruz
1156 High St.
Santa Cruz, CA 95064
831/459-2321; 831/459-2799 (fax)
http://zzyx.ucsc.edu/casfs

UC's First Organic Production Manual Features Work of Center Staff

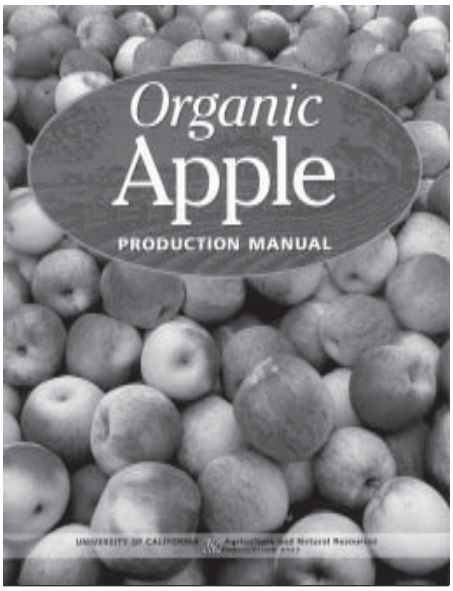
The University of California broke new ground this spring with the release of its first commercial farming manual to feature organic production techniques. The *Organic Apple Production Manual* is based in large part on studies conducted by researchers from the Center for Agroecology & Sustainable Food Systems (the Center) and UC Cooperative Extension (UCCE) in conjunction with growers from California's major apple-producing regions.

"This manual is an indispensable resource for current or potential producers of organic apples," says Sean L. Swezey, the Center's associate director and one of the book's principal authors. Says Swezey, "Modern apple production is a highly technical undertaking to begin with. Producing apples organically requires even more vigilance and ingenuity to deal effectively with pest control, soil fertility, postharvest handling and other management challenges." Other principal authors include UCCE researchers Janet Caprile, Paul Vossen, and Walt Bentley. Swezey, who also directs the UC Sustainable Agriculture Research and Education Program, worked with Center senior editor Martha Brown to coordinate development of the manual.

The manual reviews the organic apple industry, including trends in production and markets, supply and price, certification requirements, and other state and federal regulations. Individual chapters explore orchard management, disease and pest management, harvest and postharvest operations, marketing considerations and economic performance. Published by the UC Division of Agriculture and Natural Resources (ANR), the Organic Apple Production Manual is illustrated with 20 color photographs and 19 tables, contains an extensive index and lists a comprehensive bibliography of related publications for apple growers.

Organic and conventional growers alike will find a wealth of information on issues of common concern. Conventional growers considering the transition to organic production and certification will learn why it's important to make the shift carefully and incrementally. Guidelines on what records to keep, who to contact and what to expect during the transition are also included.

Many of the basic agronomic practices are the same for both organic and conventional apple production systems. These are well documented in two other ANR publications — *Commercial Apple Growing in California* (ANR Publication 2456) and *Integrated Pest Management for Apples and Pears, 2nd Edition* (ANR Publication 3340). Together with the *Organic Apple Production Manual* these publications comprise an essential reference kit for anyone considering organic apple production.



The *Organic Apple Production Manual* offers growers information on making the transition to organic growing and improving organic techniques already in place.

California is emerging as one of the nation's leading apple producers, exceeded only by Washington state. Plantings of Granny Smith and Fuji varieties in the San Joaquin Valley during the last 15 years have helped boost the state's production. Of the roughly 36,000 acres of apples grown in California, a small but increasingly significant percentage are grown organically. Organic apples and apple products, including juices and apple sauce, are a staple in consumer cooperatives, natural food stores, specialty produce stores, farmers' markets, community supported agriculture projects, and other direct marketing outlets.

The 72-page *Organic Apple Production Manual* (publication #3403) is priced at $18 a copy plus tax and shipping. To order, either contact the local county office of UC Cooperative Extension, call or write UC ANR Communication Services (6701 San Pablo Avenue, Oakland, CA 94608-1239, phone 800-994-8849, fax 510-643-5470), or order online at http://anrcatalog.ucdavis.edu. *IPM for Apples and Pears, 2nd edition* (#3340) and *Commercial Apple Growing in California* (#2456) are available for $30 and $3.50, respectively, plus tax and shipping.

Center Takes Part in Variety Trial

A strawberry variety trial is underway at the Center's farm on the UCSC campus as part of an effort to identify varieties that perform well in organic systems. Working with Carolee Bull and Joel Stryker of the US Department of Agriculture–Agricultural Research Service in Salinas, Center farm manager Jim Leap is evaluating ten varieties of strawberries planted in a section of the farm's research fields. They include Aromas, Carlsbad, Diamante, Douglas, Hecker, Pacific, Pajaro, Seascape, Selva, and Sequoia. As part of the study, the performance of plants treated with a commercial inoculant of mycorrhizae (beneficial fungi) designed to promote plant growth is being compared to untreated controls. Similar trials have also been planted on three other organically managed fields in Santa Cruz and Monterey counties.

Initial results have been encouraging. According to Leap, all of the varieties planted at the Center's farm have flourished, with no major pest or disease problems. "Of the four sites in the trial, this one is apparently performing the best," says Leap. The lack of Verticillium wilt, a common disease in strawberries, may be attributed in part to the study site's history. The field has been fallowed for several years, and a crop of broccoli (thought to suppress Verticillium) was grown and incorporated into the soil just prior to planting the trial.

Data on yield, disease, pest pressure, and colonization by mycorrhizal fungi will be collected through the remainder of the cropping season, with a second year of trials planned for the 2000-2001 season. Results of the variety trial's first season will appear in the next issue of *The Cultivar*.

Study Examines Seed Dispersal Mechanisms

Understanding the seed dispersal mechanisms of California's coastal prairie plant species is important for conservation and restoration efforts, and for understanding the impact of livestock activities on these plants. In an experiment conducted on two coastal prairie sites, Porter Ranch and Younger Ranch (both in Santa Cruz County), UC Santa Cruz undergraduate Shannon Sokolow measured the seed shadow, or primary seed dispersal, of *Holocarpha macradenia*. This endangered plant is native to central California's coastal prairies. The wildflower seed content of cattle dung was determined by cultivating several dung samples. Sokolow determined that the maximum dispersal distance for *H. macradenia* without animal dispersers was 45 cm. No viable *H. macradenia* seeds germinated in the cattle dung samples; rather, several non-native forbs were the predominant species.

Because wind and gravity alone do not disperse *H. macradenia* seeds any farther than 45 cm, and because cattle most likely do not disperse seeds long distances in their dung, Sokolow concludes that landscape fragmentation must be avoided in the remaining prairies containing *H. macradenia* in order to maintain contct between existing populations or for the plant to colonize new locations. She recommends that this experiment be repeated using a larger sample size for the graphical depiction of the seed shadow, and using dung samples collected several times throughout the year. Her study was supported by a grant from the Center as part of its Collaborative Grants Program for UCSC faculty, graduate, and undergraduate students.

BASIS Strawberry Study

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Table 1. Effects of weed control treatments on weed biomass and density.

Treatment	Weed biomass reduction (%)[1]	Density Reduction[3] Annual bluegrass	Corn spurry	Shepherds purse
Clear	85.6 b[2]	54.6 b	79.6 b	28.6 ab
Clear + broccoli	83.6 b	93.6 b	78.0 b	76.2 b
Clear + black	93.4 b	77.0 bc	75.6 b	57.1 b
Untreated	0 a	0 a	0 a	0 a

[1]Based on weed dry weights per 5.9m^2 of bed top on 11/2/99
[2]Means followed by the same letter do not significantly differ according to the Duncan's multiple range test at P=0.05.
[3]Based on weed densitites per 2,625cm^2 of bed top on 12/11/99

sults of these trials are presented in Table 1.

Ranch 9: At this ranch, which is new to the BASIS study, six treatments were compared for their weed control abilities. This included the BASIS system of microbial inoculants, organic acids, amended composts, plant extracts, enzymes, and corn gluten meal (CGM). The BASIS treatment without corn gluten meal and without the microbial inoculants was also tested. Although not as effective as methyl bromide or Vapam soil fumigants, these biological inputs provided a significant level of annual bluegrass and common chickweed suppression, whether or not the microbial inoculants or CGM were included. According to Bull, this is an encouraging result that warrants further study of the BASIS treatment's weed control mechanism.

ABOVE-GROUND STUDIES

TRAP CROPS EFFECTIVE IN EARLY SEASON

For the 1999-2000 cropping season's above-ground pest control studies, Center researchers planted farmscapes of annual trap crop species at five ranches in mid November.

Two new perennial borders were established, and two others from the study's first year are being monitored this season.

The radishes in the annual trap crop came up first and were allowed to flower, then half the crop was cut back to maintain its vigor. Researchers let the other half of the trap crop grow until just before the predicted hatch date of lygus (based on degree-day calculations), when the crop was cut and removed from the field to eliminate lygus eggs. Only one of the growers treated the trap crop with insecticide; the others mowed the trap crop to control lygus.

Early-season results (through mid May) indicate that trap crops are effectively attracting lygus bugs. Degree-day based calculations have provided accurate predictions of lygus hatch dates, making these calculations an effective tool in timing management (mowing, spraying) of the trap crops. In addition, there have been slightly fewer lygus in berries where farmscapes are in place than in the non-farmscaped controls.

Numbers of generalist predators and parasitic wasps have been higher in trap crops and perennial plantings, although as in the study's first year this has not translated to higher numbers of predators in the adjacent strawberry plantings. Researchers have also found more immature generalist predators in the trap crops than at control sites, indicating that these crops are serving as an insectary (breeding and nursery ground) for beneficials. Although lygus parasitoids are not specifically identified in this study, the fact that other parasitoids are breeding in the trap crop is an indirect indication that lygus parasitoids may also be present.

This season's above-ground research includes a new effort to identify the family and genus of spiders found in the study sites. Eri Mizuno, a new Center research assistant, is identifying spiders collected from the annual and perennial farmscapes, and from farmscaped and non-farmscaped strawberry plantings. Based on literature reviews and other research efforts, she will try and pinpoint the spiders' diets to determine the roles they may play in controlling pest species, and whether farmscaping affects population levels of important spider genera.

The BASIS-OASIS study will continue through the 1999-2000 season, with a third research season planned for 2000-2001.

- Martha Brown

Events

continued from back page

der free. Camping is available on Saturday night for $5 per adult; children camp free. Please no dogs. For more information please call Hoes Down at 530/796-3464 or see the web site http://www.eco-farm.org/hoes2000.html.

▶ **The 2000 Farm Conference** will take place November 17–19, 2000 at Santa Rosa Junior College in Santa Rosa, California. The theme of this year's conference is "Healthy Farms — Healthy Communities: Ingredients for Success." Workshops are planned for a variety of topics, including specialty crops and products, crop and livestock production, sustainable farming practices, farm and food policy, and education about family farms and food systems. Tours and short courses will also be offered. For more information contact Tom Haller at 530/756-8518, ext. 16, or see http://www.californiafarmconference.com (beginning in early July).

International

▶ **The International Federation of Organic Agriculture Movement's (IFOAM) 13th International Scientific Conference** will take place August 28–31 in Basil, Switzerland. Key conference topics include research, rural development, and living systems. For more information, contact: IFOAM 2000 c/o Research Institute of Organic Agriculture (FiBl) Postfach, Ch-5070 Frick - Switzerland or e-mail: ifoam2000@fibl.ch www.ifoam2000.ch

Variety Trials

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That promotion can extend to growers as well. "If I find something I think will sell, part of my job is to get growers interested in it. We want our growers to do well and make money, and one way to do that is getting them to try new things," says Allan.

Breaking out of routines to try new things — it's the bottom line of variety trials. "You never know what could be doing better for you unless you try it, and there is an infinite world of interesting plants out there to try," says Krupnick. For the organic industry, Krupnick also sees a more fundamental importance to trials. "We should be seeking to find varieties that thrive using the techniques and under the conditions we've established, and that really show their superiority in an organic system. We should be looking for varieties with flavor or vibrancy so superior that this becomes a market distinction in itself."

- Martha Brown

Santa Cruz area

events

▶ **The World of Bats** will take place Saturday, July 15, from 8–10 pm at the Louise Cain Gatehouse on the UCSC Farm. Bat conservationist Morgan Venable will present a slide show talk and walk focused on these night creatures. $3 for adults; free for 15 and under. Call 831/459-3240 for more information or 459-4140 for directions.

▶ **Preparing the Winter Garden** will take place Saturday, September 9, 12 noon–3pm at the UCSC Farm. Learn how to prepare your garden beds for the winter season and get the most out of your fall-planted crops. Learn about cover cropping, best-performing vegetable varieties and more. $5 for members of the Friends of the UCSC Farm & Garden; $10 for nonmembers, payable the day of the workshop. Call 831/459-3240 for more information or 459-4140 for directions.

▶ **A Garden Grill Benefit Dinner** will take place Tuesday, September 12, 6 pm–8 pm at the Merrill Provost's House on the UCSC campus. Join us for a garden-fresh dinner and the chance to learn how to prepare the bounty of summer on a backyard grill. $15 for members of the Friends of the UCSC Farm & Garden, $20 for nonmembers. All proceeds benefit the community education and scholarship work of the Friends. Please call 831/459-3240 to reserve a space.

▶ **The Fall Plant Sale** will take place Friday, September 15, 12 noon–6pm, and Saturday, September 16, 10am–2pm at the Barn Theater parking lot at the base of the UCSC campus. The region's best-suited varieties of organically grown winter vegetables and landscape plants will be available. Call 831/459-3240 for more information.

▶ **Apples for the Home Garden & Small Orchard,** a free workshop by Chadwick Garden manager Orin Martin, will take place Saturday, October 7, from10am–12 noon in the Alan Chadwick Garden at UCSC. Martin will share his infectious enthusiasm for this popular crop. Learn which varieties and rootstocks are best suited to the home garden or small orchard. A taste test follows the talk. Call 831/459-3240 for directions and more information.

▶ **The Harvest Festival** will take place Saturday, October 14, from 11am–5pm at the UCSC Farm. Don't miss this annual celebration of fall on the Farm. Music, food, talks, hay rides, kids' events and crafts, tours and more. Free for members of the Friends of the UCSC Farm & Garden and kids 12 and under; $3 for non members.

California events

▶ **A Benefit Concert by Tracy Chapman** will take place August 30, 2000 at the San Jose Performing Arts Center. Singer-songwriter Tracy Chapman will play a benefit to support the Center for Agroecology & Sustainable Food Systems and the Organic Farming Research Foundation. See page 16 for more information.

▶ **Taking Back Our Food, Farms and Playgrounds** will take place October 6–8, 2000, in Redwood City (just south of San Francisco). This conference will address interlocking issues of pesticide reform, environmental health, genetic engineering and corporate influence on agriculture. Workshop topics include pesticide drift, working with the medical community, how to organize for local policy reform, and genetic engineering for pesticide activists, among others. Lois Gibbs of the Center for Health, Environment & Justice will be the keynote speaker. The conference is sponsored by Pesticide Action Network North America (PANNA), Pesticide Watch (PW), Organic Consumers Association (OCA) and Californians for Pesticide Reform (CPR). The conference fee of $200 includes registration, materials, accommodations, meals, and membership in OCA, PANNA and PW. Scholarships are available. For more information, contact Conference Coordinator, Pesticide Action Network, 49 Powell St., Suite 500, San Francisco, CA 94102; phone 415/ 981-6205, ext. 382, in California, toll-free 888/277-4880; fax 415/981-2727. The conference Web site is http://www.igc.org/panna/octConf.html, or email ctlee4@panna.org

▶ **The Hoes Down Harvest Festival** will take place October 7–8 at Full Belly Farm near Guinda, California (on Hwy 16, easily accessible from Sacramento and the San Francisco Bay area.) This celebration brings people of all ages together for a fun day to learn how healthy food is grown. Activities include a farmers market and crafts area, children's activities, farm tours, live music and dancing. Haya actividades en español todo el dia para toda la familia.
All day admission to the festival is $5 for children ages 3–15, $10 for adults, and ages 2 and un-

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