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the Cultivar

The CENTER for AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS

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in this issue:

Study Examines Agriculture's Impact on Central Coast Water Quality

Water quality affects natural habitat for a variety of species that depend on Central Coast wetlands.

As fall rains returned to California's Central Coast, researchers from the Center for Agroecology and Sustainable Food Systems (the Center) initiated the second year of a study examining nitrogen levels in runoff from various land uses in the Pajaro River and Elkhorn Slough watersheds. Both watersheds drain into the Monterey Bay National Marine Sanctuary, the largest such sanctuary in the U.S. Land uses in these watersheds include agriculture and livestock production, managed timber, protected open space and parks, and urban and suburban development.

Although nutrients such as nitrogen and phosphorous are critical to agricultural systems, too much of these inputs can compromise water quality. Waterways affected by runoff from farms, septic systems, landscaping, and other development often have nitrogen levels above 1 part per million (ppm), a level that is considered elevated and can have ecological impacts.

"High nitrogen levels can trigger 'blooms' of algae and other plants, which reduce available oxygen during the night. Microbes that decompose these blooms also use up oxygen in the water," says Marc Los Huertos, a postdoctoral reseacher with the Center. The resulting oxygen-limited (anaerobic) environment can kill fish and invertebrates, and compromise habitat quality for birds and other wildlife. Nitrogen in the form of nitrate can also pose a health threat to humans by polluting drinking water sources when it exceed 10 ppm (measured as nitrogen) or 45 ppm (measured as ammonium).

The regional water quality agency has determined that major waterways draining into the Monterey Bay Sanctuary are affected by elevated nutrients such as nitrogen, "nuisance" algae, sediments, and pesticide contamination. The goal of the Center's water quality monitoring work is to determine the way that land uses affect nitrogen concentrations in rivers, creeks, and agricultural drainage ditches on the Central Coast, and develop recommendations for reducing these impacts. The research is led by Center director Carol Shennan and funded by a grant from the US Department of Agriculture.

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THEIR RELATIVE IMPACT—IS IT BIG OR SMALL?"

"Although studies have examined the issue of land use and water quality, no one has developed 'loading' estimates that link nitrogen loads to particular land uses in this region," says Los Huertos, who heads the monitoring project. According to Los Huertos, loading is the amount of chemical (in terms of pounds or grams) that is carried in a waterway. "Loading estimates will be needed to develop Total Maximum Daily Load [TMDL] guidelines," he explains.

TMDL guidelines are used to gauge how much of a pollutant can legally be put into a waterway by various sources (agricultural, residential, etc.; see sidebar at right for more information on guidelines). Information on nitrogen loading can also help growers and other land managers determine the impact their practices have on water quality and provide a baseline that can be used to measure the effects of changes in farming and other land management practices. "Currently, growers, residents, construction contractors, and others have no way to gauge their relative impact—is it big or small?" says Los Huertos.

TRACKING LAND USE EFFECTS

During the 2001 water year (October 1, 2000 to September 1, 2001), Los Huertos, Shennan, and postgraduate researcher Lowell Gentry collected and analyzed water samples at 35 sites throughout the Pajaro River and Elkhorn Slough watersheds. "We sampled water sources of the Monterey Bay that have important consequences for wetland and near-shore habitat," says Los Huertos. These included sites along the Pajaro River, Corralitos Creek, and Carneros Creek adjacent to forested areas, urban and suburban development, and grazing and row crop fields.

Where waters passed through forested areas high in the watershed, nitrate levels were relatively low. For example, on Corralitos Creek at Las Colinas Road, where a redwood forest dominates the watershed above the road, the nitrate-N concentration was usually <0.1 ppm. Below Las Colinas Road, nitrate-N concentrations increased as Corralitos Creek passes through low-density housing, orchards, and areas of vegetable production (Figure 1). According to the researchers, the nitrate increase is primarily due to agricultural sources, although domestic septic systems may be an important contributor.

Nitrate levels in Carneros Creek, which drains the Elkhorn Slough watershed, displayed a similar pattern. At the upstream sampling site (Dunbarton Road), the nitrate loss from oak woodland and grazing land was relatively small. In contrast, the combination of agricultural activities and low-density housing lower in the watershed contributed to elevated nitrate concentrations downstream at the San Miguel Canyon Road sampling site. Nitrate-N levels at the San Miguel site ranged from 0.7 to 17.1 ppm.

Agriculture also accounted for elevated nitrate-N levels at sampling stations adjacent to the Watsonville Slough. Although nitrate concentrations were quite low at the upstream location of Errington Road, they increased dramatically in less than 1 kilometer (0.62 miles) at Lee Road as they passed through the row crop fields adjacent

DETERMINING TMDLS

The federal Clean Water Act of 1972 has led to substantial improvement in water quality around the country. Initially, most of the effort to reduce pollution focused on "point sources" of pollutants, such as factories and sewage plants. As those sources were addressed, attention shifted to "nonpoint sources" such as agriculture and urban runoff.

California has proposed a three-step program to address nonpoint source pollution. The first involves voluntary action by land managers to reduce their impact on waterways. These efforts are currently being carried out on the Central Coast through groups such as the California Alliance with Family Armers, county Farm Bureaus, and UC Cooperative Extension. If water quality standards aren't achieved through voluntary steps, then state and, ultimately, federal regulations may be imposed.

Regulating nonpoint source pollution involves establishing a Total Maximum Daily Load, or TMDL, for particular pollutants affecting an impaired waterway. This is a multi-step process that includes—

- assessing both point and nonpoint sources of the pollutant;
- determining the contribution from each source;
- determining appropriate load reductions for each source;
- implementing a program to achieve load reductions; and
- monitoring to determine whether water quality standards are being met.

The Center's work involves determining the contribution of nitrogen from various sources, as well as determining the total "load" of nitrogen being carried in a waterway. Center researchers are also working with growers to reduce their sources in order to minimize nitrogen loads from agricultural fields.

CENTER RESEARCHERS ARE WORKING WITH GROWERS **TO MINIMIZE NITROGEN LOADS** FROM AGRICULTURAL FIELDS

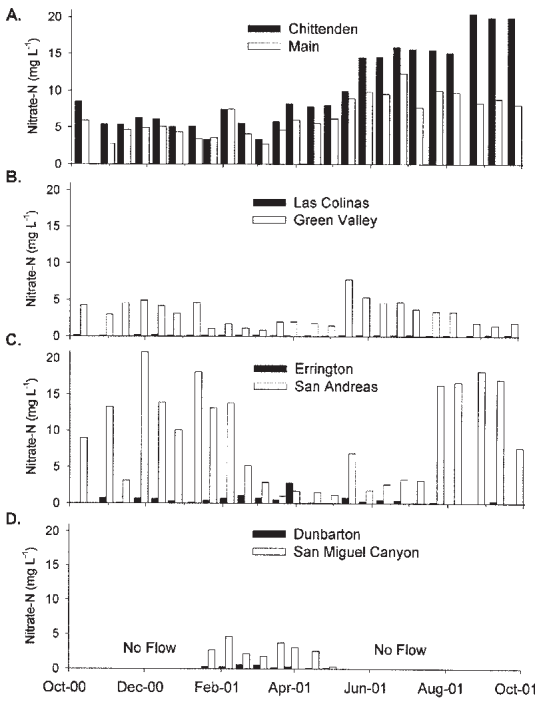

Figure 1. Nitrate-N concentrations in biweekly samples, comparing upstream (filled bars) and downstream (empty bars) locations in four water reaches. A. Pajaro River; B. Corralitos Creek; C. Watsonville Slough; D. Carneros Creek.

to the slough. This pattern held true for much of Watsonville Slough (Table 1). During the dry months when inflows from adjacent sloughs decreased, part of the slough became stagnant, with very low levels of oxygen in the water and sediments—a condition that can threaten wildlife.

Nitrate-N levels were also high in agricultural drainage ditches in the Pajaro Valley (Table 2). These ditches receive runoff from tiles (perforated pipes buried 1–2 meters underground) that drain agricultural fields. The fact that nitrate levels did not decrease with dilution during storms indicates that the shallow, perched water table in the lower Pajaro River valley is saturated with nitrate-N derived from unused fertilizer that has accumulated through several cropping cycles. "Given this saturation, concerned growers who limit nitrogen losses from their fields may not see short-term water quality improvements in these drainage ditches," says Los Huertos.

Table 1. Nitrate-N concentrations (mg L^{-1}) in Watsonville Slough (selected dates).

Location	Oct 2000	Dec 2000	Feb 2001	Apr 2001	Jun 2001	Aug 2001
Errington	<0.1	0.6	0.8	<0.1	0.4	<0.1
Lee Road	19.7	6.3	4.1	4.3	23.0	14.7
RR tracks	9.6	3.1	2.2	1.4	9.6	3.4
San Andreas	9.2	16.1	2.9	1.5	2.6	16.7
Shell St.	NS	12.4	5.2	5.5	5.7	22.2

CALCULATING NITROGEN LOADS

The Center's water quality research group calculated annual nitrogen loads for the Pajaro River, Corralitos Creek, and Carneros Creek. "To calculate a load, we estimate the volume of water passing a measuring location [such as a USGS gauging station], using daily discharge volumes," explains Los Huertos. "Then we multiply the volume by the concentration of nitrate in the water. Finally, we add up how much nitrogen has passed through our sampling site for a year—this is the annual load."

The Pajaro River—the largest of the three waterways monitored—carried 672,000 pounds of nitrogen into the Pajaro Valley. "The Pajaro River is something of an enigma for the Pajaro Valley," says Los Huertos. "It enters the valley after passing through agricultural areas higher in the watershed with a relatively high amount of nitrate, but nitrate concentrations downstream tend to be somewhat lower." This finding contrasted with both Corralitos and Carneros Creeks, which exhibited higher nitrate levels farther downstream in the watershed. The researchers speculate

Table 2. Nitrate-N concentrations (mg L^{-1}) in selected Pajaro Valley surface water drainage ditches.

Location	Feb 2001	March 2001	April 2001	May 2001	June 2001	Aug 2001
Drainage Ditch 1	20.4	19.9	23.1	24.6	23.3	21.2
Drainage Ditch 2	88.7	89.5	76.5	79.0	85.5	63.7
Drainage Ditch 3	81.2	80.7	63.7	75.3	82.3	66.3

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from the
director

Economic uncertainty seems to be on everyone's mind this fall. With the state facing an "incredible shrinking budget," all University of California programs are being asked to trim costs, deal with a hiring freeze, and prepare for lean times that will likely last for a while

Against this backdrop we're happy to have some accomplishments to celebrate. One is the completion this fall of the new Garden Classroom at the Center's on-campus Farm. A project of the Life Lab Science Program, the Garden Classroom will serve the region's students, as well as teachers from around the state. The new garden incorporates a variety of elements, including native plants, a pollinator garden, a composting area, and an "adaptations" garden, to teach students about science in a garden setting (see page 16). The Garden Classroom will enhance a variety of Center outreach programs, including our children's tours and summer camps

I'm also glad to report that the Center received a budget renewal for the Central Coast Food Systems project. A grant from the US Department of Agriculture is funding this ongoing study of water quality, farming practices, and marketing systems to give us a better sense of both the environmental and economic impacts and opportunities for the region's growers. In this issue we report on the progress of the project to date (see pages 1 and 9).

We were once again able to offer our annual Center research grants to graduate and undergraduate students this fall. These grants help make possible the field studies that form the basis for senior thesis and dissertation projects. On page 7 we report on graduate student Chris Bacon's study of the developing market for Fair Trade and organic coffee and its impact on coffee growers in northern Nicaragua, research that was funded in part by a grant from the Center.

The upcoming winter quarter will mark another milestone as we offer the first in a series of new "practicum" classes for UCSC students. Building on ideas originally proposed by former Center director Steve Gliessman, these classes offer theoretical, class-based studies of the agroecological concepts and biological processes behind various farm management practices. Labs include hands-on work in the orchards, fields and greenhouses at the Center's Farm & Garden facilities. The winter course will be taught by the Center's Apprenticeship training staff and myself, with additional courses in the planning stage.

- Dr. Carol Shennan

center staff

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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:

CASFS, University of California
1156 High Street, Santa Cruz, CA 95064
831/459-4140 or 459-3240 (telephone) 831/459-2799 (fax)
http://www.ucsc.edu/casfs

for the

Farmer

Innovative Program Links New Farmers with Land

A crowd of apprentices, local farmers, and representatives from agricultural organizations packed the Center for Agroecology & Sustainable Food System's (the Center's) Gatehouse building at the UCSC Farm on the sunny morning of October 17th. The question that brought them together was, "How can I start my own farming business?" The workshop was on Business Planning and Innovative Farm Financing Strategies, organized by California FarmLink.

David Visher of Farm and Agricultural Consulting Services (FACTS) in Davis was on hand to speak about the steps of starting a farm business: self-assessment, goal setting, evaluation, and marketing. Mark Franco, a senior loan officer from Farm Credit, discussed how new farmers could prepare themselves to be good candidates for operational and real estate loans.

"The part that was most helpful for me was the overview of options for acquiring land, by conventional as well as alternative financial arrangements," said one apprentice. Another participant reflected, "It helped me to break down the process so I can get started."

"Discussions such as these are very necessary to help aspiring farmers get out on the land with a good chance of starting a successful business," says Steve Schwartz, Executive Director of California FarmLink, a non-profit organization started in the fall of 1998. Donations from individuals and grants from businesses, foundations and governmental agencies fund the organization.

Pete Lowy

Farm manager Jim Leap (on tractor) demonstrates a spader to participants in the Apprenticeship training course.

PRICES A BARRIER FOR BEGINNING FARMERS

FarmLink's goal is to preserve family farming and conserve farmland in California. One way to do this is by linking retiring farmers with aspiring farmers. There are approximately 22,000 farmers in California over the age of 65, many of whom want to keep their lands in agricultural production but don't have family members interested in taking over the farm. Meanwhile, hopeful beginning farmers such as participants in the Center's Apprenticeship in Ecological Horticulture program are finding it difficult to locate land to buy or lease in California at a reasonable price.

Every year more than thirty apprentices graduate from the six-month training course, many with the goal of starting their own organic farm. While the Apprenticeship prepares them for the nuts and bolts of farming, with training in planting techniques, soil fertility management, organic pest and disease management, and marketing, the next step—land tenure—is beyond, the program's scope. This is where California FarmLink can help. "I think their services dovetail well with the Apprenticeship and the very real challenges that alumni face when trying to acquire land on which to practice their passion for farming and gardening," says Erin Barnett, who coordinates the Apprenticeship course.

"Last year we saw affordable certified organic land transferred to a conventional farmer because we could not help the retiring organic farmer find a link fast enough," says Danielle LeGrand, a Regional Outreach Coordinator with California FarmLink, "Apprenticeship course graduates make great candidates for our program and we'd hate to see opportunities like that get passed up again."

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Pete Lowy

Garden manager Christof Bernau (kneeling) discusses soil fertility management with apprentices in the 2001 course.

FARMLINK OFFERS MATCHING PROGRAM, OTHER SERVICES

California FarmLink has a database of retiring farm and ranch owners with a description of their farm, and a database of aspiring farmers and ranchers. Through a questionnaire process, beginning farmers describe the type of opportunity they're looking for, the regions of the state to which they'd consider moving, and whether they're looking to lease, crop-share, or buy. From this database matches are made, and California FarmLink works with both parties to facilitate a meeting, assist in developing contracts or agreements, and in some cases help pay for outside technical assistance if it is needed for the land transfer.

California FarmLink can also work with those who have found a farm to lease or buy, but need help during the transition process. One FarmLink client was a farm worker employed by a retiring farmer under the arrangement that the worker's share of the business grew over the years from 10% to 50%. When the retiring farmer passed away, the farm worker was in a position to buy the business but needed help negotiating with the landowners and getting loans to buy the property. California FarmLink facilitated an agreement between the buyer, the property owners, and the Farm Service Agency so that the buyer was able to purchase a farm worth approximately $225,000 with only $2,500 cash down.

In another case, a land trust approached California FarmLink for help finding farmers to buy a property that the trust had put under a conservation easement. California FarmLink introduced the land trust personnel to several farmers from the FarmLink database who matched well with the property. Then, when the land trust was trying to decide whose bid to accept, California FarmLink advocated for one of its beginning farmers over some of the other larger landowners who had also applied. When the beginning farmer's bid was accepted and it came time to sign an agreement, California FarmLink subsidized the cost of having a lawyer review the conservation easement. The agreement is currently closing and both parties are happy with the outcome.

Conservation easements are one tool that can make land more accessible to beginning farmers. Not only does this arrangement preserve the property for future generations of farming (as such easements guarantee that the land will never be developed), conservation easements can also lower the land's cost. In many cases, development pressures—particularly in California—have driven land values sky high, and prices often far exceed the land's agricultural value (based on the difference between the price one could get for building duplexes and supermarkets on the property versus the value to a farmer for crop production). For a beginning farmer without much capital, paying for the land's agricultural value is far more feasible than paying for its development value. By getting a land trust or other third party to buy the development rights via a conservation easement, the cost to the farmer interested in purchasing the land can be brought down to a more reasonable level. For example, in the case described above, the land trust sold the property under the easement at 40% below market rate. California FarmLink believes that in many cases conservation easements are appropriate, and the organization can help to negotiate the conditions and bring in a third party to assist in the transaction.

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FarmLink's Services

In addition to FarmLink's work connecting beginning and retiring farmers, the organization offers a range of services for experienced farmers and their families. "For instance, even if a farmer's retirement is 10 years into the future, California FarmLink wants to help him or her explore and create options for continuing their farm's productivity after their retirement," says Danielle LeGrand, Regional Outreach Coordinator with the organization. California FarmLink also —

- Serves as a clearinghouse for information and contacts on such issues as farm business planning, intergenerational farm transfers, and loan programs.
- Works with experienced farmers who are not landowners and are looking to expand their operations or obtain long-term land tenure.
- Works with retiring farmers on farm succession planning, mentorship skills, and risk management through workshops and one-on-one technical assistance.
- Assists families in passing down the farm to the next generation, helping them to address the goals of parents and heirs, and to aid in dealing with issues of equity when one child seeks to continue farming and others do not.
- Advocates for policies that promote family farm transitions, preserve California farmland, and help beginning farmers obtain land.
- Facilitates an understanding and use of conservation easements and other farmland protection tools.

For details on any of these services, call California FarmLink at 707.829-1691 or visit our web site at www.californiafarmlink.org.

Fair Trade Helps Small-Scale Coffee Growers Weather Crisis

Those of us who enjoy a cup of coffee every morning can thank the 20 to 25 million coffee growers—many of them small-scale farmers—who supply the world's enormous appetite for coffee beans. Coffee ranks second only to oil when it comes to the monetary value of internationally traded natural commodities. "If you drew a mile-wide band around the equator, that would equal the area devoted to coffee production," says Chris Bacon, a UC Santa Cruz Environmental Studies graduate student.

With the support of a graduate student research grant from the Center for Agroecology and Sustainable Food Systems, Bacon is studying the way that changes in the coffee market, particularly the growth of the market's Fair Trade and organic sectors, affect Nicaragua's small-scale coffee growers.

These growers are currently facing a dual crisis: Nicaragua is in the midst of a severe drought, and international coffee prices are at a 50-year low due in part to the high volumes of low-grade coffee being produced in southeast Asia. Part of Bacon's work is to analyze the way that Fair Trade and other alternative markets may buffer growers from the worst effects of these challenges. He's also interested in how different marketing arrangements affect the coffee growers' choice of farming practices.

SPECIALTY COFFEE MARKET EXPANDING

Although most coffee is still sold on the highly consolidated conventional market, the specialty or gourmet market is rapidly expanding. "Think about how Starbucks has gone from 200 stores 10 years ago to close to 3,000 stores today; that reflects the way the specialty market has grown. The specialty or gourmet market represents $7.8 billion of the $20 billion a year U.S. coffee industry," says Bacon, who advises coffee company CEOs and the Specialty Coffee Association of America.

Both Fair Trade and organically certified coffee—what Bacon refers to as sustainable coffee—make up a small but growing portion of the specialty market. Criteria for Fair Trade certification include a guaranteed minimum price to the growers' cooperative (currently $1.26 a pound, or $1.41 for organically grown coffee, compared to 59 cents for conventionally traded coffee). Fair Trade certification is only offered to cooperatives whose growers farm 5 hectares (12.35 acres) or less. The certifiers encourage agroecological practices as well as long-term trading relationships between buyers (the roasting companies) and the cooperatives. And although most Fair Trade coffee is grown organically, not all organic coffee receives Fair Trade certification.

In analyzing the expanding sustainable coffee market, Bacon has found that some of the biggest companies and non-governmental organizations (NGOs) encouraging the market are in the San Francisco region. "Right now the decision to buy Fair Trade coffee is in the hands of the roasting companies and retail outlets, many of which are centered in the Bay Area," he explains. These include companies like Thanksgiving Coffee and the Santa Cruz Coffee Roasting Company, whose owners and workers have an ethical commitment to the Fair Trade and organic movements. "It's these commitments that are dictating their decision to buy Fair Trade; the eco-labels can give them some business benefit as well."

"What's interesting is that companies like Thanksgiving are transforming the idea that you have to accept what the market says. Rather than wait for the market to grow, these roasters are trying to create a market for sustainable coffee through promotion and advertising," says Bacon.

"Bird Friendly" is a certification and marketing technique coffee companies use to help consumers understand the impact of coffee-growing practices. Coffee grown under a canopy of shade trees—a common practice on smaller farms using organic techniques—offers birds more habitat than coffee plantations where shade trees are removed. Promoting shade-grown coffee alerts consumers to "greener" options in their purchasing choices.

Student groups and human rights activists are helping drive market growth from the consumer's end. "The idea is to line up consumption habits with stated values, such as fair working conditions and environmentalism," says Bacon. He helped start an organization at UC Santa Cruz called *Comercio Justo* (Just Commerce) that has worked successfully to open institutional markets, including the campus's cafés and coffee carts, to Fair Trade coffee.

Another student organization at Columbia University forced Starbucks out of their campus contract when the company refused to carry Fair Trade coffee. The university replaced them with Green Mountain, one of the country's biggest Fair Trade roasters. "These are examples of the hundreds of student groups around the country demanding that Fair Trade coffee be made available," says Bacon.

FAIR TRADE STRENGTHENS COOPERATIVES

To complement his market analysis, Bacon is working with growers and cooperatives in northern Nicaragua to find out how the Fair Trade and organic coffee movements affect growers' livelihoods and farming practices.

The timing of his research put Bacon in the midst of one of Nicaragua's worst coffee farming crises. The combination of drought and low coffee prices has many of Nicaragua's coffee workers facing unemployment. "The

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people who work on large-scale coffee farms are the first to suffer because those farms have a higher cost of production," says Bacon. "They employ labor, use more inputs, and sell on the conventional markets. Thousands of workers from these large plantations have lost their jobs. They've marched off the farms and into the streets to protest and seek humanitarian assistance."

To find out how the crisis is affecting growers linked to the Fair Trade and organic markets, Bacon enlisted the help of the cooperatives' agricultural extension agents who work directly with the growers. "Last summer we developed a standardized method for surveying farm households and their farms," says Bacon. "We surveyed 228 coffee farmers to test the hypothesis that growers who are members of cooperatives linked to Fair Trade or organic markets are less vulnerable to the coffee crisis than those selling to the conventional market."

In his preliminary analysis of the survey results, Bacon has found that farmers connected to alternative markets were four times less likely to indicate a risk of losing their farm this year than farmers connected to conventional markets. "That's a significant finding in terms of the way that these growers can use these relationships with alternative markets to stay on their farms and maintain their land and livelihood," says Bacon. He also found that the prices growers received at the farm gate through their cooperatives were twice as high as those being paid via conventional markets and agricultural export companies (Table 1). This is important in times when the conventional price has fallen well below the costs of production.

Table 1. Average Farm Gate Prices, 2000-2001 Harvest

Where did you sell the coffee?	Price paid per pound
Cooperative-conventional market	US $ 0.41/lb
Cooperative-Fair Trade	US $ 0.84/lb
Cooperative-Organic	US $ 0.71/lb
Bird friendly-direct to roaster	US $ 1.14/lb
Agro Export Company	US $ 0.39/lb
Intermediary	US $ 0.37/lb

Source: Participatory farmer survey conducted from July to August 2001. All farmers were members of cooperatives involved in the project. Note: The prices paid by buyers as well as the price structures internal to each cooperative will determine the prices reported at the farm gate. Many cooperative general assemblies decide to use a portion of the higher prices offered by fair trade and organic coffees to invest in infrastructure, pay past debts, provide credit and technical assistance and support rural development projects; this will result in lower prices reported at the farm gate.

Bacon acknowledges that the current market climate has exaggerated this cost difference. "But price is only one indicator of what's happening," he explains. "The bigger impact is on the cooperatives themselves and their ability to strengthen the organization of small-scale farmers. We found that the two Fair Trade certified cooperatives we worked with had many more rural development projects and services, and more capacity to organize, than did cooperatives dealing with the conventional market. This is probably more significant than the price they receive."

Chris Bacon

Byron Corrales, a third-generation sustainable coffee grower, samples coffee from beans grown on area farms. Corrales is a founding member of Nicaragua's National Agriculture and Ranchers Association.

Tying his market analysis and farmer survey work together, Bacon finds that the growth of sustainable coffee markets has indeed had an impact on cooperatives, at the farm gate, and on farming practices. "The positive relationship of these cooperatives to alternative markets has helped farmers realize that during a crisis they need to strengthen their own organization to find better markets and work ecologically to reduce costs," says Bacon.

Despite these positive impacts, the market for sustainably produced coffee is still too small to accommodate all the coffee being grown under Fair Trade and organically certified conditions. "Much of the coffee ends up on the conventional market at conventional prices," says Bacon. "We've been discussing with the growers their decision to adopt organic practices, because there's a risk that they won't realize a price premium. They need to consider other positive impacts of organic production, such as reducing costs or improving working conditions."

IN-DEPTH STUDY PLANNED

Bacon recently received a prestigious Switzer Environmental Fellowship for $13,000 to support his research, which he has developed under the guidance of professors Roberto Sanchez, Steve Gliessman, and David Goodman of UCSC's Department of Environmental Studies. Beginning in June 2002 Bacon will spend a year or more in Nicaragua to conduct a more in-depth study of coffee cooperatives and farming practices. He plans to analyze and compare a cooperative working with the Fair Trade and organic markets with a cooperative selling to the conventional market. He'll look at the relationship between farm households, farm management practices, and shade management of coffee grown by farmers linked to these two types of cooperatives. His work parallels that of Ernesto Méndez, another

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Vacuums Clean Up Lygus in Trials

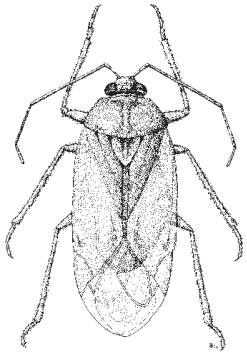
Vacuuming up insect pests in strawberry fields isn't a new idea—strawberry growers have been using tractor-mounted "bug vacs" to suck pests from strawberry plants for more than a decade. But the technique has drawbacks, including its impact on populations of beneficial insect that could help reduce pest numbers.

During the 2001 cropping season, researchers from the Center tried a new twist on the vacuuming procedure by applying it to trap crops, where populations of strawberry pests—particularly the lygus bug (*Lygus hesperus*)—had concentrated. A grant from the Organic Farming Research Foundation to Center specialists Sean Swezey and Bill Settle, and postgraduate researcher Polly Goldman funded the trap crop study. Center members worked with six strawberry grower-collaborators in Monterey and Santa Cruz Counties to implement the study on their farms.

Research team members Goldman, Janet Bryer, Merrilee Buchanan, Amanda Lewis, and Diego Nieto established and monitored early- and late-season trap crops planted on raised beds within strawberry fields. "A combination of early- and late-season trap crops offer lygus a continuously blooming, non-strawberry habitat," says Goldman "The goal is to maintain a habitat throughout the season that's attractive to lygus and draws them away from the strawberry plants."

The early-season trap crop consisted of 1/3 Daikon radish (*Raphanus sativus* L. Daikon group), 1/3 culinary radish (*R. sativus* L. Radicular Group "cherry belle") and 1/3 wild mustard (*Sinapis alba*). The late-season mixture included 45% semi-dormant alfalfa (*Medicago sativa* L. 'Stallion'), 45% non-dormant alfalfa (*Medicago sativa* L. 'cougar') and 10% alyssum (*Lobularia maritima*).

For the vacuuming experiment, which was conducted with the help of Ohri Yamada, a visiting student from France, two separate blocks of trap crops were planted at four of the cooperating growers' sites. At each site, one of the two trap crop blocks was randomly chosen as the experimental (vacuumed) trap crop, and the other was used as an unvacuumed control. The experimental trap crops were vacuumed every two weeks using a tractor-mounted vacuum device. Immediately before and after each large-scale vacuuming, the researchers sampled the trap crops with a hand-held vacuming device to compare changes in numbers of lygus and natural enemies. Results show that



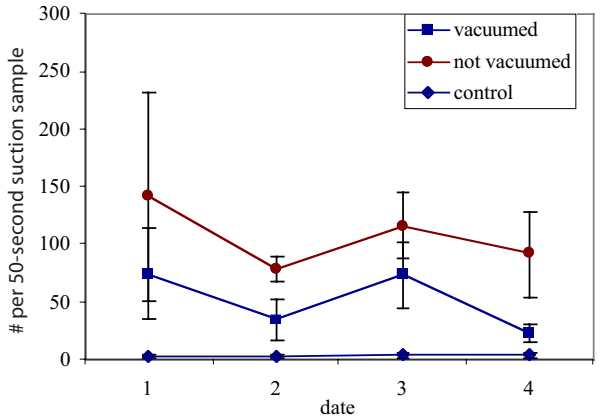
Tara Dalton

Lygus bugs *(Lygus hesperus)* deform strawberries by feeding on the developing fruit, causing a condition known as "catfacing."

the tractor-mounted "bug vacs" substantially reduced the lygus populations in the trap crops immediately after vacuuming (Figure 1).

The researchers also experimented with multiple passes over the same trap crop using the tractor-mounted device, vacuuming them once, twice, and three times, and sampling for insects after each pass. "Our preliminary results show that these multiple passes didn't remove additional lygus from the trap crops," says Goldman. Analysis of the vacuuming experiment's impact on in-season population dynamics of both lygus and beneficial insects in the strawberry plots is now underway.

Figure 1. Effect of trap crop vacuuming on total lygus in trap crop.



Samples taken immediately after vacuuming. "Vacuumed" and "not vacuumed" refer to trap crops; "control" refers to strawberries at the edge of non-farmscaped fields.

Center researchers feel that the vacuuming study showed enough promise in controlling lygus to warrant further

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study. "Now that we know that we can impact lygus numbers in the trap crops, we plan to expand the research in the coming season," says Goldman. This includes vacuuming trap crops weekly and examining both lygus numbers and lygus damage levels in strawberries adjacent to the vacuumed trap crops. Based on its availability, they also hope to release *Anaphes iole,* a lygus egg parasitoid, into the trap crops to see how such releases can best be used with vacuuming to optimize lygus control.

Study Examines Potential for Increasing Ecological Farming Practices

Center social issues researchers are studying ways to facilitate the adoption of ecological farming practices and enhance the viability of small farms on the Central Coast as part of a study of the region's food and farming systems (see related cover story on water quality research).

Headed by Patricia Allen, the Center's associate director for social issues, the group is currently focusing on food-marketing systems. Research has shown that the adoption of ecological farming practices often depends upon factors outside of the on-farm production system. For example, a lack of markets and the limited financial resources of some growers have been identified as barriers to more widespread use of these practices. The social issues team, which includes post-graduate researchers James Murrell and Jan Perez, is therefore focusing on parts of the food system that reach "beyond the farm gate." The research, coordinated by Center director Carol Shennan, is funded by a grant from the US Department of Agriculture (see "New Project Focuses on Central Coast Farms and Food Systems," *The Cultivar,* Vol. 18, No. 2), and includes Monterey, San Benito, San Mateo, Santa Clara, and Santa Cruz Counties .

Allen and her colleagues are analyzing features of both alternative and conventional marketing systems. Alternative marketing strategies such as community supported agriculture (CSA) and eco-labels are increasing in importance for many growers, particularly small-scale growers. "Although alternative marketing strategies currently account for only a small proportion of agricultural sales in the Central Coast, they can be important for demonstrating the use of ecological farming practices and for their role in improving the viability of small farms," explains Allen. "At the same time, we realize that the vast majority of growers operate on a larger scale and work within the conventional marketing system." Allen points out that significantly increasing the total acreage on which ecological production practices are adopted requires discovering opportunities within the conventional marketing system.

One of the research group's projects is an intensive study of community supported agriculture in the Central Coast region. "Research in other regions has suggested that CSA farms tend to use organic or sustainable production practices and can provide options for small-scale farmers," says Allen. The goal of the current project is to learn how the CSA model is being implemented on the Central Coast and to understand its potential role in developing a more sustainable food system in this region. The group recently distributed a detailed survey to CSA members throughout the Central Coast and is conducting interviews with CSA growers. Focus group interviews with CSA members are also planned. According to researcher Jan Perez, "There's been very little research done on CSAs in California. Now, thanks to the cooperation of CSA growers and members, we're developing a much better understanding of the role and potential of community supported agriculture on the Central Coast." Results of the survey and interviews will be reported in the next issue of *The Cultivar.*

Another focus of the research is a marketing strategy known as eco-labeling. Eco-labels, such as the organic label, are a marketing alternative that may play a role in adoption of ecological farming practices for both large-scale and small-scale growers. Many eco-labels, based on region, environmental enhancement, or social equity are being developed throughout the world. To explore the potential of eco-labels on the Central Coast, the research team will focus on the impact of the new eco-label, "Fields to Oceans," recently launched as part of the Monterey Bay Farmer's Clean Water Initiative.

The "Fields to Oceans" eco-label encourages shoppers to support growers whose farming practices protect Monterey Bay's natural resources.

Recognizing that alternative markets may play a limited role in expanding ecological farming practices, the research group is also analyzing potential "leverage points" in the conventional food distribution system for increasing organic and sustainable production.

"In looking at the dynamics of the conventional food chain, we've so far found that the other players [such as shippers, processors, and retailers] appear to play a determining role in grower' agricultural practices" says research group member James Murrell. "An example is where a retail grocery chain has discouraged growers from using vegetative buffer strips—an important ecological production practice—citing food hygiene reasons."

Institutional purchasing may be another leverage point for encouraging food production using organic, sustainable techniques. "We know that many public institutions such as schools, hospitals, and prisons are potential markets for farmers who use ecological farming practices," says Allen. "But this option is often hindered by problems such as coordination and transportation. We want to assess the

> continues on page 19

Growing Peas in the Home Garden

Garden or English peas (*Pisum sativum*) are hardy, cool season, vining annuals grown for their fresh immature green seeds and pods. Peas are classified in the Fabaceae (formerly Leguminosae) family, which consists of approximately seven hundred genera and seventeen thousand species, with cosmopolitan distribution throughout the temperate, subtropical, and tropical zones of the world. Many species in this family are used as food, forage, timber, and dye plants.

Peas are thought to have originated on the eastern rim of the Mediterranean into the mideast. Remains of 7,000-year-old carbonized seeds have been found in Switzerland. By the height of the Greek and Roman civilizations, peas (and legumes in general) were well established garden, field, and green manure crops.

Although peas are not heavy yielders (in terms of pounds per area), they are well worth the effort in small gardens. A fresh garden pea's taste is so far superior to its store-bought equivalent that it is in fact a different vegetable—sugar vs. starch, fresh and lively vs. dull and soggy.

Along with spinach, peas usually herald the first working of the soil and planting in spring. If all goes well, sweetness and succulence await you 50 to 70 days after planting seeds. Because they need to be trellised, peas afford excellent opportunities for intercropping (see sidebar, next page).

Once established, peas don't require much work. They are able to grab onto the trellis and spread themselves out for greater exposed photosynthetic area and better air circulation to reduce the incidence of mildew. They are not very sensitive to weed pressure. In fact, weeding established pea patches can do more harm than good, as peas have numerous surface roots that are sensitive to disturbance.

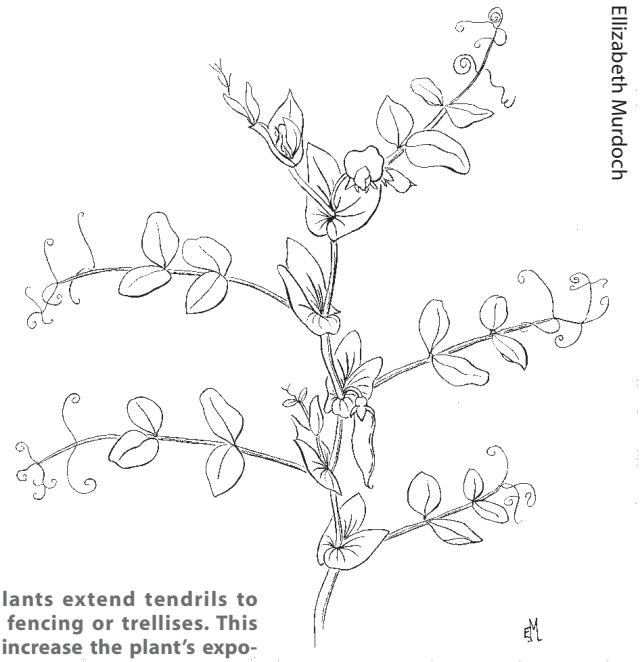
GROWING HINTS

Cultivation. All peas are emphatically cool season crops. Optimally, they are direct sown when the soil temperature averages over 50° F. Sixty to eighty days of temperatures below 80° F are requisite for good production. Soil temperatures of 55°–75° F will yield germinating seedlings in 7–10 days. Overly wet and cold (below 50° F) or wet and warm (over 75° F) soil increases the percentage of pre-emergent rot. In fact, because pea seeds are large and can imbibe and hold so much water, allowing the soil to dry down significantly between waterings will reduce rot and ensure good germination.

Soils. Good drainage is essential for vigorous growth. Early cropping favors sandy soils as they drain and warm more quickly than clays.

Peas, as do most legumes, prefer a slightly acid (6.8) to slightly alkaline (7.2) soil pH. This higher pH range also provides for the high calcium needs of peas. Peas are intolerant of acid soils.

Planting. Peas should be direct seeded or gently transplanted from speedling/plug trays. Seeds can either be drilled in rows or broadcast sown. Drills can be single or double rows 2–4 inches from the trellis to facilitate the tendrils (modified leaves) finding the fence.



Ellizabeth Murdoch

Pea plants extend tendrils to grasp fencing or trellises. This helps increase the plant's exposure to sunlight.

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Side Cropping

With a single or double row of peas on a trellis in the center of a 48-50-inch-wide raised bed, a crop (or two) of quick-maturing plants can be grown along the bed edges (side cropped) for more efficient use of space. These include —

Crop	Planting method	Days to harvest
baby spinach	direct sown	20-30 days
mature spinach	direct sown	40-50 days
cutting lettuces	transplanted	20-30 day
mature leaf or mini romaine lettuce	transplanted	40-50 days
butter lettuce	transplanted	50-60 days
arugula	direct sown	20-30 days
direct-seeded radishes	direct sown	30-40 days

Seeds should be sown heavily (12–15 per foot), as pea seeds generally have a moderate germination percentage (60%–80%) even under ideal conditions. Thin to 8–12 seeds per foot if necessary. The general adage about covering seed two to three times its narrowest diameter applies here; seeds should be planted 1–1 1/2 inches deep, then gently tamped or watered in.

Pea seeds can also be thickly broadcast at 2–3 seeds per square inch, and raked in or covered with soil. Twiggy brush (see below) or one to two layers of horizontal netting creates the trellis for support. This broadcast method nets a higher yield per area but can increase incidence of powdery mildew due to restricted air circulation.

Note that pea seed viability is relatively short (3–4 years) under ideal circumstances. In most home garden situations seed will only last 1–3 years. When ordering pea seeds, think in 1/2 and 1 pound increments (1,500–2,000 seeds per pound). Varietal selection is important as to plant height and time to maturation, but most importantly, pay attention to disease resistance. Basically, if a varietal description doesn't tout or mention disease resistance, be a smart shopper and realize it probably has none. The more recent the varietal introduction, the more disease resistant it is. Unfortunately, the converse is true as regards heirloom varieties. (See page 14 for varietal descriptions.)

Nutrients. Because legumes are capable of fixing nitrogen via association with soil bacteria, garden peas are mistakenly thought to need little or no supplemental nitrogen. The truth is that they fix very little nitrogen unless inoculated with the appropriate species of bacterium (see *Inoculation,* below). They will also use most of the nitrogen they fix and thus don't particularly enrich the soil for the following crop. Phosphorous is an important nutrient for early root development and to assist with flowering, fruiting and sugar development. Fortunately legumes are efficient at gathering and concentrating phosphorous.

Fertilizing the peas prior to planting is optional on enriched or improved soils. A compost of chicken manure, mixed greens, and straw or leaves will boost nitrogen and phosphorous levels. Composts of brassicas and legumes will concentrate phosphorous and calcium.

Inoculation. Pea plant vigor and thus production is markedly increased when the seed is inoculated with the appropriate species of *Rhizobium* bacteria (see sidebar). These bacteria can be purchased in a powdered carrying agent (usually talc) from most seed catalogues and nurseries. To inoculate, simply dampen the seed, add powdered inoculate and mix until the seeds have a blackened, peppered look. Plant as soon as possible as the water activates the bacterial population and desiccation is harmful.

Watering. Peas require 1–2 inches of water per week. They are intolerant of water stress (i.e., too little water); stress will reduce plant size, decrease yield quality—resulting in tough, starchy peas—and severely shorten the length of cropping. Flowering and early fruit set are key times to ensure an even flow of water. While peas have a tap root that can penetrate up to 3 feet, most of the effective feeding roots range from just under the surface to 12–15 inches deep.

Once peas are established, and especially as they begin fruiting, they are subject to a fungal disease called powdery mildew. Overhead watering in conjunction with high humidity will bring on the disease. To help avoid the problem, either water overhead in the morning prior to a sunny stretch of weather so that the plants will dry out, or use drip tape or soaker hose around the base of the plants.

Trellis or Fencing. All but the shortest varieties of peas need some sort of support. Although many varieties are advertised as self-supporting (especially the "leafless" types), this is not true. Fencing allows closer plant spacing (1–2 inches between plants to 2 plants per inch), because the plants can spread out on the trellis or fence. Fencing also increases sunlight interception, minimizes disease, and facilitates easier picking.

One age-old tradition for trellising peas is what the British refer to as "twiggy brush." The branched prunings of last year's growth from fruit trees inserted into the soil make an excellent, cheap, and somewhat artistic fence. The brush is usually good for two to three years. One- and two-inch chicken wire will also suffice. Unlike beans, peas aren't a heavy plant or fruit, thus they don't need as strong a fence. In fact, garden twine run vertically or woven between hori-

Rhizobium Bacteria

One of the remarkable features of most legumes is their ability to host symbiotic soil bacteria on root nodules. This association allows the bacteria to take nitrogen gas from air in the soil and convert or "fix" it chemically into a form available to plants. The bacteria residing in the legume root nodules are called Rhizobia (*Rhizobium* spp.). Each species of legume hosts a specific species of the *Rhizobium*; that is, the species that associate with clovers won't inoculate peas and visa versa. You can significantly increase the vigor and yield of pea plants by inoculating the seeds with the appropriate *Rhizobium* prior to planting.

zontal 2x4s makes a biodegradable/compostable trellis. String on a wooden A-frame also works. The important thing is to install the trellis prior to planting and to rotate it around the garden so as not to be tempted to repeat the crop in the same bed before two to three years have passed.

Crop Establishment. Unless peas are ridiculously oversown, thinning is unnecessary. Spacing plants farther than 3–4 inches apart makes no sense, nor increases yield per foot. One weeding at the 3-inch stage usually keeps the peas ahead of the weeds. Because peas are so succulent, the less the crop is handled the less the physical damage. Even micro-breaks in the foliage can lead to an "invasion" of powdery mildew.

Mulch. Mulching helps protect the surface roots from heat and desiccation, thus prolonging cropping as summer approaches.

Harvesting. Peas must be picked every 2–4 days to ensure quality and continued production. This is usually not a problem on a garden scale. To avoid harming the plants as you pick, hold the stem in one hand and pinch the pod off the vine just behind the calyx with the other hand.

BUSH VS. CLIMBERS

Peas, as well as beans and tomatoes, come in two forms: bush (determinate) and climbers (indeterminate). As with beans, originally all peas were rampant climbers. Dwarf or bush varieties are a result of breeding efforts that have selected for quicker maturation and easier care and labor (fencing and picking). Each type has its pros and cons –

Bush types

- Mature quickly, 50–60 days (40 days for some early varieties)
- Concentrated cropping period, 1–3 weeks
- Less effort and materials for fencing or trellising
- Increasingly greater varietal possibilities
- Require bending and stooping to harvest, especially on dwarf early varieties
- Lower overall yield
- Higher pod to vine ratio

Climbers

- Slower maturing, 60–75 days
- Extended cropping period, 3–5 weeks
- Require extensive trellising
- Almost vanishing varietal possibilities
- Picker can stand tall and straight to harvest
- Significantly higher overall yield
- Lower pod to vine ratio

Note: All peas need to be kept picked to prolong production. As few as 2–3 pods left to mature will shut down further pod production, as the plant shunts a lion's share of its energy into ripening seed.

THE THREE TYPES OF PEAS

Shelling Peas *(Pisum sativum)*

Shelling peas and *petit pois* come in single, double and multiple podded varieties. Multiple-podded varieties "throw" two or more pods at each node and are thus more productive. Usually, the more modern the variety, the greater the productivity.

Shelling peas must be picked after the 8–10 individual peas have sized up but before their sugar has turned to starch (every 2–4 days). A properly mature, but not overripe, pea pod should be mid-dark green, shiny, and fully round and plump. And of course, they must be shelled or shucked because of the starchy nature of the pods, which requires lots of labor. If well grown and picked with proper timing, they are moist and sweet with a low starch content and can be, and often are, eaten while picking in the garden.

If they do make it into the house, shelled peas can be added raw to salads, lightly steamed (2–3 minutes), or added with leafy greens at the very end of a stir fry dish. As with corn, the sugars in peas start to convert to starch within minutes of picking. Thus quick usage or cooling and chilling to lower the core temperature is essential. This is one instance where living hand to mouth amounts to high living.

Shelling pea plants can be divided into 3 heights:

- short (and quickest maturing) varieties under 2 feet tall; mature in 40–50 days
- intermediate varieties 2–4 feet tall; mature in 50–65 days
- climbing types (often called telephone pole) 5–8 feet tall; mature in 60–75 days

Unlike garden beans, where the bush varieties are a disappointing step down in eating quality from their climbing counterparts, bush peas feature as good as and in some cases better taste than climbers.

Petit pois are shelling peas of diminutive stature. The plants are smaller—18 inches to 2 1/2 feet. The leaves, pods and peas inside are smaller. However, the succulence, intensity of sweetness, and productivity per plant dwarf standard shelling peas.

Snow Peas *(Pisum sativum* var. *macrocarpon)*

Snow peas or Chinese snow peas differ from shelling peas in that the pod is harvested early when it is still flat and before it starts to twist. With the notable exception of the variety Oregon Giant, the peas (actually ovules inside the ovary) are starchy and unpalatable. Although initially disappointed when I grew snow peas, I've come to regard them as my favorite type of pea. With such an exotic name as snow pea I expected sweetness and snowmelt succulence. Alas, snow peas are all about crop texture and moderate juiciness. Still, they are "de rigeur" in Asian stir fry dishes. One dilemma regarding snow peas is that varieties tend to be either productive or tasty but not both. (See varietal descriptions for solutions.)

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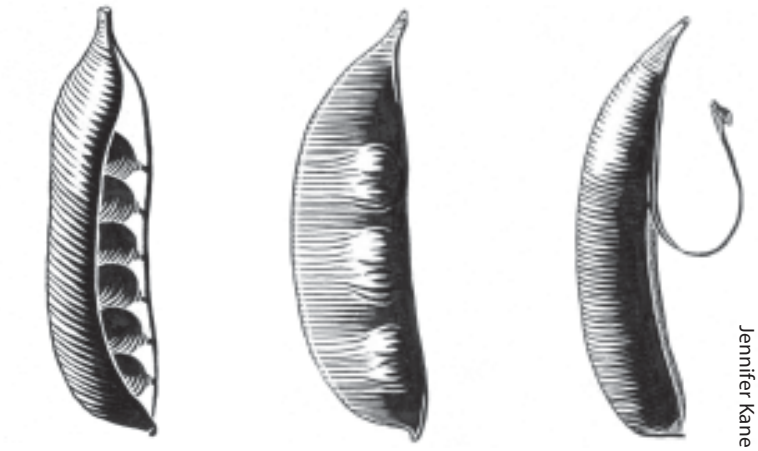
Sugar Snap Peas *(Pisum sativum var. saccharatum)*

The edible pod or "eat the whole thing" pea is both the most significant vegetable development in our gardening lifetimes (pre genetic engineering) and a somewhat overrated item. Originally developed by Dr. Calvin Lamborn of the Gallatin Seed Co. in Idaho, it was a breeding mistake. He was attempting to solve the production problem of twisting snow peas by crossing a heavy-podded shelling pea with a snow pea and voilà—the sugar snap pea.

Sugar snaps feature thick, round pod walls that tightly enclose the peas. The walls themselves are sweet and juicy. The peas are versatile in that they can be used young as an ersatz snow pea, at the proper stage (best flavor results when pods are plump, round and have an audible snap) as a sugar snap, or even as a shelling pea when overmature. The allure of the sugar snap is that it produces more nutrition and taste per plant or area than any other type of pea. It also allows you to eat a shell-type pea with no shelling and is far sweeter than any other type of pea. So, what are the drawbacks?



Jennifer Kane

Left to right: Shelling Pea, Snow Pea, and Snap Pea

- The original sugar snap variety is a 6–10 foot-tall plant with poor vine/fruit ratio. Subsequent breeding has developed dwarf varieties that are only moderately productive.
- The original sugar snap and most of its dwarf offspring have little or no resistance to powdery mildew, and the dwarf types have only average taste and texture.
- The pods have a pronounced "string" that needs to be removed before eating or cooking.

While they are amazing, my feeling about sugar snaps is similar to my thoughts on wind surfing—if I wanted to surf I'd surf, if I wanted to sail I'd sail.

VARIETAL DESCRIPTIONS

Shelling Pea Varieties

Bush Varieties (in order of days to maturation)

These need less fencing, crop early, and have a short, concentrated harvest period–

Dakota (52 days) About the earliest-producing pea. Good productivity on 20"–24" vines bearing 4"-long pods with 6–7 peas per pod. A good bet where cool spring weather turns quickly to summer heat. Disease resistant.

Spring (52 days) Dark-podded, early, smallish, 3"-long pods, with 6–7 peas per pod. Good for fresh eating and freezing.

Maestro (55 days) Vigorous 24"–30" vines, high yield, long cropping period. Peas fill out or enlarge late in long, double pods.

Knight (56 days) 2'-high plants produce single and double 3"–4"-long pods with 7–8 flavorful peas per pod. Old-fashioned, heavy pea flavor; peas are the largest for an early variety. Extremely disease resistant, especially to powdery mildew.

New Century (58 days) A significant new variety. 30"–36"-tall, vigorous vines bear extra-large 6"–7"-long pods with 8–9 peas per pod. Peas are 1/4" wide. Very concentrated harvest period; successive plantings recommended.

Lincoln (60 days) Classic heirloom (1908) with 30" vines, limited disease resistance. Easy to shell, good heat tolerance, and a great old-timey flavor.

Green Arrow (65 days) Classic long-podded (5"–6") variety with 8–10 big peas per pod on 24"–30" vines. Good flavor, heavy yields.

Wando (65 days) Older variety with little or no disease resistance, but best heat tolerance. Vines grow to 36", bearing 3 1/2"-long pods.

Novella II (65 days) Best of the leafless varieties. Bred to have more tendrils for effective self support and less foliage. Good for cool, moist areas, and allows closer plant spacing because of less foliage. 24"–30" vines bear small 3"-long pods with 6–7 peas/pod. Very disease resistant. Pods held above foliage for easy picking.

Climbing Varieties

Maxigolt (60 days) Vigorous bush or moderate climber. Heat tolerant, 4 1/2'–5'-tall vines. A versatile spring or fall performer. Unarguably the biggest (6" long), plumpest, sweetest, heaviest-cropping pea I've ever grown.

Alderman's Telephone Pole (75 days) Produces thick, huge, 6"–8"-long pods on 6'–8'-tall vines that need a strong trellis. Pods are easy to pick and shell. Long harvest period. Old heirloom variety with high flavor when cooked

Utrillo (75–80 days) 5'-7' tall, best sown late summer for late fall harvest. Big peas, 5"-6"-long pods. Top yields, very sweet peas.

Petit Pois

Precoville (60 days) Small vine (15"–20"), small, 2"-long pods. Good flavor when eaten raw, good texture.

Waverex (70 days) Heavy yields of 3"-long pods with 6–7 peas/pod on 15"–20" vines. Intensely sweet.

SNOW PEA VARIETIES

Bush Varieties

Oregon Giant (60 days) A recent introduction from Dr. James Baggett of Oregon State University combines extreme

disease resistance with the biggest (5"–7" x 1"), heaviest pods and sweetest flavor of any snow pea. This variety can even be picked late when pods are starting to twist and "berries" are pronounced in the pods. In fact full flavor is achieved at this stage. Long harvest period. Vigorous 3 1/2'–4 1/2' vines. The best snow pea ever (for now)!

Oregon Sugar Pod II (62 days) Another Dr. J. Baggett introduction. Similar to Oregon Giant, but just a notch below in size, flavor, productivity, etc. Excellent choice.

Dwarf Grey Sugar (60 days) Introduced in 1892. 30"–36" vines. Red blossoms, red blush to foliage. Small pod (2" long), light flavor, stringless, good at immature stage.

Ho Lan Dow (60 days) First snow pea I ever grew (25 years ago) and still reliable. Moderate 24"–36" vine, high productivity, small sweet pods (2 1/2"–3" long). Low disease resistance.

Norli (60 days) Tall vines (4'–5') bear small 2 1/2"–3"-long pods. Moderate flavor, good pod presentation makes picking easy.

Snow Green (59 days) Good disease resistance. 24" vines. Moderate production and pod size (2 1/2"–3" long). Must be picked early or gets tough.

Climbing Varieties

Mammoth Melting (75 days) Classic heirloom variety. The 6'–8'- tall vines bear 3 1/2"–4"-long pods. Low disease resistance. Poor vine/pod ratio but superior taste if picked when pods are flat.

Carouby de Maussawe (75 days) French heirloom with vigorous 6'–8' tall vines. Super sweet taste, even raw. Purple flowers. Makes an attractive annual hedge or screen.

SUGAR SNAP PEA VARIETIES

Climbing Varieties (actually there is only one)

Sugar Snap (75 days) The original and best tasting of all sugar snaps. On the downside, tall vines are hard to pick, plants are very prone to mildew, and the pods have a serious string.

Bush Varieties

Sugar Ann (55 days) Earliest sugar snap. Small pods 2"–2 1/2" long. Sweet flavor. Short vines (2').

Super Sugar Mel (60 days) The most vigorous, highest yielding, biggest, heaviest podded, sweetest tasting of the bush sugar snaps. 36"–40" vines. Best picked when pods are fully enlarged. Good heat and disease tolerance.

Sugar Lace (60 days) A new introduction. Short (24") vines bear virtually stringless pods that are plump and sweet. Vines are "leafless" and thus have an abundance of tendrils to aid in self-support and higher density planting. Large pods are 3 1/2–4" long.

Sugar Sprint (60 days) Sweet, virtually stringless pods. The 3"-long pods plump up quickly. Compact 2' vines are disease resistant.

Cascadia (60 days) Short (28"–30") vines bear 3 1/2"-long pods with high yield, sweet taste, string. Disease resistant. Superb eating quality.

Mega (75 days) Latest-maturing variety. Good in both hot and cool conditions. Large (mega) 4"-long pods with crisp, juicy, sweet flavor similar to Sugar Daddy.

– Orin Martin

REFERENCES

The Book of Garden Secrets: A Guide to Understanding How Your Garden Grows and How You Can Help It Grow Even Better, by Dorothy Hinshaw Patent and Diane E. Bilderback. Rodale Press, 1982.

World Vegetables: Principles, Production, and Nutritive Values, by Mas Yamaguchi. Van Nostrand Reinhold, 1983.

SEED SOURCES

Johnny's Selected Seeds
Foss Hill Rd., Dept. 5561
Albion, ME 04910
207.437-4395, 800.738-6314 (fax)
www.johnnyseeds.com

Shepherd's Garden Seeds
30 Irene St.
Torrington, CT 06790
860.482-3638
www.shepherdseeds.com

Stokes Seed Co.
P.O. Box 548
Buffalo, NY 14240-0548
800.396-9238
www.stokeseeds.com

Territorial Seed Company
PO Box 158
Cottage Grove, OR 97424-0061
email: tertrl@territorial-seed.com
www.territorial-seed.com

The Cook's Garden (Burlington, VT)
PO Box 5010
Hodges, SC 29563 (order center)
800.457-9703
www.cooksgarden.com

Center
Notes

Apprenticeship Receives Donations

Meg Cadoux Hirshberg (1984 apprentice) and her husband Gary Hirshberg made a generous gift of $10,000 to the Center's Apprenticeship in Ecological Horticulture program this fall. Gary is the president and CEO of Stonyfield Farm, Inc., and made the donation in the form of their own Stonyfield Farm stock. Anyone interested in finding out more about how to make donations in the form of stock, or other donation options, may contact Ann Lindsey at 831.459-1558 or alindsey@cats.ucsc.edu.

The Foxwhelp Fund of the Tides Foundation recently donated $1,000 to the Center in support of the sustainable agriculture curriculum project. This award will help fund the publication of the *Training Manual for Intensive Organic Production in the Garden and Small Farm,* currently being developed by apprenticeship staff.

Garden Classroom Opens for Visitors

Local school children, families, and UCSC undergraduates have been busy learning about sustainable gardening practices in the Life Lab Garden Classroom, located near the entrance to the Center's on-campus Farm. The recently completed Garden Classroom, a project of the Life Lab Science Program, provides a hands-on outdoor laboratory for studying the natural world of the garden.

The Garden Classroom will be the focus of redesigned children's tours of the Farm beginning in spring 2002. The new tours will offer grade-specific themes connected to California's State Science Standards and tied to the seasonal work of the Farm. The garden will also host classes and training programs for graduate students and teachers learning about Life Lab's garden-based science curriculum.

An interpretive sign from the new Garden Classroom teaches visitors about compost.

Stop by the Garden Classroom and you might observe: children checking for eggs in the custom-designed chicken coop or feeding their leftover lunch scraps to the worms in the new worm bins; UCSC science students learning about outdoor teaching strategies; pre-schoolers from Family Student Housing crawling through a tunnel of gourd plants; one of the Center's second-year apprentices working with a UCSC intern to build a wheelchair- accessible garden bed; or local teachers learning about compost systems in the new "Rot Zone."

The Garden Classroom will celebrate its official Grand Opening on June 1, 2002. Please call 831.459-2001 for more information on the opening celebration, tours and other activities.

Jennifer McNulty

Chefs Robert Morris, Heidi Schlecht, and Amy Linstrom prepared an elegant meal for the Friends' benefit dinner.

Friends' Benefit Dinner Draws Full House

In November, the Friends of the UCSC Farm & Garden got an early holiday gift in the form of a sold-out benefit dinner at Blacks Beach Cafe in Santa Cruz. Thanks to the talents of Blacks Beach Cafe owner/chef Robert Morris and chefs Amy Linstrom and Heidi Schlecht, owners of Feel Good Foods, a packed house of supporters enjoyed a gourmet five-course meal. Bonny Doon Vineyard owner Randall Grahm donated wines for each course. Other donors included Country Meadow Australian Lamb, Happy Boy Farms, Molino Creek Farming Collective, New Leaf Community Market, and Stagnaro Brothers. Proceeds from the dinner will support the Friends' scholarship and community education work. Many thanks to everyone who made this event a success.

Cal Poly Class Designs Sustainable Structures for Center

A class of third-year architectural design students from Cal Poly San Luis Obispo spent the fall 2001 quarter designing apprentice and visitor scholar housing, office space, and a general site plan for the Center's on-campus Farm facility. The class, taught by architecture professor Polly Cooper, toured the 25-acre Farm in August, reviewed the existing master plan, and interviewed Center apprentices and staff before developing their initial ideas. After getting feedback from Center members, they finalized their plans and presented them at a meeting held December 5, 2001 at the UCSC Arboretum's Horticulture Building.

Designs focused on sustainable building materials, energy efficiency, and minimal impact on the landscape. The project included ideas for improving circulation, access, and other site considerations. Center staff will incorporate the students' ideas as they develop long-range plans for the Center's facilities. Our thanks to Polly Cooper and her class for their tremendous work.

Jon Kersey

Professor Polly Cooper (right) and Heidi Renteria, Social Sciences' assistant development director, discuss an office design with Cal Poly student Raphael de la Lama.

Cal Poly student Mark Ferrette describes his ideas for Apprentice and visiting scholar hous-ing to Susie Melican of the Life Lab Science Program.

Jon Kersey

Linking Farmers with Land

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However, purchasing land is not always the best option for beginning farmers, and in fact 45% of growers nationwide farm on rented land. For a new farmer, the chance to build a business, raise money, and gain experience on leased land may be a better option than purchasing land, assuming lease costs are within reach. Lease-to-own or crop-share agreements represent some of the strongest opportunities for beginning farmers. FarmLink can negotiate these lease options as well as land purchases. "We are working to preserve California's family farms and help the next generation of farmers get started, so our role is to facilitate any type of arrangement that works well for both parties," says Steve Schwartz.

LINKING OPPORTUNITIES AVAILABLE

At the Center's Farm and Garden on the UCSC campus, the six-month Apprenticeship program is drawing to a close as the weather turns cool, the fruit trees lose their leaves, and winter cover crops begin to sprout. Students are making plans for their next step. Many are considering farming in states other than California—for some because these are the states they come from, and for others because of more attractive land prices.

"Sure, I'd love to stay on the Central Coast where there's support for organic and so many markets," says one Apprenticeship graduate, "but I think it would be financially impossible to start up a business here . . . at least for now."

California FarmLink hopes these students and other beginning farmers will maintain an optimistic attitude and continue their mission of responsible land stewardship and food production. The future of California agriculture depends on this next generation. It takes time for farmers to find the land, markets, and living situations that are right for them, and obviously California FarmLink doesn't have links that suit everyone. However, while there are currently no retiring farmers in the database from the Central Coast region, we do have linking opportunities available in Merced, Siskiyou, Tehama, Sonoma, Lake, El Dorado, and San Joaquin Counties. If any of these possibilities interest you, please contact California FarmLink at 707.829-1691, visit our web site at www.californiafarmlink.org, or send email to info@californiafarmlink.org.

– Danielle LeGrand

Central Coast Water Quality

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that some of the nitrogen carried by the Pajaro River enters the groundwater before it can be measured in surface water samples; dilution by feeder streams may also decrease nitrogen concentrations downstream.

The annual nitrate load in Corralitos Creek totaled 17,000 pounds. According to Los Huertos, this figure is somewhat misleading; much higher levels of nitrogen are being lost from the watershed, but since much of the water in Corralitos Creek leaches into the groundwater, a potentially large amount of nitrogen doesn't reach surface waters. This season the Center research group will work with hydrologist Andy Fisher, a professor of Earth Studies at UCSC, to try and determine how much water is actually lost from some selected coastal creeks to groundwater. This information will help in developing a more accurate picture of annual nitrogen loads entering groundwater and Monterey Bay.

Carneros Creek, which empties into Elkhorn Slough, carried an annual load of 5,940 pounds of nitrogen. Of the nitrogen measured, 23% was in an organic form, reflecting a relatively high sediment load in Carneros Creek compared with the Pajaro River and Corralitos Creek. Erosion is a major land management issue in the Elkhorn Slough watershed; staff of the Natural Resouces Conservation Service are working with growers in the area to reduce erosion and sediment loading by adjusting farming practices to minimize surface runoff.

MINIMIZING NITROGEN RUNOFF

Annual load figures, combined with nitrate levels from the study's sampling stations, are beginning to provide a picture of how various land uses contribute to overall nitrogen loads in Central Coast waterways. Although the variety of land uses on the Central Coast make it challenging to assign precise nitrogen levels to land use practices, it's clear that agriculture accounts for a significant portion of the nitrogen loads in surface waters sampled. "We know that less than half of the nitrogen applied to soils is removed with the crop and half is lost, and that's reflected in our sampling results," says Los Huertos.

According to the Center's water quality research group, for growers in the Watsonville Slough area or anywhere along the Central Coast, there are several practices—some of which are already used—that can reduce nitrogen loading of both surface and groundwater.

"Timing irrigation to minimize leaching of nutrients out of the root zone is an effective way to limit nitrate losses," says Los Huertos. "The nitrate form of nitrogen is very mobile, often moving with water in the soil." Therefore, limiting the amount of water moving below the root zone can minimize nitrate movement from the farm into groundwater and ultimately into surface waters.

Some conventional growers have found that applying preplant nitrogen is unnecessary, because the soil supply of nitrogen is relatively high at planting and much of the preplant nitrogen is lost before plants can access it. The researchers suggest avoiding preplant nitrogen in a block or several rows of a field to see whether there are any yield or quality differences.

Another practice that has gained acceptance amongst conventional growers is the use of in-season soil nitrate tests. In contrast to the yearly soil sampling that most growers practice, in-season tests allow the grower to access soil nitrogen status when the plant demand is occurring. Most growers find that by using the soil quick test, for example, they can reduce their nitrogen input costs. "Organic growers can also measure nitrogen levels in the soil to see how they change through the season. If nitrogen levels are high during non-cropping periods, that's a problem," says Los Huertos.

Using a fertilizer balance sheet is one of the best ways to keep track of nitrogen use. According to Los Huertos, this means simply developing an accounting sheet to record the nitrogen inputs and estimate the nitrogen outputs with yield—information that is essential to understanding how much nitrogen is being lost from the system. "Growers can use a computer spreadsheet program to track fertilizer balance, and we're developing a web-based program that will be available in early 2002. Organic growers can also develop nutrient budgets to minimize nitrogen losses," he says.

Finally, there are a number of resources to help growers implement practices that can protect water quality. These include programs such as the Community Alliance with Family Farmers' "Fields to Ocean" water protection program, the Six Counties Coalition of Farm Bureaus, and UC Cooperative Extension's Water Quality Short Course. The Santa Cruz County and Monterey County Resource Conservation Districts (SCCRCD and MCRCD) are working with growers who are concerned about environmental quality, work that has already led to a number of successful projects. Growers and other interested in learning more about these efforts can call Traci Roberts at the SCCRCD (831.464-2950) or Marc Los Huertos at UCSC (831.459-4926).

– Martha Brown

Fair Trade Coffee

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Environmental Studies graduate student conducting a similar study with small-scale coffee farmers in El Salvador.

Bacon hopes his work will offer cooperative managers, growers and marketers information they can use to improve markets and farming conditions. "I see this research as providing a mirror to the farmers and cooperatives, to reflect what they're doing so that they can better understand and improve their practices and conditions. I also want to help Fair Trade and organic certifiers and sellers critique the strengths and weaknesses of their programs," says Bacon.

He also hopes that more consumers will realize the direct impact they have on the lives of those growing the beans they brew each day. As growers make changes to improve coffee quality through sustainable practices, they create a better environment on the farm, with healthier working conditions and increased biodiversity. But ultimately it's up to coffee roasters and consumers to create the market that will support these growers. Says Manuel Umanzar Torrez, a small-scale Nicaraguan farmer from San Lucas, Madriz, "The consumers need to improve the coffee prices."

– Martha Brown

Research Updates

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potential for opening these institutional markets to more Central Coast growers." One category of institutional buying known as farm-to-school programs, where farmers sell directly to school food services, is garnering increased attention throughout the country as a way to both help farmers and provide better nutrition for school children. Here on the Central Coast, Center social issues researchers will be collaborating with community organizations interested in these kinds of programs to see whether they can be implemented in the region's schools.

Water Quality Results Presented

Marc Los Huertos presented the results of the Center's Central Coast water quality monitoring work (see cover story) at the Second International Nitrogen Conference on Science and Policy, held in Potomac, Maryland in October 2001. The conference's theme was "Optimizing Nitrogen Management in Food and Energy Production and Environmental Protection." A paper by Los Huertos, postgraduate researcher Lowell Gentry, and Center director Carol Shennan, "Land Use and Stream Nitrogen Concentrations in Agricultural Watersheds along the Central Coast of California," appears in the conference proceedings and is available on-line at www.thescientificworld.com.

Events

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flower, herb and vegetable starts, perennials, grasses, and other landscape plants available in the region. Proceeds support the Apprenticeship in Ecological Horticulture. Memberships and renewals available the morning of the sale.

▸ **Strawberry Shortcake Festival,** Wednesday, May 15, 4 pm–6 pm, UCSC Farm. Join us for a spring afternoon on the Farm as we enjoy fresh strawberry shortcake and lemonade, and listen to live bluegrass music. A tour of the Farm takes place at 5 pm. $3-$5 donation requested; all donations support low-income CSA shares.

▸ **Garden Classroom Grand Opening,** Saturday, June 1, UCSC Farm. Come help celebrate the completion of Life Lab's Garden Classroom. Call 831.459-2001 for details and directions.

▸ **A Garden of Poetry and Music,** Saturday, June 15, 12 noon–2 pm, Alan Chadwick Garden, UCSC. Set aside time for an afternoon in the Garden as we listen to the poems and tunes of the region's artists. This event offers a wonderful respite from spring gardening chores.

▸ **Art in the Garden,** Saturday, June 15, 12 noon–2 pm, Garden Classroom, UCSC Farm. Kids ages 7-11 are invited for an afternoon of arts and crafts in the Chadwick Garden. $5. Call 459-2001 for more information. Snacks and drinks provided.

▸ **Wildlands and Watering Cans Day Camps,** June 24-28, July 8–12, 15–19, UCSC Farm. These week-long day camps offer kids ages 7 to 10 the chance to enjoy gardening activities, hikes, games, cooking and more at the Farm. Sessions run from 9 am to 4 pm. Call John Fisher at 831.459-2001 or send email to johnfish@cats.ucsc.edu for details. Pre-registration required.

International

▸ **14th IFOAM Organic World Congress,** August 21–24, Victoria Conference Centre, Victoria, British Columbia, Canada. Sponsored by the International Federation of Organic Agriculture Movements and the Canadian Organic Growers. For information on events, registration fees, guidelines for exhibitors, and accommodation information, see the IFOAM web site, www.cog.ca/ifoam2002, call 1.250.655-5652, email ifoam2002@cog.ca, or write IFOAM 2002, c/o Building 20, 8801 East Saanich Road, Sidney BC v8L 1H3, Canada.

Santa Cruz area

events

▸ **Stone Fruits Pruning Workshop,** Saturday, February 2, 10 am–12 pm at the UCSC Farm. Fruit tree expert orin martin leads this workshop with a focus on peaches and plums. Wear warm clothes; heavy rain cancels. $5 for Friends of the UCSC Farm & Garden; $10 for non-members, payable the day of the workshop. No pre-registration needed.

▸ **Birds in the Garden,** Saturday, February 2, 10 am–12 pm, Life Lab Garden Classroom, UCSC Farm. Kids ages 7–11 are invited to watch and learn about birds and build simple feeders at the new Life Lab Garden Classroom at the UCSC Farm. $5. For more information, call 459-2001.

▸ **The Art and Fun of Tea Blending,** Saturday, March 2, 1 pm–4 pm, UCSC Farm. Herbalist and tea blender Julie Rothman will demonstrate the art of medicinal and beverage teas and lead an herb garden walk. Participants will sample various herbal teas and leave with tea plant lists and tea recipes. $10 for Friends' members; $15 for non-members, payable the day of the workshop.

▸ **Gopher Control and Exclusion,** Saturday, March 16, 10 am–12 noon, UCSC Farm. Thomas Wittman of Molino Creek Farming Collective will discuss the best ways to keep your garden gopher free. He'll also talk about building and using bat and owl boxes. $5 for Friends' members; $10 for non-member, payable at the workshop. No pre-registration needed.

▸ **Bats and Owls for Kids,** Saturday, March 16, 10 am–12 noon, Life Lab Garden Classroom, UCSC Farm. Kids ages 7-11 are invited to learn about bats, owls, and other predators that help control pests in the garden. Farm tour, videos, and other educational activities. $5; call 459-2001 for more information.

▸ **Spring Work Day,** Saturday, March 23, 10 am–4 pm UCSC Farm. Help pull weeds, harvest cover crops, build compost piles and more. Bring gloves, tools, and a dish to share at lunch. Spend the day or a couple of hours.

▸ **Introduction to Bee Keeping,** Saturday, April 27, 2 pm–6 pm, UCSC Farm. Join Albie Miles for a look into the life of the honeybee. If you're thinking about getting into bee keeping, this workshop will be a great introduction. For those interested, Albie will order equipment to start your own hive. $5 for Friends' members; $10 non-members, payable the day of the workshop. Please call 459-3240 if you want to order equipment.

▸ **Spring Plant Sale,** Saturday and Sunday, May 4 and 5, 10 am–2 pm, Barn Theater Parking Lot, UCSC. (Friends of the Farm & Garden will have pre-entry priority from 9 am–10 am on Saturday.) The biggest and best collection of organically grown

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Pete Lowy

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UC Santa Cruz
The Center for Agroecology & Sustainable Food Systems
1156 High Street, Santa Cruz, CA 95064

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