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The CENTER for AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS

# the Cultivar

The CENTER for AGROECOLOGY & SUSTAINABLE FOOD SYSTEMS

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inside this issue:



# New Project Focuses on Central Coast Farms and Food Systems

*Center staff and affiliated faculty have initiated a project to improve farming practices, monitor water quality, and investigate the effectiveness of alternative marketing, production, and research efforts on the Central Coast.*

Maintaining water quality is an ongoing challenge in the Monterey Bay watershed, where industry, urban development, and farming all affect sensitive waterways. Excess nitrogen and phosphorous, herbicides, insecticides and sediments that flow into sloughs and wetlands surrounding Monterey Bay have compromised water quality, contaminated shellfish, birds and other wildlife, and led to unsafe nitrate levels in groundwater.

A new research effort by the Center for Agroecology & Sustainable Food Systems (the Center) is addressing a number of Central Coast farming and food system issues, as Center members monitor water quality, identify pollutant sources, help farmers develop practices that minimize environmental impacts, and analyze the effects of alternative practices and programs.

Supported by a special grant from the US Department of Agriculture (USDA), the research program funds Center staff and affiliated faculty to work with a consortium of government agencies, non-governmental organizations (NGOs) and growers to improve water quality and conserve biodiversity throughout the region's watersheds. Techniques such as conservation tillage (see Research Updates, page 5), new fertility management tools, erosion control, crop rotations, and alternatives to synthetic fertilizers are being evaluated for the region and their impacts on water quality monitored as part of this effort.

Groups involved in the consortium include UC Cooperative Extension, the USDA-Agricultural Research Service, Natural Resources Conservation Service (NRCS), California Alliance with Family Farmers, the Watershed Institute at California State University Monterey Bay, Santa Cruz County Farm Bureau, and the Monterey Bay National Marine Sanctuary.

As part of the project's focus on the Central Coast's food system, the Center's social issues staff is examining the effect of alternative production, marketing and research efforts on both ecological sustainability and social conditions for growers and consumers. They intend to examine the effectiveness

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**"WE WANT TO GET A PICTURE** OF THE ALTERNATIVE FOOD STREAM ON THE CENTRAL COAST. WHO'S INVOLVED IN IT? **WHAT ARE THE BENEFITS?"** SAYS CENTER RESEARCHER PATRICIA ALLEN.

of programs and practices that are posed as alternatives to conventional production, distribution, and consumption, and to identify barriers to the development of a healthier food system, both ecologically and socially.

#### MONITORING WATER QUALITY

Excess nitrogen and phosphorous originating from septic systems, lawn care products, nitrogen fertilizers, and farming practices can run off in irrigation and rainwater, polluting streams, lakes, and sloughs. Elevated nitrate levels may lead to harmful "blooms" of algae and other plants that can use up oxygen in waterways, starving wildlife of the light and oxygen they need. Nitrogen also pollutes groundwater and can rise to harmful levels in drinking water. Wells throughout the Elkhorn Slough watershed have already been closed due to unsafe nitrate levels.

Although problems with nitrates and other pollutants have long been acknowledged, there's been little consistent monitoring of many of the waterways in the Monterey Bay region. Center director Carol Shennan, Center researchers Marc Los Huertos and Lowell Gentry, and UCSC undergraduate Sahara O'Hanlon have spent the past 5 months measuring nitrate levels in creeks, streams, and ditches adjacent to farms in the Elkhorn Slough watershed and other areas around Monterey Bay. The research group is also working with the Watershed Institute of Cal State University Monterey Bay to monitor Gavilan Creek, which flows into the Salinas River.

"Right now we're trying to establish a baseline of nitrate levels so that we'll have a way to measure the effects of sustainable farming practices when they're put in place," says Los Huertos. "Ideally we want to look at levels of both nitrate and phosphorous above and below outfall sites, as well as on the farms themselves, so that we know what the impact of a farm is on a particular creek, for example Carneros Creek that runs into Elkhorn Slough."

But determining the impact of one particular place or practice can be tricky. As Center director Carol Shennan explains, "It's not easy to pinpoint the source of nitrate or phosphorous pollution – it may come not only from farms, but from residential developments, septic systems, runoff from roads, and atmospheric sources. That's why it's often called 'non-point source' pollution – because there's often no single 'point source' such as a factory causing the problem, but rather a combination of often widespread sources."

As part of the Center's monitoring work, Los Huertos is evaluating several models that can be used to predict non-point source (NPS) pollution in a watershed. "The idea is to be able to predict levels of NPS pollution under different soil type and land use conditions," says Shennan. "We're trying to calibrate the models using sites in Carneros Creek to see how accurately they can predict NPS pollution levels under Central Coast conditions." According to Los Huertos, the nature of the coastal streams and their connection to the groundwater makes them particularly difficult to model accurately. "Nevertheless, as someone from the USDA-ARS [Agricultural Research Service] sedimentation laboratory said, if we can model these streams we can do any of them!" says Los Huertos.

According to Shennan, NRCS personnel are particularly interested in the development of tools to predict the impact of certain land use practices. "With appropriate modeling tools, you could potentially know the effect on the watershed of, for example, switching a certain amount of acreage from row crops to cattle grazing. Or if you have erosion control measures in place, you could use the model to see what impacts to expect from them. This could be particularly important when you're trying to identify target areas where a concentrated effort to control sediment runoff or nitrate pollution would have the most impact."

#### ANALYZING IMPACTS OF ALTERNATIVE SYSTEMS

Senior issues analyst Patricia Allen and post-doctoral researcher James Murrell are looking at the roles of growers, consumers, and other players in the Central Coast food system to better understand alternative strategies. Allen says that the initial task is to "map" Central Coast counties in terms of the incidence of sustainable farming practices, alternative marketing efforts (such as Community Supported Agriculture projects, farmers' markets, and roadside stands), and research, education and extension services focused on alternative practices. "This initial mapping effort will give us a context for the rest of our analysis," Allen explains.

Allen and Murrell will then survey and interview Central Coast growers, consumers, and others to discover the actual effects of alternative farming, marketing, and research and extension programs. "We want to get a picture of the alternative food stream on the Central Coast: Who's involved in it? What are the benefits? Who is benefitting – not just in terms of growers, but also consumers and workers? For programs like organic labelling and regional food labelling, we want to see what type of impact these programs are having on the Central Coast. We also want to know the potential for larger impacts," says Allen.

Victor Schiffrin

**The Center's social issues staff is addressing the impacts of Central Coast farmers' markets and other alternative marketing strategies on both growers and consumers.**

In addition, the researchers will analyze any barriers or limitations to the effectiveness of alternative production, marketing, and research and extension efforts. Social, economic, and institutional factors and policies will be considered in the analysis of possible limitations. "Oftentimes people know how to farm with ecological methods, but larger, better-financed farms may be able to implement these practices while those struggling cannot," says Allen.

### DEVELOPING STANDARDS, ECO-LABEL

The Center's efforts to develop and monitor the impacts of sustainable farming and marketing practices dovetails with another new program, the Pajaro Valley Pilot Project. Managed and staffed by a partnership between AG Innovations Network and the Community Alliance with Family Farmers (CAFF), the Pilot Project will enroll volunteer growers in the Pajaro Valley (Santa Cruz and Monterey counties) who adopt a set of recognized standards to protect water quality, and will promote these growers to highlight their regional identity and environmentally sensitive practices. Funded by the State Water Resources Control Board, the project has developed an "eco-label" to identify produce from ecologically friendly farms that enroll in the program, creating an economic incentive for growers to adopt water-protecting techniques.

> *continues on page 19*

# Center Grants Support Student Fieldwork

The Center's competitive grants program offers UCSC graduate students funding to support fieldworkthat will be the basis for their dissertations. Here we profile two of the projects funded by the Center in 2000. For a complete list of funded faculty and student projects, see the Center's Web site (http://zzyx.ucsc.edu/casfs).

### ORGANIC COTTON: THE FABRIC OF CHANGE

Although cotton is often portrayed as the "natural" fabric, there's nothing natural about the pesticides, fertilizers, and defoliants that go into conventional cotton production. Add to that the growing use of genetically engineered seed and you have some of the highest levels of synthetic toxic chemical agricultural inputs of any crop in the world. Countering the conventional cotton industry is a growing interest in organic cotton, as farmers and consumers search for alternatives to high-input practices and their environmental and human health impacts.

Lisa Bunin, a graduate student in the Sociology Department, has spent the past three years in central India and in California's Central Valley studying organic cotton as both

> *continues on page 17*

Lisa Bunin

**Farmers in the Maya Pradesh region of India raise organic cotton for a growing "green" market in Europe and the U.S.**

from the
# director

Winter rains have finally arrived after weeks of unseasonably warm weather, giving us all a chance to take a breath, watch the cover crops grow, and look back on a busy summer and fall season at the Center.

Thanks in part to the support of Congressman Sam Farr and funding from the US Department of Agriculture, we've substantially expanded our research efforts in the Monterey Bay watershed over the past six months. These efforts include addressing questions of non-point source pollution and the best ways to manage farmland so as to minimize impacts of agricultural practices on water quality. In addition, we've begun to study the way that alternative farming, marketing, and research projects in the Central Coast region affect both growers and consumers *(see cover story)*. These projects tie in well with our ongoing studies of alternative pest control and soil fertility management techniques on Central Coast farms.

A new round of Center research grants elicited a strong set of proposals from UC Santa Cruz undergraduate and graduate students in late fall. These "mini grants" from the Center support students as they develop and conduct the research that forms the basis for their thesis and dissertation work. Their efforts, both locally and abroad, extend and enrich the Center's own work. Two of the projects supported last year – studies of organic cotton production in India and California, and coffee production in El Salvador – are profiled in this issue *(page 3)*.

Closer to home, years of variety trials in the Alan Chadwick Garden have provided garden manager Orin Martin with a special sense of crops that perform well in a home garden setting. His article on potatoes *(page 7)* offers gardeners and farmers tips on organic growing strategies and recommendations for best-tasting and producing varieties.

On a broader front, the issue of agricultural biotechnology continues to hold center stage in discussions of agriculture's future. In this issue of *The Cultivar* we introduce a new editorial section, In My Opinion *(page 12)*, providing a forum for opinions on biotechnology and other topics. We hope this and future articles will stimulate discussion and we look forward to your feedback on this new feature.

- 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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Research
# Updates

## Center Takes Part in Conservation Tillage Study

The issue of tillage took center stage at the recent climate summit in the Netherlands, when American delegates suggested that farmers could absorb tens of millions of tons of carbon into their soils each year by abandoning plowing. Each time the soil is plowed, or tilled, carbon dioxide escapes into the atmosphere as soil microorganisms digest available carbon that is freed up when the soil is exposed to air. This digestion process lowers levels of soil organic matter while increasing levels of carbon dioxide, the greenhouse gas that has turned up the globe's temperature.

Tillage is not only environmentally damaging, it's also expensive. According to UC Cooperative Extension researcher Jeff Mitchell, growers in parts of California may make as many as 11 tillage passes through the field following harvest to prepare for a succeeding crop. The labor and fuel used in pre-plant tillage can account for up to 24% of overall production costs for annual row crops in these areas.

Growers in the Midwest have long used no-till and low-till systems to help preserve soil organic matter and minimize the cost of tillage. Rather than till under the previous crop or cover crop, crops are planted directly into field stubble or mowed cover crops. However, most of these systems rely on chemical herbicides to control weeds.

Mitchell, in cooperation with Center farm manager Jim Leap, is examining ways to incorporate conservation tillage practices into organic row crop systems. A key to this effort is to identify cover crops that will grow vigorously and produce a high-residue surface mulch to suppress weed growth, but will also die back at the time vegetables are transplanted in order to minimize competition for water and nutrients.

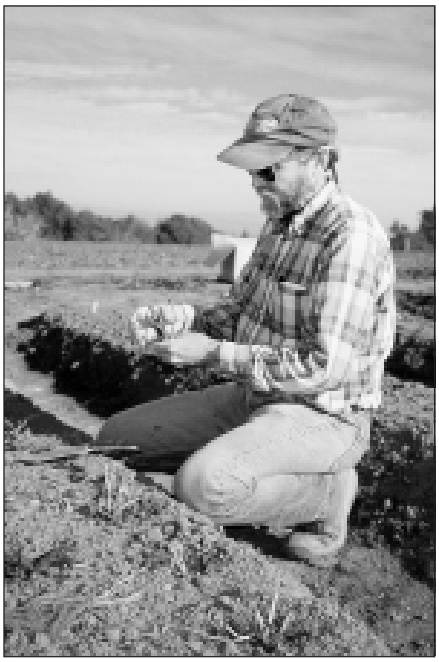
In November, Leap planted three cover crop treatments (each replicated four times) at the Center's on-campus farm: 1) Triticale/Merced Rye/Common Vetch; 2) Lighting Persian Clover/Paradana Balansa Clover/Antas Subclover, and; 3) Barley/Common Vetch. In each of these cover crop combinations, Leap and Mitchell will compare tillage versus no-till systems. In the no-till plots they will also compare two different methods to knock down the cover crops: flail mowing, and chopping, which according to Leap tends to limit regrowth of the cereals.

Following these treatments, pumpkins will be planted into the treatments. Leap and Mitchell will evaluate cover crop biomass and nitrogen content at the time of planting, as well as the percent of the cover crop that has died back at two and four weeks following mowing or chopping, and yield of the vegetables transplanted into the mulch.

This study is part of a broader program to develop sustainable practices that can be implemented on farms in the Monterey Bay region. Conservation tillage can not only reduce the escape of greenhouse gases, it can help prevent erosion – a critical element in the effort to protect water quality (see cover story).

## Second Year of Strawberry Variety Trial Begins

Identifying strawberry varieties that perform well in organic systems is the goal of a two-year variety trial taking place at the Center's on-campus farm. Center farm manager Jim Leap is working with Carolee Bull of the USDA–Agricultural Research Service and Steve Koike of UC Cooperative Extension to monitor the trial. Funded by the UC Sustainable Agriculture Research and Education Program and the California Department of Pesticide Regulation, the study includes trials planted on two other organically managed sites in Monterey and Santa Cruz counties.



Martha Brown

**Farm manager Jim Leap plants strawberries for the second year of a variety trial at the Center's on-campus organic farm.**

Last year's trial evaluated ten varieties: Aromas, Carlsbad, Diamante, Douglas, Hecker, Pacific, Pajaro, Seascape, Selva, and Sequoia. Of these, several of the standard Central Coast varieties – Aromas, Pacific, and Seascape – were the best-performing cultivars at all three organic trial sites.

In November, Center staff and research cooperators planted out all but one of the same ten varieties at the Center's farm, replacing the Hecker cultivar (which according to Bull didn't have the fruit quality growers want) with Oso Grande. Half of each varietal planting was treated with a commercial inoculant of mycorrhizae (beneficial fungi), which may promote plant growth and disease resistance. These will be compared with untreated controls.

Bull notes that this study gives organic growers their first opportunity to see the various cultivars compared side-by-side under organic conditions. Growers are welcome to visit the Center's study site at UC Santa Cruz any day from 8 am to 6 pm (call 831.459-3240 or 459-4140, or see http://zzyx.ucsc.edu/casfs for directions). Harvest will begin next spring and informal "taste tests" will take place every Monday and Thursday morning during data collection sessions. Contact Jim Leap at 831.459-3375, jimleap @cats.ucsc.edu for exact harvest times. Complete results from the trial's first season and initial results from the second year of the study will be reported in the next issue of *The Cultivar.*

This fall, Center staff also established an insectary planting of annual crops adjacent to the strawberry variety trial. The planting is designed to act as a "trap crop" for the strawberry pest *Lygus hesperus* (lygus bugs) and a nursery crop for beneficial insects. Two types of trap crops were planted: two rows of a mix of semi-dormant and non-dormant alfalfa, and two rows of a mix of daikon, wild, and culinary radishes.

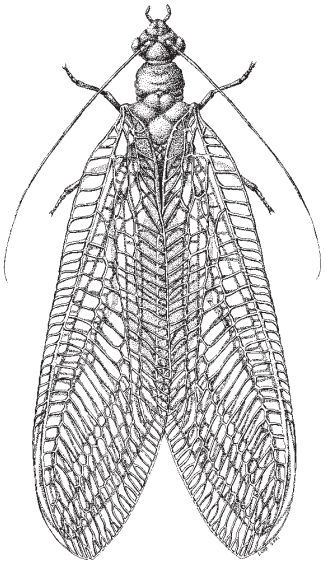
Beth Howard, a UCSC Environmental Studies student, will monitor lygus damage to strawberries adjacent to the trap crop, comparing different trap crop treatments. These include mowing the crop when lygus eggs are present; releasing beneficial insects into the trap crop to control lygus; and/or "vacuuming" the trap crop with a bug vac.

According to Center postgraduate researcher Polly Goldman, the hedgerow planting will also serve as a demonstration site for growers. "These are the same types of planting and management strategies we're using in the BASIS – OASIS [Biological/Organic Agriculture Systems in Strawberries] project," says Goldman. "Here growers can see the farmscaping approaches we're using to control lygus bugs and boost populations of beneficial insects." The BASIS study, which is looking at a number of alternative strategies for pest, disease, and weed control, is underway on conventional and organic strawberry farms in Santa Cruz and Monterey counties (see *The Cultivar*, Vol. 18 No. 1, pp. 6-8, 18).

## Center Investigates New Lacewing Rearing Technique

Lacewings are generalist predators whose larvae prey on a number of agricultural pests, including aphids, mites, and lygus bugs. Growers often release insectary reared lacewings in efforts to control pests in cotton, almonds, strawberries, and other crops.

"Because of the relative ubiquity of these predators in agricultural environments and well-established mass rearing techniques, we are investigating new laboratory rearing methods with the aim of releasing better-adapted predators into organic cotton fields and strawberry farmscapes," says Sean Swezey, the Center's extension specialist and director or the UC Sustainable Agriculture Research and Education Program.



Luke Bennett

**Green lacewings are the most common generalist predators found in field crop ecosystems in the western U.S.**

Center researchers are looking at ways to simplify the way lacewings are reared in the lab in order to streamline biocontrol efforts. "When you rear a predator, you also have to rear its live prey as well as the prey's food, all potentially under separate climate conditions and in separate rooms," explains researcher Polly Goldman. "What we're looking at is rearing lacewings on an artificial diet that eliminates the need to provide live prey."

Normally, lacewing larvae would be raised using flour moth or grain moth eggs as a food source. Beginning in January, Center staff will compare the effect of the moth egg diet with that of artificial diet preparations developed by the company BioLogixs, evaluating such factors as how many lacewing eggs and larvae survive each stage of the rearing process, and how many eggs the adult lacewings lay over the course of their lives. If successful, the artificial diet could potentially cut the cost of rearing predators for mass release.

> *continues on page 19*

# Make Potatoes Part of Your Garden Plan

If you could cultivate a vegetable crop that could be grown in almost every climate (except hot tropical zones) from sea level to 15,000 feet, could be eaten for breakfast, lunch, dinner, and snacks, prepared in a myriad of ways, be easily kept without processing or refrigeration for up to 6-8 months, produced high yields (2-5 pounds per square foot) and was extremely nutritious (high in protein, vitamin C, niacin, B vitamins, iron and energy) but low in calories (sans butter and sour cream), you would wouldn't you? If you did you would be in the minority of home gardeners. Most gardeners eschew the illustrious "spud" *(Solanum tuberosum),* thinking it doesn't warrant space in the small garden and that home grown potatoes don't taste much better than their store-bought counterparts. Not true! Wrong on both counts.

*Solanum tuberosum* (the Andean potato) originated in the highlands of the Andes mountain ranges of South America (Peru, Columbia, Ecuador, Bolivia) at elevations up to 15,000 feet. Potatoes have been in cultivation for more than 2000 years and there are more than 2,000-3,000 varieties extant today. It is an herbaceous perennial in its native habitat, but treated as a tender annual in the temperate zones and damaged by frost at 28°-30° F.

The plant's only edible portions are the tubers produced underground, apically (at the tip) on stolons (horizontal underground stems; see drawing at right). While potatoes produce viable seed, the genetic makeup of sexually-produced plants is so diverse and variable (heterozygous) that production from this seed is negligible. Thus potatoes are propagated asexually from "seed pieces," either small whole tubers or cut pieces containing one or more "eyes" (vegetative shoot buds). The tubers themselves are modified stems. If you stand a spud on end and cut it in half, the interior displays a pithy central core (stem) with branches leading to the eyes. The tuber's original purpose was to store carbohydrates, sit dormant over the winter and enable the tuber to sprout new shoots and begin a new life cycle the following year.

### CLIMATE

The potato is a cool season crop that is sensitive to high temperatures, especially during the period of tuber initiation and enlargement. It requires a frost-free season of 100-120 days to produce a crop suitable for storage. Northern latitudes compensate for a shorter growing season with increased day lengths.

Optimal air temperatures for vine growth are 60º-65° F, with a maximum of 80° F and a minimum of 45° F. Tuber production is reduced at soil temperatures of greater than 75° F and virtually stops above 85° F. Cool night-time temperatures can compensate somewhat for warm daytime temperatures.

Day length also has an effect on tuber production. The lengthening days of late spring and early summer produce optimal vine growth, while the shorter days of late summer favor tuber initiation and enlargement.

Meg Stalcup

**Potato plants grow from a "seed piece" (darkened in this schematic). The tubers develop at the tips of underground stems.**

## CULTURAL REQUIREMENTS

### *SEED SOURCES*

It is important to use certified disease-free "seed" (see Seed Sources, end of article). Homegrown seed or seed from a gardening neighbor will also work well if it is free of disease. The purpose of the planted seed piece is to shuttle nutrients into the new growing shoots and insure a vigorous start to the growing cycle, irrespective of soil and air temperatures in the cool weather of spring. In fact for the first two to three weeks after emergence, the plant relies almost exclusively on the stored carbohydrates of the seed piece rather than on photosynthesis.

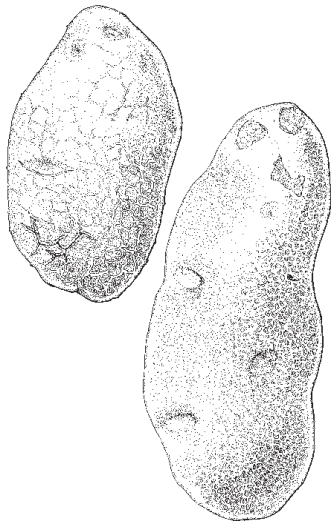
The ideal seed piece is a whole tuber weighing 2-4 ounces with 2 or more live eyes. Larger seed pieces have an excess of carbohydrates that can be a source of rot. Unfortunately, it is virtually impossible to buy 2-4 ounce seed tubers. Thus cutting larger tubers into appropriate size pieces with two or more eyes is standard practice. Cut seed pieces can be dusted with lime, gypsum, or woodash to reduce seed piece rot.

Another garden-scale practice is to "chit" seed pieces. This involves placing seed tubers in a flat or tray, apical tip facing upward, in indirect sunlight at 60°-70° F, with high (85%) relative humidity. These environmental conditions force the apical bud into growth, producing a short, stout shoot. With careful handling these seed pieces can be planted with two notable results: sprouted tubers resist rot much more effectively than dormant seed pieces, and the crop will mature 10-14 days earlier.

### *NUTRIENTS*

Like many crops with a long maturation period, potatoes are heavy feeders, requiring high fertility levels to produce an abundant crop. They have a very "efficient" fibrous root system that responds well to fertility inputs, particularly of nitrogen and potassium. The nitrogen is needed almost entirely in the early phases of growth to produce a large plant, as optimal yields are assured by an abundant supply of carbohydrates furnished by the leaves. Potassium is necessary for the high starch content and keeping quality of the tubers.

Potatoes respond to green manures, although you will have to delay planting until the green manure crop decomposes after being turned under. A compost made of a grass/legume cover crop along with a blend of 70% horse manure (high in potassium) and chicken manure (high in nitrogen and phosphorous), plus straw creates a balanced mix of nutrients with an emphasis on nitrogen and phosphorous. The compost mix should be applied at and slightly above the eventual effective feeding root zone of the plant (the top 12"-15" of soil). While the compost needs to be stable, potatoes can deal with a slightly less mature compost than most vegetable crops.



Meg Stalcup

**The familiar Russet potatoes last well in storage and are great baked or mashed.**

### *SOIL TYPE AND PREPARATION*

Potatoes produce best on lighter textural classes – sands and silts. These lighter soils offer less physical resistance and thus bigger and more uniformly shaped tubers. They also have a greater aerobic capacity to fuel tuber respiration and speed their enlargement. Well-drained soils are requisite, especially on clay, to prevent rot. Potatoes are undoubtedly the most versatile vegetable at dealing with a wide range of pH – values of 5.0-7.0 are acceptable. At lower pH values, the incidence of scab (a fungal disease caused by *Streptomyces scabies*) is dramatically reduced.

It is somewhat a misnomer to call potatoes a deep-rooted crop. Almost all the feeding roots are at or above the seed piece. They have a fibrous root system that extends wider than deep (2 feet wide by 1 foot deep). Thus it is not necessary to prepare the soil deeply, but thorough preparation is needed to facilitate increased pore space for good drainage and uniform tuber enlargement.

Generally, potatoes are planted in ⌴- or V-shaped trenches (with soil banked up on the side) 8-18 inches deep. The seed pieces are planted in the bottom of the trench and covered with 2-6 inches of soil. In heavier textured soils and under wet conditions, a shallower planting is optimal. In sands and silts and under dry conditions, a deeper planting is preferred. It's recommended that you not water the beds between planting and sprout emergence in order to reduce a variety of potato diseases. If the soil is dry, fully irrigate a few days before planting.

As the potatoes emerge and grow, the ridged up soil is drawn up around the base of the plants (see schematic, page 7), leaving the top 4 to 6 inches exposed. This "hilling up" process can be repeated once or twice. If this operation is done in the morning when the plants are upright and turgid there is less chance of injuring the plants.

There are two main advantages to hilling –

• It protects surface-forming tubers from sunscald, or greening. Greening of potatoes is associated with the production of the alkaloid solanine, which is disruptive to the

human digestive tract. Although solanine accumulates mostly in the skins, eating green potatoes should be avoided. Russet and fingerling varieties tend to form tubers on the surface, so hilling is essential.

• When auxiliary nodes along the stems are covered with soil, excluding light, the potential for stolen and tuber production increases, leading to an increased yield.

#### *SPACING*

To a great degree, distance between plants affects the number and size of tubers set. At 9 inches between plants the yield might be 3-4 pounds consisting of 8 to 10 tubers weighing 5-6 ounces each. At 2 feet between plants, plants will produce 4 to 6 tubers weighing 8-12 ounces each. Standard in-row plant spacing varies from 9-18 inches, with 12 inches being common. Distance between rows should be a minimum of 24-30 inches.

#### *IRRIGATION*

As might be obvious from observing the succulent biomass above ground and the high water content of the tubers below ground, potatoes are a water consumptive crop, requiring 1-2 inches of water per week. An even flow of water, especially during the period of tuber enlargement, is critical for evenly shaped tubers and high yields. As potatoes are subject to innumerable foliage diseases (see below), subirrigation (drip, T-tape or furrow) is superior to overhead sprinkling. As the plants begin to senesce and turn yellow, withhold irrigation for 10-14 days prior to harvest to finish off the crop and facilitate curing and storage.

#### *HARVESTING AND STORAGE*

When a digging test indicates that a variety is at the maximum preferred size (90-120 days, depending on variety), they can be cured for storage. This process slows the tubers' respiration and thickens their skin. Cut off the vines at ground level and remove them from the field to reduce the chance that spores of early and late blight (see below) or infection on the leaves will come in contact with the tubers. Test dig 8 to 10 days later to check the skins' toughness, leaving them a few more days if they're not yet ready.

Harvested tubers can be bagged or boxed and stored at 40°-50° F, with low light levels and high relative humidity (85%-90%). At temperatures less than 40° and approaching freezing, the starch is converted to sugar and the tubers develop an "off" taste and a caramelized look.

### DISEASES

Like their relatives the tomatoes, potatoes are undoubtedly subject to more diseases than any other vegetable crop. Two principal disease that can potentially wreak havoc on a potato crop are late blight and early blight.

Late blight *(Phytopthora infestens)* is a fungal disease that attacks both potatoes and tomatoes. This is the culprit responsible for the devastating potato famines that swept Ireland and northern Europe in the 1840s. These famines are probably the most graphic example of overdependence on a limited gene pool in food crops. In reality, almost 100% of the Irish potato crop relied on one variety, a large storage potato named the "Lumper."

Late blight attacks potato foliage during extended humid-wet warm conditions (mid 50ºs F to mid 70ºs F). Irregular-shaped, water-soaked areas occur on stems and leaves, and a downy white-gray growth appears initially on the underside of the leaves. The foliage eventually loses vascular capability and plants begin to rot, giving off a putrid stench. Tubers are infected not by downward movement of the disease in the plant, but by spores falling on the soil. A thick mulch can help retard the disease's spread.

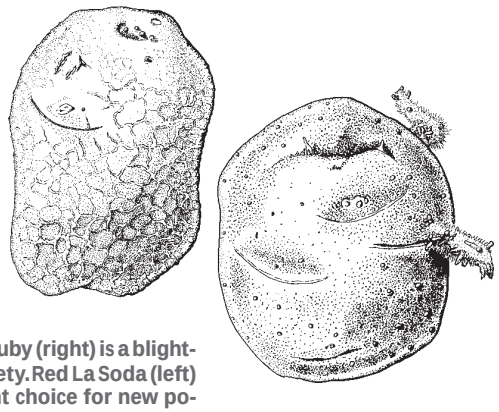
Although it is termed late blight, this disease often strikes early in the crop season, due to cool, wet spring weather. It is possible to have a moderate infection and still achieve acceptable yields of tubers that are suitable to mid-term storage.

Tips for preventing late blight –

- Plant certified, disease-free "seed".
- Delay planting until warm, dry weather is prevalent. In mild winter areas, spores overwinter on living plant tissue, on volunteer plants; in cold winter regions, they overwinter on infected tubers left in the ground.
- Reduce or eliminate overhead irrigation.
- Plant resistant varieties, such as Buffalo, Bison, Carola, and Carlotta.
- Mulch plants to prevent spores moving from leaves to tubers.
- Use a 3-4 year rotation, avoiding all *Solanaceae* family members, i.e., tomatoes, peppers, and eggplant (which are also subject to late blight) between potato crops.

Early blight *(Alternaria solani)* is another potentially devastating potato disease. Ironically, early blight tends to strike late in the plant's growth cycle. Circular, concentric, dark brown lesions form on older leaves and cause yellowing, eventually stunting or killing the plant. Conditions and remedies are similar to late blight. Without using a microscope, it's difficult to distinguish late blight from early blight in the field.

### GROWTH PHASES



Meg Stalcup

**Buffalo Red Ruby (right) is a blight-resistant variety. Red La Soda (left) is an excellent choice for new potatoes.**

The growth cycle of potatoes has four distinct phases –

1. Planting to Day 30: Emergence and almost complete vegetative establishment. Plants produce almost all their stem and leaf surface.

2. Day 30-60: Stolen and tuber initiation take place.

3. Day 60-90: Tuber enlargement. It is critical to have optimal environmental conditions and a steady flow of water during this phase.

4. Day 90-120: Senescence. Vines die down and skin thickens, which promotes long storage. During this phase tuber weight increases dramatically as does the conversion of water and sugars to starch. It is at this point that the individual taste traits of different varieties express themselves. Fully matured potatoes offer a much higher nutritional profile than "new" potatoes.

### NEW VS. STORAGE POTATOES

The potato is actually two different vegetables if you compare new potatoes to storage tubers. New potatoes are simply young, small (2-6 ounce), thin-skinned spuds harvested 70-90 days after planting. You can "rob" a few new potatoes by carefully harvesting from the hilled-up plants, disturbing only stolons and not the feeding roots, then replacing the soil and letting the main crop develop.

For commercial growers, new potatoes are often justified by high market prices early in the season. For the home gardener, it's all about impatience and a taste treat. Because new potatoes have thinner skins, a high water content, and a low percentage of starch, they possess a light, almost sweet taste. They are best enjoyed lightly steamed (whole or mashed with a fork), adding just a touch of butter, black pepper, and ground rosemary. While they are delectable, remember that yields are significantly lower (1-2 pounds versus 3-5 pounds per plant) and nutrition is less than that of storage potatoes. New potatoes keep for only a matter of days and the full taste-texture features of each cultivar are blurred. Recommended varieties for new potatoes –

Red La Soda – sets and bulks up early
Early Red Norland – produces 2-3 pounds per plant at 70-80 days (note: prone to late blight)
Yukon Gold – much earlier than Yellow Finn
Cherry Red – many small (2-4 ounce) round spuds
Rote Erstling – early set
Anoka – the earliest white-fleshed variety

### TASTE AND TEXTURE

Potato taste and texture are measured by the starch or soluble solids content of each variety. There are three basic categories – moist, waxy and dry.

#### *MOIST*

Characteristics – Low starch content, high water content.

Uses – Lightly boiled or steamed.

Varieties – Almost all reds, especially white-fleshed types, Red Gold, Rote Erstling, Red La Soda, Buffalo All Red.

#### *WAXY*

Characteristics – Intermediate between moist and dry, with the richest taste and texture of all spuds. Most versatile usage.

Uses – Steamed, roasted, mashed or baked.

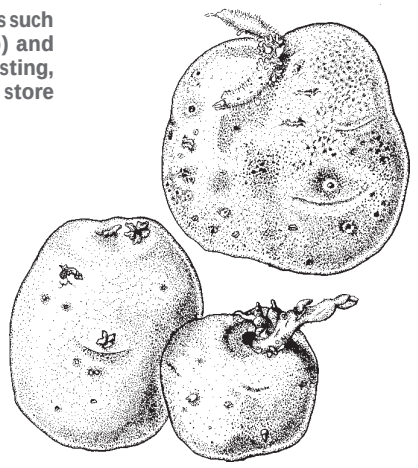
Varieties – Yellow Finn, Yukon Gold, Bintje, Carola, Carlotta, Morning Gold. Most fingerling types, including Austrian Crescent, Rose Finn Apple, Ruby Crescent, Yellow Russian Banana.

#### *DRY*

Characteristics – Mealy (which is actually a positive term when referring to potatoes as opposed to fruit), crumbly, dry, flaky. Dry spuds fall apart and become soggy when steamed or boiled.

Uses – These are the best bakers and mashers (as well as the longest storing).

Varieties – All Russets and Bakers, Blues, Daisy Gold, Burbank Russet, All Blue, Blue Viking.



Yellow-fleshed varieties such as Morning Gold (top) and Yukon Gold are rich-tasting, versatile potatoes that store well.

Meg Stalcup

### GREATEST HITS AND VARIETIES OF NOTE

#### *YELLOW (WAX) FLESH VARIETIES*

Carlota/Carola – A highly productive, medium-sized oblong variety, with a perfect blend of water and starch. The skin is a pretty light yellow. Best roasted or steamed. Scab and blight resistant.

Bintje – A oblong-shaped Scandinavian heirloom variety developed in 1911. This all-purpose potato is the best of the "waxy" yellow varieties. It grows well under a range of conditions, producing high yields (up to 5-6 pounds per plant at the Center's UCSC Farm & Garden).

Yellow Finn – This pear-shaped variety has a "netted" skin and light yellow flesh. A late-maturing, moderate yielder with a "pre-buttered" taste and dry, firm, "fluffy" flesh. Best baked or mashed.

Yukon Gold – A "prettier" potato than Yellow Finn, Yukon Gold matures earlier – as early as 70 days after planting – and produces large tubers. Great for new potatoes. Thin-skinned with a light taste and waxy, moist flesh. High yields.

Note that all yellow varieties keep well in storage.

### *RED VARIETIES*

Red LaSoda – This is the standard supermarket red potato, a mid-season maturer that can be harvested early for early creamers and new potatoes. Produces good yields of uniform-sized tubers with a light taste. Performs well in warm conditions, with higher water needs than some varieties. Mature crop is best boiled or steamed. Subject to hollow heart, a condition caused by heavy watering late in the season that causes sudden regrowth.

Early Red Norland – This adaptable variety yields well (2-4 pounds per plant) and can be ready as early as 70 days after planting. Earlier plantings may produce slightly lower yields. Prone to late blight.

Huckleberry – An early-mid season pink-fleshed variety. Produces high yields.

Bison and Buffalo Red Ruby – Great taste, resistant to blight.

Rote Erstling – Early producer with yellow flesh.

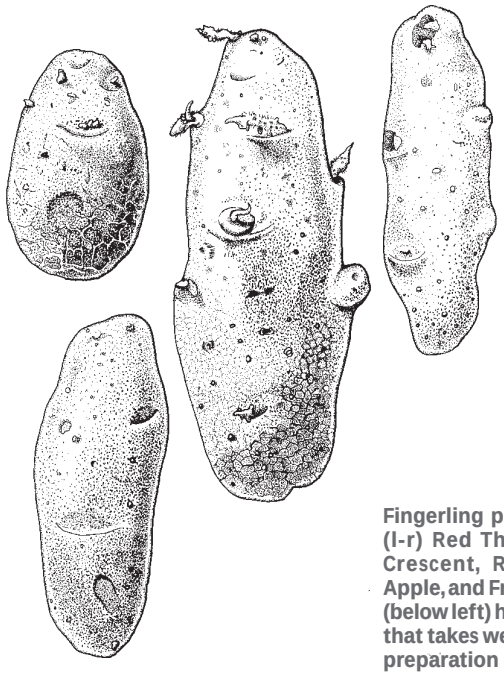
### *FINGERLING VARIETIES*

Austrian Crescent – The biggest and arguably the best of the Finn-like varieties, producing 2 pounds per plant of 7"-10"-long tubers. This firm, waxy potato is best roasted or steamed, although steaming gives the skin a slightly bitter taste. Great for salads.

Rose Finn (Fir) Apple and Ruby Crescent – These varieties are very similar to one another, maturing in 100-120 days. Both have rose-colored skin with yellow flesh.

Yellow Russian Banana – An early, high-yielding variety. Yellow skin and flesh, firm textured. Disease prone.

Butterfinger – Produces small tubers with russeted skin. The fluffy, dry, firm flesh holds together well when cooked. Qualities are similar to Russets.



Meg Stalcup

**Fingerling potatoes such as (l-r) Red Thumb, Austrian Crescent, Rose Finn (Fir) Apple, and French Fingerling (below left) have a waxy flesh that takes well to a variety of preparation methods.**

Ozette/Anna's Cheeka/Haida/Kasaan – These are different names for the same genetic variety of heirloom potato. Originally brought from Peru by the Spanish in the late 1700s, this variety was grown in a Native American village at Neah Bay, on Washington's Olympic Peninsula. Creamy yellow flesh with a nutty flavor.

Red Thumb – A unique, attractive red fingerling with pink flesh.

– Orin Martin

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### SEED SOURCES

Irish Eyes with a Hint of Garlic (formerly Ronniger's and Greg Anthony's Seed Co.)
P.O. Box 307, Thorp, WA 98946
509.964-7000, 800.964-9210 (fax)
email: potatoes@irish-eyes.com
www.irish-eyes.com

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

Territorial Seed Company
PO Box 158, Cottage Grove, OR 97424-0061
541.942–9547, 888.657–3131 (fax)
email: tertrl@territorial-seed.com
www.territorial-seed.com

Peaceful Valley Farm Supply
PO Box 2209, Grass Valley, CA 95945
888.784-1722
email:contact@groworganic.com
www. groworganic.com

In My
# Opinion

## Promise or Threat? The Ethical Challenge of Agricultural Biotechnology

Now that agricultural biotechnology has moved from the laboratory to the field to the dinner table, discussions about its value have gone from a simmer to a rolling boil. The genetic manipulation of seeds, plants, and animals has extraordinarily complex implications for society and agriculture, yet only recently has discussion of this technology begun to appear in popular media. It is likely to transform farming practices as much as the chemical revolution following World War II, and it will likely be as controversial as nuclear energy.

If agricultural biotechnology were to even partially fulfill the promises claimed by its adherents, it would indeed be one of the most remarkable human innovations. Proponents claim that by engineering desirable traits into seeds, agricultural biotechnology will feed a world of ever more hungry people, combat disease, promote nutrition, and provide more environmentally friendly agricultural practices. Conversely, its foes portray it as a technology whose release will have apocalyptic consequences: it will cause disaster, create superweeds, alter our genetic legacy, create resistant agricultural pests, kill unintended targets, and "risk our future." Most European countries have a moratorium on the use of genetically engineered seeds, and the public there has not accepted genetically modified organisms in their food supply as we have in the U.S.

How are we to make sense of all these claims? Both proponents and detractors are suggesting that society needs to engage in a dialogue to determine how to appropriately regulate agricultural biotechnology. More than almost any other technological innovation, agricultural biotechnology's risks will be broadly spread throughout society. What seems certain is that society now has an opportunity to weigh benefits and costs, and to make decisions that will have far-ranging implications.

In the fall of 1999, the National Catholic Rural Life Conference (NCRLC), an agrarian populist group based in the Midwest, contacted me and requested that I write a critique of agricultural biotechnology from the perspective of Catholic teaching. This group supports farmers and religious leaders and was struggling to respond to the explosion of biotechnology from an ethical perspective. My political ecology professor, David Goodman (chair of UC Santa Cruz's Environmental Studies Department and a faculty affiliate of the Center for Agroecology & Sustainable Food Systems) encouraged me to write the critique for a term paper, which was published by the NCRLC. This article for *The Cultivar* draws on the report. Even though a minority of *The Cultivar's* readers may be interested in Catholic theology, this tradition does offer a useful way to approach issues of social ethics, i.e., the relationship between social groups. I hope the issues this article raises are relevant to any ethical analysis of agricultural biotechnology.

### AGRICULTURAL BIOTECHNOLOGY AND ETHICS

Proponents of agricultural biotechnology claim that intrinsic beliefs have no role in evaluating genetic engineering. For example, Robert Shapiro, the CEO of Monsanto (a leading biotech firm) stated: "Like most tools, like most scientific knowledge, biotechnology in itself is neither good nor bad. It can be used well, or it can be used badly." The ethical perspective of the biotech advocates discussed above is best described as utilitarianism, which can be defined as: "the doctrine that what is useful is good, and consequently, that the ethical value of conduct is determined by the utility of its results." Many well-meaning scientists operate out of this philosophy, some without even being aware of its implications. Some utilitarian thinkers engage in actions that might be considered morally wrong, but justify them by utilitarian thinking.

In contrast, Catholic social teaching insists on a consideration of the means used to achieve good as new technologies are invented. Based on this teaching, any biotechnological innovation must observe the following norms:

- It must respect the integrity of creation
- It must uphold a respect for life
- It must promote human dignity

Pope John Paul II elaborated these principles in 1990 as moral norms to guide our relationship with the environment and the use of biotechnology. He did not prohibit the use of this technology, but he insisted it be controlled by society. Genetic engineering is acceptable if certain conditions are met: life must be respected, the integrity of creation must be safeguarded, and above all, the dignity of the human person must be upheld.

### ASSESSING ECOLOGICAL AND HUMAN HEALTH IMPACTS

Despite the claims of proponents, we do not have sufficient information at this time to make an adequate evaluation of the ecological impacts of transgenic crops. In the U.S., the federal government has maintained a strong pro-agricultural biotechnology stance. Field testing requirements are minimal, and those who develop the technology usually conduct them. These tests do not adequately assess the ecological threat of unwanted traits spreading to wild species or the possibility that engineered plants will themselves become pestilential weeds. In either scenario, creation's integrity would be compromised. Nor do we have sufficient information to comment on the potential human health impacts of genetically modified organisms (GMOs). The probability is quite low that there are risks, but were there to be health problems, their scale would be staggering. At this time, virtually no testing on the human health implications of GMOs is being done.

### HOW WILL GMOS FEED THE WORLD?

What about the claims that agricultural biotechnology will benefit society? According to biotech advocates, the threat of world hunger can only be met by improving seeds through genetic engineering to improve yields. There is surprisingly little discussion of exactly how these increased yields from biotech crops will address world hunger. Critics of this justification for agricultural biotechnology assert that while concern for world hunger is important, unless the problem is diagnosed properly, misguided efforts to address it will actually have a detrimental effect. Peter Rosset, the director of the Institute for Food and Development Policy, and Miguel Altieri, a leading agroecologist, assert that this claim rests on two persistent misconceptions about hunger:

1. People are hungry due to a gap between food production and human population density and growth;

2. Genetic engineering is the best or only way to meet future food needs.

Contrary to these assertions, according to these two authors, there is no relationship between the prevalence of hunger in a given country and its population. There is enough food produced in the world to feed everyone. World production of food would be able to provide 4.3 pounds of food for every person daily: 2.5 pounds of grain, about a pound of dairy and meats, and a pound of fruits and vegetables. Proponents of agricultural biotechnology err in translating global aggregate agricultural statistics to the reality of hunger in a specific region or country. The real causes of hunger are poverty, inequality, and lack of access. What is more, there are no yield-increasing traits yet approved for commercial release in this country. Claims that agricultural biotechnology will "feed the hungry world" need to be thoroughly questioned.

### ENGINEERING SUSTAINABILITY?

Proponents assert that agricultural biotechnology will contribute to more sustainable agricultural practices even as yields are increased. Biotechnology, it is claimed, offers new opportunities for significantly increasing the productivity of agriculture, reducing the cost of food production and decreasing the environmental damage of agricultural practices. By reducing pesticides, fertilizers, and tillage (field plowing), it would make farming more sustainable.

Perhaps the most fundamental question to ask about agricultural biotechnology is the relationship between technology and agriculture. Does technological intervention have a genuine possibility of creating more sustainable agricultural practices? Can we reasonably assume that the petrochemical industries selling these technical packages want to promote on-farm sufficiency? Genetically modified crops may reduce the need for certain kinds of inputs, but they do little to change the overall direction taken by conventional farming. Society must question the claims made about agricultural biotechnology and challenge its promoters to make concrete the rosy abstractions currently being presented. In contrast to continuing on the "technology treadmill" on which genetically engineered crops are still stuck, the sustainable agriculture movement critiques the inputs, scale, and environmental impacts of conventional farming practices; in short, it seeks to reconfigure the entire agricultural paradigm. Significant economic barriers exist, however, which block the transition of most farms toward genuine sustainable agriculture.

### THE PRIMACY OF SEEDS

One of the most troubling aspects of the agbiotech revolution has been the largely ignored expansion of the patent system to include life forms. Industrial patents were developed during the 19th century as a way of protecting the intellectual property of inventors. Patents were designed as a trade off between society and inventors, in which a monopoly is granted to the inventor in order to promote the common good. Plants were originally excluded from this system. Several recent administrative and U.S. Supreme Court decisions have established the right to patent genes, gene sequences, engineered crop species, and the technical processes to engineer them. Industry officials maintain that these legal rights are critical to agricultural biotechnology because tremendous expenses are incurred in developing processes and organisms that are relatively inexpensive to reproduce and bring to market.

Critics of the biotechnology industries charge that patents on life forms and the context in which they occur, i.e., the concentration of corporate power over seed companies, pose serious ethical problems. Crop seeds had been viewed as the common heritage of humankind until just a few decades ago, but the biotechnology revolution and economic globalization are accelerating a trend away from traditional common property systems. Biotech companies from the wealthy Northern countries are "discovering" useful genes in the poor Southern countries and making a profit from them, exacerbating existing global inequality.

In the U.S., critics have charged that Monsanto has attempted to monopolize the GMO corn and soy markets,

and conspired to fix these markets. The problem of monopoly is nothing new in agriculture, but unlike previous monopolies over land and transportation, we are now witnessing economic control over the reproduction of life itself. Monsanto requires farmers to sign documents asserting that they will not save this seed. Where suspicions arise, it has hired private security guards to investigate and has sued farmers they suspect of saving seeds. This would have been unthinkable twenty years ago. Patents are a so-called "negative right" because they prevent others from using similar organisms unless they pay the first corporation that developed it; this too raises troubling questions of social ethics.

#### ETHICS SUPPORT PRECAUTIONARY PRINCIPLE

The biggest challenge to any ethical system posed by agricultural biotechnology is the lack of information. Put simply, the tests have not been done. Gene flow – the movement of genetic material and traits between genetically engineered crop plants to weedy relatives within pollination distance – commonly occurs through plant reproduction, but few researchers are studying the ecological implications of these new gene sequences. The chance of GMOs affecting human health may be remote, but the FDA does not require tests to determine potential health impacts. Our government has chosen administratively to place the burden of proof on critics rather than adopt a "precautionary principle" approach, which would require those who stand to benefit from the new technology to prove that it is consistently safe.

This absence of information becomes particularly troubling when we recognize that agricultural biotechnology is moving full speed ahead. To introduce GMOs into 50% of the nation's corn and soy crop, and to prohibit consumers from being able to avoid these foods, is ethically unacceptable. We cannot say that the technology is inherently right or wrong at this time, but that does not in any way give its adherents the right to introduce it on such a broad scale. Those who own and control a technology never have the right to force others to participate in it.

From a Catholic perspective, it is not yet possible to determine whether agricultural biotechnology meets the three criteria set forth by the Pope in 1990. In the Fall of 2000, while celebrating "Jubilee of the Agricultural World," the Pope re-iterated his concerns: "(Agricultural biotechnologies) must be submitted beforehand to rigorous scientific and ethical examination, to prevent them from becoming disastrous for human health and the future of the earth." To follow this ethical principle, there should be an immediate moratorium on the further introduction of agricultural biotechnology. We do not have enough information to determine whether it meets the standard of respecting life, human dignity, and the integrity of Creation, and it is socially unacceptable to risk violating these ethical norms to pursue this technology. The promise of GMOs does not justify the risk. As a society we must remember the lessons we have learned from introducing other technologies such as pesticides and civilian nuclear power. Responsible social ethics support the precautionary principle.

A few religious leaders have begun to question the ethical acceptability of biotechnology's patent regime, raising several issues. First, God is the author of life, and it is preposterous for anyone to claim to have invented something that is alive. Engineering two genes out of an organism's entire genome and claiming it to be "novel" would have to be considered a gross exaggeration. It may be appropriate to claim patent over the process of modifying a gene in a transgenic organism, but the recent expansion of patents to include engineered traits and all engineered varieties of a species goes too far.

Second, the patenting of life forms constitutes an unwarranted extension of private ownership because it furthers the process of turning living things into private property. Proponents of biotech patenting argue that the ownership issues are no different than a farmer owning a cow or someone owning a pet, but these analogies are inaccurate. Patenting assures the right to either control or derive financial benefit from all of the patented life forms; it is a much broader sense of ownership. A more accurate analogy would be that of a corporation developing the first mousetrap to sell for a profit, but then suing other corporations for developing all other kinds of devices that trapped rodent pests. Owning a living organism is one issue, but preventing others from owning similar organisms unless they pay the first corporation that developed it – the "negative right" – is another. This expanded patent system is incompatible with Catholic teaching, which holds that private property systems should work to provide a just and equitable sharing of the world's goods, not a system of preventing others from benefiting from them.

#### BRINGING GMOS UNDER SOCIAL CONTROL

The most important question to ask when considering the release of a new technology is: how will it impact society? Sadly, to date this question has been ignored. Questions, concerns and objections about genetically modified foods have been bulldozed in the life industries' rush to bring an unprecedented new technology to unprepared consumers. The Federal government has successfully ignored the ethical problems raised by GMOs. For this reason it would seem that civil society organizations must step into this vacuum of political leadership and insist on more open and thorough debate on this issue. What follows are some suggestions to give society and sustainability advocates the opportunity to exert some control over the application of agricultural biotechnology.

Labeling of all foods containing GMO ingredients is a small but critically important first step. It is a basic human right that people be able to control the food they consume. Given the ubiquity of corn and soy products in manufactured products, foods containing GMOs will be difficult to avoid, but people have the right to know and choose.

The government must abandon its hands-off policy and involve itself in regulating and helping set direction for the

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Center
# Notes

## Tracy Chapman Raises Funds for Center Scholarships

Grammy Award-winning singer-songwriter Tracy Chapman played to a sold-out house in San Jose, California in August, donating a portion of ticket sales to the Center and the Organic Farming Research Foundation (OFRF).

Chapman's support of sustainable agriculture was apparent with the 1995 release of her widely praised album, *New Beginning*. The album notes featured photographs of the artist in the fields at the Center's on-campus Farm, and seeds were distributed at her concerts to encourage people to get their hands in the soil. As she toured the country following the release of her latest album, *Telling Stories*, Chapman made her San Jose performance an opportunity to provide financial support to the work of the Center and OFRF.

The Center's proceeds will support scholarships in the Apprenticeship in Ecological Horticulture at UC Santa Cruz. The apprenticeship is a six-month residential program that offers rigorous hands-on training in organic farming and gardening. Nearly 1,000 graduates of the program are working on farms and in rural and urban agricultural programs across the U.S. and around the world.

Our thanks to those who bought benefit tickets packages, to Earthbound Farm for their support of the pre-concert dinner, and to Tracy Chapman and Lavonne Murlowski for their generosity and help in organizing the event.

Martha Brown

**Audience members examine Center information at the Tracy Chapman concert, which benefitted the Center's Apprentice Scholarship fund.**

## Center Sponsors California Farm Conference

John Fisher, the Center's community outreach coordinator, served as president of the recent California Farm Conference held in Santa Rosa, California. The three-day November conference drew 500 participants to the Santa Rosa Junior College campus for short courses and workshops covering topics from market strategies to agritourism to practical agriculture on the internet.

"Many of the people who attended this year have land in the area and wanted to learn what to do with it," says Fisher. "There were small-scale orchardists, people with small vineyards, and a lot of small-scale organic growers, including many growing specialty crops. Much of the conference had a very practical orientation."

Conference topics reflected a variety of regional topics, including the proliferation of vineyards in the area. The short course on sustainable vineyard management sold out, while others voiced concern over the loss of diversity caused by new vineyards.

"That's a unique thing about the California Farm Conference," says Fisher. "Conference sponsors invite community members to help plan the program. That way local people – in this case many of them local farmers – get to voice their interests and choose conference topics and speakers."

In addition to the Center, this year's conference sponsors included UC Cooperative Extension Sonoma County, New College of California, the Community Alliance with Family Farmers, California Federation of Certified Farmers' Markets, Golden Gate Farmers' Market Association, Santa Rosa Junior College, UC Small Farm Center, and the USDA Farm Service Agency. The conference also benefitted from the hard work of Wendy Krupnick, garden manager at Santa Rosa Junior College's Shone Farm. Krupnick organized the meals using produce from Shone Farm and other local farms.

Planning for next year's California Farm Conference will begin in January. Conference organizers hope to alternate between sites in southern and northern California, with either Ventura or Oxnard as the likely location for the 2001 conference.

## Tour Program Wraps Up Successful Season

Each year the Center's on-campus Farm and Alan Chadwick Garden sites draw visitors from around the world who are interested in organic production and the Center's education and research programs.

This past tour season was no exception, with visits from local school groups, regional master gardeners, college classes, and international agricultural contingents. Highlights included visitors from the island nation of Yap, a group from Albania interested in the Center's unique agricultural studies, and two contingents from China.

The Center also drew visitors interested in using the Farm & Garden as models for their own programs. They included a group of staff and faculty from Reedley College (in California's Central Valley), which is expanding its curriculum to include organic agriculture. University of Washington students who are designing their own sustainable agriculture effort visited the Farm as part of their background research.

The tour season wrapped up with a late-fall visit from the Culinary Institute of America. Twenty-five students from the institute's Hyde Park campus in New York toured the Farm as part of their education about sustainable agriculture and food-production issues. The visit was one stop during their four-week field trip in California, and it ended with preparation of a luscious six-course meal they shared with the Center's faculty and staff.

"It was awesome," said John Fisher, CASFS outreach coordinator. "The food was good, but what's really great is that we expose them to quality food production, and they expose us to quality food preparation. The visit makes that connection vivid for everyone."

Jennifer McNulty

**Student chef Peter Kielec prepares lunch in the Farm Center's kitchen during a fall visit from the Culinary Institute of America.**

Hovering over a steaming pot in the Farm Center kitchen, student chef Peter Kielec said the Farm tour was a great stop on their trip, which has included five cities and visits to wineries, farms, and even the Jelly Belly factory.

"Anything having to do with food, we're learning about," said Kielec, a junior in the the Culinary Institute's restaurant-management program. "We're totally into sustainable agriculture and organic foods – making sure there's earth to grow the food we feed everybody."

"After they saw our farm and heard about our work, the students were shaking my hand and saying how refreshing our work is," said Fisher. "It was gratifying. The Culinary Institute definitely sees the value of exposing their students to organic farming."

The tour season begins each year in mid March and continues through the end of November. To arrange a tour, call 831.459-3240 or 459-3248, or email John Fisher at johnfish@cats.ucsc.edu. Both the UCSC Farm and Alan Chadwick Garden are also open year-round on a drop-in basis, from 8 am to 6 pm.

## Center Co-Hosts SCOAR Meeting

The Center will co-host to the upcoming Scientific Congress on Organic Agricultural Research (SCOAR), sponsored by the Organic Farming Research Foundation (OFRF). This inaugural meeting of SCOAR takes place January 22-23, 2001 at the Asilomar Conference Center in Pacific Grove, California.

SCOAR's mission is to plan and promote organic farming research and information exchange for understanding and improving organic agricultural systems. One of SCOAR's major goals will be to develop a national agenda to guide development of new organic programs and initiatives nationwide in the coming decade. The meeting will bring together researchers and growers to define a shared strategy for planning and promoting organic research. "This is an important event," says Center director Carol Shennan. "It's a unique opportunity to identify growers' needs and refine organic agriculture's research agenda." Topics to be addressed include identification of major priorities for organic research and education; exploring the "state-of-the-art" in organic systems research; and a focus on current critical issues, such as contamination by genetically modified organisms, alternatives to mandatory spray programs, and nutritient management planning.

The Asilomar meeting will be the first in a series of regional and national SCOAR activities that bring together organic producers and scientists. To receive notice of future SCOAR events and news from SCOAR meetings, you can register for the SCOAR mailing list on the OFRF Web site (www.ofrf.org), write Mark Lipson at OFRF, PO Box 440, Santa Cruz, CA 95061, send email to scoar@ofrf.org, or call 831.426-6606.

## Graduate Student Field Projects

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a farming practice and a socially constructed green product. Her research examines how organic production systems in different parts of the world arose to challenge the global hegemony of modern, chemical agriculture by providing material evidence that a more benign system of cotton production exists and remains viable in today's global economy.

Based on her experiences in Maya Pradesh, India, Bunin argues that farmer-generated knowledge about the adverse effects of modern agriculture provided an impetus for farmers in the region to switch to organic growing methods. Says Bunin, "Farmers observed on their own fields how the application of agricultural chemical over more than a decade began to degrade the soil, contribute to a decrease in animal strength, and an increase in certain pest resistances. In response, pioneer farmers used their fields as laboratories to test and develop alternative, organic agricultural practices. They spread this knowledge over-the-fence to neighboring farmers who, disillusioned by the many failed promises of the green revolution in India, wanted to reduce the hazards and costs associated with chemical-based agriculture."

Bunin's research includes an analysis of the relationship between emerging Western markets for green commodities and the spread of organic cotton farming practices in India and the U.S. According to her study, three factors helped generate a climate favorable to organic cotton: 1. heightened public environmental awareness in Western Europe and the U.S. about the dangers inherent in chemical-intensive production/agriculture, coupled with expanding "green consumer" markets; 2. stable, inexpensive supplies of organic cotton grown in low-wage regions like India, by farmers schooled in Western-certified organic farming methods; and, 3. collaborations between non-governmental organizations (NGOs) and industry in the creation, promotion, and marketing of organic cotton growing practices and products.

Bunin's work in California documents how the reluctance of organic cotton buyers to sign pre-planting contracts with individual farmers in the state has stifled the conversion to organic. "Why should clothing companies commit to purchasing California-grown cotton when they can buy it much cheaper in countries like India where labor, input, and technology costs remain much lower?" she asks.

On the more hopeful side of the global production equation, Bunin describes an enthusiastic willingness on the part of several large clothing manufacturers to blend 3%-5% organic cotton into their mainstream cotton garment lines.

California organic cotton grower Claude Sheppard (right) talks with field day participants.

This strategy, championed by The Sustainable Cotton Project (a California-based NGO), is intended to help stabilize organic cotton supplies and demand, and thus decrease the per unit cost of organic cotton commodities, making them less costly for both buyers and sellers.

Bunin will complete her dissertation in June 2001 and plans to continue her work in the field of international organic agriculture policy.

For more on Bunin's work, including photos from her exhibit "Organic Cotton: A Developing Story in Rural India," go to www.switzertnetwork.org, click the newsletter link, and scroll to her article.

### SMALL COFFEE FARMS OF EL SALVADOR

Once it was a matter of choosing between dark roast and light roast, or grabbing a pound of Kona or Columbian off the grocery store shelf. Now consumers are being asked to pick their morning beverage based on an often-bewildering matrix of environmental and social justice causes. Buying coffee has become a political act, with labels proclaiming "bird friendly," "shade grown," "organic," and "fair trade" vying for shopper's dollars.

Ernesto Méndez, an Environmental Studies graduate student, is interested in whether these designations – and the price premiums they carry – translate to better economic returns for small-scale coffee farmers. "There's a lot of press saying that products labeled shade grown or organic give the grower an advantage," says Mendez. "That may not be true in all cases."

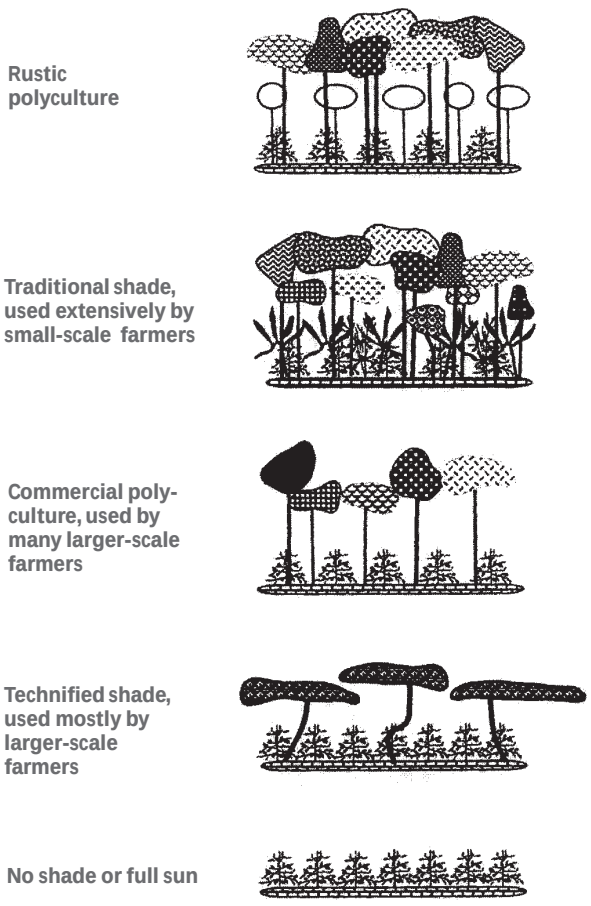
Méndez will spend the next year working with farmers in El Salvador, analyzing both the environmental benefits of "traditional shade" coffee systems and the social and economic motivations for choosing this particular farming technique.

According to Méndez, traditional shade systems feature few external inputs, older coffee varieties grown at relatively low densities under a high diversity of shade trees, and intensive labor. These systems have proven environmental advantages, helping conserve bird, plant, and insect biodiversity.

On-farm diversity may also offer economic advantages. "I'll be doing a whole-system evaluation, documenting not only coffee production but production of tree products for timber, firewood, fruits, and other uses," says Méndez. He'll also evaluate the role of traditional shade systems in conserving native tree species on small coffee farms.

Méndez is particularly interested in the way that local organizations, including cooperatives, rural development groups, government extension services, and producer's organizations influence a farmer's choice of coffee-growing systems. He'll compare techniques chosen by farmers affiliated with these organizations to those of independent growers.

Ultimately, Méndez hopes to document the advantages, limitations, and importance of traditional shade-grown coffee systems to farmer's livelihood strategies. This information can then be integrated to wider coffee commercialization studies to help determine whether the marketing strategies that shoppers confront are living up to their promises.




**Schematics of various coffee growing techniques, showing different levels of plant diversity.** ***Source: Smithsonian Migratory Bird Center website.***

## Biotechnology: Promise or Threat?

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industry. It cannot treat agricultural biotechnology as it would cars or other consumer goods, because the potential risks will reach almost everyone in society. The USDA has a branch originally designed to protect farmers and consumers from foreign pests, the Animal and Plant Health Inspection Service (APHIS), which should receive expanded funding and a broader mission statement to include addressing the potential threats posed by GMOs.

Biblical principles of justice, indeed, basic principles of fairness, must be brought to bear on the issue of risks associated with agricultural biotechnology. If new information undermines the agricultural biotechnological revolution, there would be staggering economic impacts. Hundreds of thousands of farmers could wake up one morning to find their entire crop worthless. The present political economy assigns risks to life industries and to farmers, yet the legal defenses of the former are substantial while those of the latter are insignificant. Civil society organizations would do well to consider advocating for a GMO liability bond. Such a bond should be large enough to cover all of the economic risks of agricultural biotechnology assumed by farmers. Life industries should not be permitted to externalize the risks of GMO crops.

Civil society organizations, in concert with farmer advocacy groups, may want to investigate the applicability

of the Sherman Anti-trust Laws to the Life Industries. The accelerating concentration of economic power in the agricultural industry makes food production and distribution much less accessible to social control. The trend of accelerating economic concentration will continue unless society intervenes in some manner.

Agricultural research priorities are in need of radical correction. Civil society organizations should advocate for more comprehensive studies of the *social* impacts of agricultural biotechnology. In addition, they should insist on an end to government-funded research that enhances agrochemical use and poses environmental risks. Every opportunity should be taken to advocate for government-funded agricultural research to pursue agroecological sustainability.

Civil society organizations should pursue reform of patent laws in the U.S. and abroad. Patenting life forms is ethically unacceptable. Technological processes should be eligible for patents, but not living organisms or their genes. A campaign to ban the patenting of life is already underway (www.iatp.org).

By contrasting Catholic teaching on the integrity of creation with the scientific utilitarianism of its advocates, we can conclude that agricultural biotechnology is not value free. It does bear the values and ideology of its creators. Unless subjected to compelling scrutiny, the public will not be made aware of the social costs of adopting this technology. I call on all persons of conscience and all persons of faith to recognize the ethical challenge posed by agricultural biotechnology and resist its expansion. We may not be able to "put the genie back in the bottle," but we can and must insist that human and ecological health be put before corporate profit. Our call to respect human dignity and the integrity of creation requires it.

– Keith Douglass Warner OFM

*Keith Douglass Warner OFM is a Franciscan Friar and a doctoral student at UC Santa Cruz. This article was excerpted from "Questioning the Promise: Critical Reflections on Agricultural Biotechnology from the Perspective of Catholic Teaching," published by the National Catholic Rural Life Commission (www.ncrlc.com). An expanded discussion of life patents will appear in a future issue of The Journal of Agriculture and Environmental Ethics.*

*Opinions expressed in this section are those of the author and do not necessarily reflect the views of Center members or the University of California.*

## Central Coast Research Effort

*continued from page 3*

"Consumers who buy products bearing the logo, perhaps even paying a small premium, are assisting the agricultural industry, meaning farmers, marketers, and retailers, to protect the Monterey Bay," says Holly Price of the Monterey Bay National Marine Sanctuary.

According to a recent news release, the consortium hopes that the Pajaro Valley project will serve as a model for other watersheds that drain into the larger Monterey Bay ecosystem. Staff and faculty from the Center for Agroecology & Sustainable Food Systems will work with CAFF, the Farm Bureau and other groups to measure water quality factors on farms enrolled in the pilot project.

- Martha Brown

## Research Updates

*continued from page 6*

"In the preliminary work we did this fall, we found that lacewings raised on the artificial diet preparation produced twice the number of eggs in a 30-day period as lacewings raised on a diet of grain moth eggs," says Goldman. "Their development time was also shorter than reported times from other studies."

Goldman is especially intrigued by BioLogixs' idea of rearing lacewings that are native to the particular region where they will be released. "Right now, for example, cotton growers in the San Joaquin Valley are releasing lacewings that are native to the southern part of the country, where conditions are much more humid," says Goldman. "We think it may be more effective to have cultures of the native natural enemies available to growers for release."

Based on space availability and funding, the project will eventually expand to provide the Center with a colony of lacewings to use in research projects. These include ongoing efforts to control cotton pests in the northern San Joaquin Valley and strawberry biocontrol projects incorporating trap crops and predator releases on the Central Coast.

Santa Cruz area

# events

**▸ A Pome Fruits Pruning Workshop** will take place Saturday, January 27, from 10 am-12 noon at the UCSC Farm. Garden manager Orin Martin will show you how to get the most out of your pome fruit trees (apples and pears) at this workshop. Wear warm clothes; heavy rain cancels. $5 for Friends of the Farm & Garden members; $10 for non-members, payable the day of the workshop. Call 831.459-3240 for more information or 831.459-4140 for directions.

**▸ A Stone Fruits Pruning Workshop** will take place Saturday, February 3, from 10 am-12 noon at the UCSC Farm. Same as above event, but this time the focus will be on stone fruit trees (peaches and plums).

**▸ "Good Bugs" for the Garden** will take place Saturday, February 24, from 7 pm-9pm at the Patagonia Store, 415 River St. in Santa Cruz. Pest control expert Sean Swezey will present a free slide show and talk for growers interested in attracting and keeping beneficial insects in the garden and on the farm. Call 831.459-3240 for more information.

**▸ UCSC Farm & Garden Docent Training** begins in March. Docents receive forty hours of training and in exchange are asked to give back four hours per month leading tours and helping with outreach for the Center for Agroecology & Sustainable Food Systems. For more information call 831.459-3248 or send email to johnfish@cats.ucsc.edu.

**▸ An Asexual Propagation Workshop** will take place Saturday, March 10, from 10 am-1 pm at the UCSC Farm. Garden manager Christof Bernau will show you how to start plants from cuttings. This class will provide you with the skills to start your own plants at home. $5 for Friends' members; $10 for non-members, payable the day of the workshop. Call 831.459-3240 for more information or 831.459-4140 for directions.

**▸ Introduction to Beekeeping** will take place Saturday, April 28, from 2 pm-6 pm at the UCSC Farm. Join Albie Miles for a look into the life of the honeybee. If you're thinking about getting into bee keeping or just want to learn more about these important pollinators, this workshop will be a great introduction. $5 for Friends of the Farm & Garden members; $10 for non-members, payable the day of the workshop. Call 831.459-3240 for more information or 831.459-4140 for directions.

**▸ The International Short Course on Agroecology** will take place August 13-24 at the UC Santa Cruz campus in Santa Cruz, California. Offered through the UCSC Department of Environmental Studies and the Center for Agroecology and Sustainable Food Systems, the course is intended for extensionists, farm advisers, trainers, NGO managers, farmers, graduate students, researchers, professors, and other agricultural professionals from around the world.

This course will explore the application of agroecological knowledge to the design of sustainable farming systems, emphasizing the integration of agroecology theory with agricultural practice. Coursework will focus on sustainable management practices in small farm systems and their function in supporting farming communities and environmental health around the world.

Core instructors for the course include Stephen R. Gliessman, Erle C. Ellis, Joji Muramoto, Ariane de Bremond, and V. Ernesto Mendez, joined by a host of instructors and specialists from the University of California and other state institutions and organizations.

For details on fees, registration deadlines, and course activities, see http://www.agroecology.org/shortcourse/2001/announce.htm, send email to shortcourse@agroecology.org, or contact course coordinator Joji Muramoto 831.459-2506 or 831.459-2867 (fax).

## California events

**▸ Partnerships for Sustaining California Agriculture: Profit, Environment and Community** will take place March 27-28 in Woodland, California. This two-day conference will explore innovative farming and ranching systems in California, highlighting agricultural production, research, and extension activities involving practices that are profitable as well as environmentally friendly. The conference is sponsored by the UC Sustainable Agriculture Research and Education Program, U.S. EPA, Region 9, California Department of Pesticide Regulation, and USDA Western Region SARE. For more information, see the conference Web site at www.sarep.ucdavis.edu/agpartners/ or call UC Davis University Extension at 800.752-0881.

**▸ Higher Education and Research for Agriculture and Food Systems in the 21st Century,** a conference sponsored by the Global Consortium of Higher Education abd Research for Agriculture (GCHERA), will take place July 12-14 *in San Francisco, California. For more information, see the GCHERA Web site at www.gchera.iastate.edu.

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