Summer 1994

In This Issue:

Technical Reviews:

Guest Editorial: Closer Links Between Sustainable Ag, IPM Beneficial

[*Editor's Note:* ***David E. Schlegel****, regional co-coordinator of the federal USDA Sustainable Agriculture Research and Education (SARE) program in the western U.S. and Plant pathologist and University of California Division of Agriculture and Natural Resources administrator, wrote this commentary for Sustainable Agriculture. UC SAREP director* ***Bill Liebhardt*** *will return from sabbatic leave in July; his commentary will return in the fall*.]

In April I attended the second national IPM symposium/workshop in Las Vegas, Nevada. It was very successful in every sense. The conference was at tended by about 700 Agricultural Experiment Station, Cooperative Extension and Agricultural Research Service scientists as well as food processing company representatives, private agricultural consultants and others from the general public. The audience represented the cross-section of people interested in the implications of integrated pest management for agriculture.

The turnout was 30 percent greater than the first symposium, but more importantly, the tone and content of many of the discussions and posters were remarkably similar to what would be expected at a national sustainable agriculture symposium. Indeed, on numerous occasions reference was made to IPM strategies that are environmentally, economically and socially acceptable.

More than 200 posters were presented, which were spectacularly informative. Technical application was a key component of the presentations. As I walked through the aisles of displays, I could not help but notice that many, if not most, exemplified more systems-oriented and interdisciplinary approaches, in sharp contrast to IPM activities reported during the first symposium. I also saw posters displaying projects funded by the federal sustainable agriculture initiative, USDA's Sustainable Agriculture Research and Education (SARE) program, which was authorized by Congress in the 1990 Farm Bill.

There is no question in my mind that IPM and sustainable agriculture need to be much more closely linked. This has been one of my goals since the beginning of the sustainable movement, but it is a slow process. At the federal and regional levels, the USDA SARE program has worked from the premise that pest management is a vital part of whole farm systems and must be addressed in research and education proposals. It has been clear to me for a very long time that these connections should exceed simple awareness; there needs to be joint funding for both pursuits, where appropriate. We need to devise ways to formally link these programs at the federal level, as well as regionally and locally, when appropriate. Integrated pest management, however, should not be pulled entirely under the "sustainable agriculture umbrella" because IPM has activities singular to its mission.

Vice President Gore has stated that "75 percent of the agricultural land in the U.S. will be under IPM by the year 2000." The USDA has taken this proclamation very seriously and has charged its agencies (13 in all) to come up with a plan that provides for coordination of the various programs. In my view this plan must include a formal relationship with the federal USDA SARE program, and this should set an example for similar cooperation between state and educational programs throughout the nation. I am optimistic about the funding picture for both sustainable agriculture and integrated pest management, but it will be more promising if we can devise a realistic and functional plan for coordination and joint funding.-*David E. Schlegel, regional coordinator, USDA Western SARE*, University of *California Division of Agriculture and Natural Resources*.

SAREP Awards Graduate Student Grants

Seven graduate students have been awarded $6,960 by UC SAREP for projects related to sustainable agriculture, according to **Jill Auburn**, SAREP associate director. The projects are:

Gerald Cohn, Department of Agricultural Economics, UC Davis, $1000 for "Community Supported Agriculture-Survey and Analysis of Consumer Motivations." A written and telephone survey of consumers at ten community supported agriculture (CSA) operations in California will be used to collect demographic characteristics, consumption patterns, and quality/price preferences of consumers. (Major professor: **Michael Caputo)**

Polly Goldman, Agroecology Program, UC Santa Cruz, $1000 for "Use of Agricultural Borders for Sustainable Arthropod Pest Management in Organic Cotton." Pests and their natural enemies will be monitored in cotton fields and their borders planted to crop and noncrop species. Greenhouse studies will evaluate the preference of arthropod pests on cotton plants related to the plants' previous exposure to insect damage. (Major professor: **Stephen Gliessman)**

Cynthia Havstad, International Agricultural Development, UC Davis, $1000 for "Compost Use and Research Needs of Central Valley Vegetable Farmers." Telephone and in-person interviews with farmers (both users and nonusers of compost), farm advisors and compost producers, and focus group meetings, will be used to identify benefits and drawbacks of compost use in the northern Central Valley of California. (Major professor: **Carol Shennan**)

George Heimpel, Department of Entomology, UC Davis, $1000 for "Improving Biological Control of San Jose Scale Using Flowering Cover Crops." Experiments in an almond orchard in Sutter County will document whether the use of flowering cover crops can improve biological control of San Jose Scale by *Aphytis* parasitoids and, if so, by what mechanism the improvement is achieved. (Major professor: **Jay Rosenheim**)

Rachel O'Malley, Environmental Studies and Biology, UC Santa Cruz, $960 for "Managing Rice for a Sustainable Future: Winter Flooding, Organic Production and Pest Food Webs." Food web analysis and on-farm research will be used to quantify the agronomic and ecological effects of winter flooding of rice fields in the Sacramento Valley. (Major professor: **Daniel Doak**)

Laura Tourte, Department of Vegetable Crops, UC Davis, $1000 for "The Effect of Kelp (Seaweed) Extract and Fish Powder Sprays on Organically Grown Processing Tomatoes: Plant Growth, Yield and Economics." Replicated experiments will test the effects of kelp extract and fish powder on shoot and root growth, yield and fruit quality (acidity and soluble solids) of organically grown processing tomatoes. Economic benefit will be evaluated using cost and returns analysis. (Major professor: **Carol Shennan**)

Kathleen Walker, Department of Environmental Science Policy and Management, UC Berkeley, $1000 for "An Analysis of Apple Growers' Access to IPM Information in Kern and Santa Cruz Counties." Telephone surveys will be used to determine apple growers' primary sources of pest management advice and their awareness of alternatives to conventional practices. (Major professor: **Stephen Welter**)

Briefly Noted

Compiled by David Campbell SAREP

Congressional Working Group on Sustainable Ag Formed

Jill Shore Auburn, SAREP acting director and **Alice Jones**, national director of USDA Sustainable Agriculture Research and Education program, recently presented information on the Sustainable Agriculture Network (SAN) and results of the first National Organic Farmers Survey to the newly formed Congressional Working Group on Sustainable Agriculture. Rep**. Sam Farr** (D-CA), a member of the House Committee on Agriculture, has been instrumental in establishing the new congressional working group, which will provide Members of Congress with information on: the National Organic Standards Board, the USDA sustainable agriculture program, research and education programs at leading academic institutions, administrative and legislative initiatives that would remove barriers and foster the growth of sustainable agriculture, and the objectives of sustainable agriculture and the organic food industry in the 1995 farm bill. Additional members of the congressional working group are representatives **George Brown, Gary Condit**, and **Calvin Dooley** (all from CA), **Charlie Rose** (NC), **Peter DeFazio** (OR), and **Karen Thurman** (FL). For more information, contact **Linda Delgado**, legislative assistant to Farr, (202) 225-2861.

Organic Farmers Name Top Three Research Priorities

The first-ever national survey of certified organic farmers found that the top three research priorities of growers are to identify ways to increase consumer demand for organic products, to study the relationship of growing practices to crop quality and nutrition, and to study the relationship between plant nutrition and pest resistance. The mail survey, conducted by the Organic Farming Research Foundation (OFRF), was completed by 550 of the 2,700 growers who received it. Nearly one-third of those responding had participated in on-farm research projects, and more than 80 percent said they would be interested in doing so if resources were available. For more information, contact OFRF, P.O. Box 440. Santa Cruz. CA 95061; (408) 426-6606.

GAO Asked to Investigate FDA Handling of BGH

Representatives **David Obey** (D-WI), **George Brown** (D-CA), and **Bernie Sanders** (I-VT) have asked the U.S. General Accounting Office (GAO) to investigate allegations that three Food and Drug Administration (FDA) employees may have violated federal conflict-of-interest regulations during the agency's handling of the approval process for bovine growth hormone

(BGH). All three employees had ties to Monsanto, the maker of Posilac, the first recombinant bovine growth hormone product to hit the market. FDA officials said that they have reviewed the conflict-of-interest allegations and found them to be without basis. The letter from the three representatives to the GAO counters by stating "There is strong evidence that all three of these employees may have violated at least two ethical regulations applicable to them pursuant to the Code of Federal Regulations." For more information see "rBGH News of the Week," *Food Safety Week*, Institute for Agriculture and Trade Policy, April 26, 1994.

Federal Farm Worker Safety Regulations Delayed

Under pressure from farm groups, Congress passed legislation in March that delayed implementation of new rules designed to prevent thousands of pesticide poisonings each year. The rules, which have been under consideration since 1984 and were to take effect April 15,1994, will now be dormant until January. According to the EPA, pesticides acutely poison between 10,000 and 20,000 farm workers annually. The agency believes the new rules can prevent up to 80 percent of those poisonings. In California, 615 cases of pesticide poisoning related to agriculture were reported in 1990, and analysts believe that up to 80 percent of those poisonings go unreported. See **Michael Doyle**, "Pesticide protection rules delayed," *Sacramento Bee*, March 23, 1994.

California State Policy Issues

Two bills seeking reduction of chemical use in agriculture have been introduced in the California legislature. Assembly member Julie Bornstein (D-Palm Desert) carried AB 3383, sponsored by the Community Alliance with Family Farmers (CAFF), which would provide farmers with incentives and field support to adopt more ecological farming practices. The legislation would enable an expansion of the already successful Biologically Integrated Orchard Systems (BIOS) program underway in Merced County. Another bill, SB 475 carried by Sen. **Nicholas Petris** (D-Oakland), would require California to significantly reduce pesticide use, phase out the most hazardous pesticides, and increase support for farmers to learn safer pest management practices. For information about AB 3383, contact **Reggie Knox,** CAFF, (408) 425-8145. For information about SB 475, contact **Joan Clayburgh,** Pesticide Watch, (415) 543Z627; or **Ralph Lightstone**, California Rural Legal

Assistance. (916) 446-7901. J

Summer 1994 (v6n3)

Small Farmers Jam "Subscription" Farming Conference

by Gail Feenstra, SAREP

More than 125 people, most of them small family farmers, packed a UC Davis meeting hall in December 1993 ~ for a workshop on community supported agriculture (CSA) or "subscription" farming. The conference detailed the CSA concept, in which consumers purchase subscriptions from nearby farms, allowing farmers to plan ahead to meet the needs of prepaid customers. Co-sponsored by SAREP, UC Small Farm Center, Community Alliance with Family Farmers (CAFF), UC Cooperative Extension and Fiddlers' Green Farm, the one-day workshop reflected the growing interest of farmers who are seeking more markets for their produce, and consumers who are pursuing local fruits and vegetables.

Andrew Lorand, a longtime CSA consultant and agriculture teacher at the Sacramento Waldorf School, began the day's events with an overview of CSAs in the United States, their history and some fundamental principles. Subscription farming began in Western Europe and Japan in the mid-1960s, first appeared in the U.S. in the mid-1980s, and has recently been gathering momentum in California.

Consumer Contact

Lorand said all CSAs have the same fundamental idea Farmers sell directly to a group of consumers who agree to buy "shares" in the farmer's harvest in advance. Both farmers and consumers share in the risk and the bounty of the harvest. Consumers receive weekly boxes of fresh, seasonal, local produce, often produced organically. Farmers have a guaranteed market and income for working capital. According to Lorand, besides the concept of shared risk, one of the most appealing things about a subscription farm is that there is direct, personal contact between growers and consumers. It is a socioeconomic model that can be adapted for any community. He noted that today, there are more than 400 CSAs around the country and the number is growing rapidly.

The program continued with talks by three CSA farmers including **Sue Temple** of Fiddlers' Green Farm, Capay Valley; **Judith Redmond** of Full Belly Farm, Capay Valley and CAFF executive director; and **Steve** and **Gloria Decater** of Live Power Farm in Covelo. They discussed the differences in their CSAs, their reasons for beginning subscription farming, marketing strategies for different clientele, farm production organization, the preparation of produce boxes, educational and communication strategies they have developed with their shareholders, and the challenges of CSAs.

Each CSA representative described a different method of dealing with shareholders depending upon the type and number of members, the percentage contribution the CSA income makes to their entire farming operation and other factors. Full Belly Farm finds the presence of an organizer at one of its distribution sites to be invaluable. Full Belly farmers have developed creative ideas to determine the right mix of vegetables to plant to fill their 175 weekly boxes; Redmond described the contents of typical boxes for each season. In addition to a diverse farming operation of their own, Full Belly farmers sometimes trade vegetables for fruit or different vegetables from other organic farmers in their neighborhood. They have also learned how to combine their farmers' market operation with their CSA business, allowing them to shift items back and forth as necessary.

Farm Diversity Key

Redmond noted that not only is diversity important on the farm and in the CSA boxes, but biological and economic diversity is a crucial element for the survival of agriculture in California.

She said the concept of community supported agriculture "allows us to put our vision and hopes for California agriculture into practice. CSA works against short-term concentration of resources. It improves California agriculture by giving consumers a choice in the future."

"We're creating an economic partnership between farmers and consumers by establishing a direct, stable market," she said. "This also allows us to exchange ideas with subscribers about our food system and California agriculture."

The Decaters, who are developing a solar power-based farming system and plow with draft horses, sell 100 percent of their produce through the CSA. They have developed a loyal group of shareholders in San Francisco and are building their rural membership in Covelo and Willits. Their San Francisco shareholders insisted that they increase their share price by 45 percent when they had to raise money to make major farm improvements. They said that at first they were reluctant to raise prices, but now feel it was the right decision. The Decaters spend a lot of time marketing their CSA to potential Customers. They said it is important to explain to people what they already pay for vegetables at the supermarket over the course of a year and how par. participating in a CSA can be better for them. The Decaters emphasized the importance of freshness, quality, variety, support for the local community and the connection subscribers will have with the farm.

Identify Goals

Sue Temple discussed the "nuts and bolts" of starting and operating a CSA from her perspective at Fiddlers' Green. Before the Temples started their CSA, they identified the short- and long-term goals of doing a CSA and thoroughly researched organizational production and marketing issues. Temple suggested that before beginning a CSA, it is important to know the individual farm. Then the farmer can decide if a CSA would complement the existing operation or how the operation might shift to accommodate a CSA. Temple noted that it is essential to know the consumer base, including the family size, ages, buying and eating habits and financial capabilities. Finally, she suggested that CSA farmers make a commitment to a relationship with their land *and* with their consumers. Temple said that education and communication are essential elements in building community among shareholders. In addition to communicating with customers through a newsletter, the Temples make opportunities available for their members to visit the farm for work days and potlucks. Members and their families can see the seasonal rhythms for themselves as they help with planting, harvesting or simply enjoy the beauty of the farm. The Temples believe in the CSA approach because it helps people understand where their food comes from, connects them with the earth and with each other.

After a panel discussion and question-and answer period, more than 50 participants drove to Fiddlers' Green Farm for a farm tour and more personal discussions with Temple, co-owner **Jim Eldon**, and harvest manager **Liz Milazzo.**

Workshop participants' enthusiasm led to a second CSA conference in March in Escondido in Southern California co-sponsored by UC Cooperative Extension and the Small Farm center For more information on CSAs, contact David Visher at the Small Farm Center; Faustino Munoz, UC Cooperative Extension in San Diego at (619) 694-2846; or Gail Feenstra, SAREP at (916) 752-8408.

Proceedings of the December 1993 Davis workshop are now available for $8 through the Small Farm Center; make checks or money orders payable to "UC Regents." VISA/Master Card purchases may be made by calling the Small Farm Center at (916) 752-8136.

Summer 1994 (v6n3)

FIRST ALMONDS . . . New Walnut BIOS Open to Farmers

It's working for Almonds growers in Merced County, the Clinton administration ration likes it, and now there's money for walnut farmers in Yolo and Solano counties to participate in a new Biologically Integrated Orchard Systems (BIOS) program. More than $200,000 n grower incentives and technical support is now available for farmers who wish to reduce the use of agricultural chemicals from the walnut BIOS program,;

Chuck Ingels, SAREP perennial cropping systems analyst and a member of the BIOS management team, notes that the program is open t o 20 walnut growers, each of whom will enroll approximately 30 acres n the program.; With the help of the management team/ farmers and 0 their pest control advisors will develop a farm plan, participate in on farm workshops, cover crop management, innovative equipment use, beneficial insect releases, and earthworm management, according to Ingels.

USDA undersecretary of agriculture **Richard Rominger**, a Winters farmer, recently visited almond BIOS program participants and noted that "These are the kinds of projects the Clinton administration wants to see taking place all across the country." Funding and services for BIOS are provided by Community Alliance with Family Farmers Foundation and the USDA's Agricultural Stabilization and Conservation Service, and by 0 grants from the Pew Charitable Trust and the Charles Stewart Mott Foundation. For more information contact CAFF at (916) 756-8518.

Summer 1994 (v6n3)

Arcata Farm and Education Project

by Gail Feenstra, SAREP

Nestled in the lush evergreens of California's north coast lies a tiny farm that is making a big impact on the lives of people in the surrounding community. **Janet Czarnecki**, education and outreach coordinator for the Arcata Farm and Education Project, is excited about the new connections the project has made with the Arcata community since mid-1993. The Arcata Project, funded by SAREP in two grants totaling approximately $26,000 from 1992-1994, is a student-operated, community supported farm designed to serve as a sustainable agriculture educational facility for students, community members and farmers. It has served as an innovative model of community education about sustainable agriculture in Arcata.

CSA Begins

The project's most recent development has been the initiation of a new CSA-a community supported agriculture project or a "subscription farm"-on the project's 2 1/2 acre farm. (In CSAs, farmers sell directly to a consumers who agree to buy "shares" in the farmer's harvest in advance- see "Small Farmers Jam Subscription' Farming Conference, page 4.) The CSA started in October 1993 with ten 10-week shares and 15 shareholders. This core group enthusiastically supported the CSA through the fall by sharing recipes, writing newsletters and organizing potlucks. The CSA members also enjoyed an additional "soup share" for the month of January: They were invited to the farm to pick any root crops, cabbages and greens (kale, chard) for a donation. In that manner the extra crops in the fields were used instead of being composted, and members were able to maintain their connection with the farm. The spring summer CSA season began in late spring (after the "mud and floating gardens" subsided) and will run until September or October Czarnecki says the Arcata Farm CSA will expand to 20 to 40 shareholders at that time. Community support has been enthusiastic and essential for the success of the Arcata Farm project in all of its outreach activities, she notes.

University Classes

In addition to being the site of the CSA, the Arcata Farm is also the location of California State University, Humboldt's sustainable agriculture classes, coordinated by farm director **Susan Toms**. The lecture and field work class as well as a field practicum taught by **Jon McNally** and **Andrew Rahn**, are extremely popular and successful with the students, according to Toms.

The Arcata Farm and Education Project and the City of Arcata cooperate to produce public composting workshops. Additionally, Arcata Farm personnel work with **Deborah Giraud**, UC Cooperative Extension farm advisor, to teach community classes including winter gardening, strawberry culture and spring topics.

Czarnecki has been working with teachers and students at the Sunnybrae Middle School, a public school, and Equinox, a local private school, to develop lessons about sustainable agriculture for the science curriculum. She leads both classroom activities and outdoor experiences to teach the children about the health of the soil, compost building, cover cropping, and local food production. Some of the classes take place at the Arcata Farm, located across the creek from the Sunnybrae Middle School. She is also developing school gardens at both sites.

Hmong Poultry Project

In addition to community gardeners, university students and school children, the Arcata Farm is also used by a community of Hmong refugees. The Hmong are developing a special poultry project in which they will build a traditional Hmong-style poultry house for Asian chickens. They are using a small plot of land for the poultry house and for growing varieties of Asian vegetables for their families. People at the Arcata Farm look forward to sharing culturally diverse farming techniques and different foods.

The Arcata Project has given many different people in the community the opportunity to learn about sustainable agriculture and is directly connecting people with their food supply. It is a wonderful model for other communities interested in building community around sustainable agriculture.

Click here to visit the Arcata Educational Farm World Wide Web site

---

Feasibility of soil fumigation by sealing soil amended with fertilizers and crop residues containing biotoxic volatile compounds.

J.J. Stapleton and A. Gamliel

Adapted from Plant Protection Quarterly 3(3,4): 13. 1993

Editor's Note: A summary of this research, along with 18 other abstracts, appears in the recently published Cover Crops Workgroup Report. This report was compiled for the recent Workgroup meeting. For information on obtaining this report see page 15 of this newsletter. As noted above, the article originally appeared in the Plant Protection Quarterly, a publication by UC pest management specialists and advisors.

For the past 50 years farmers have been able to use synthetic chemical fumigants to disinfest soil of pest and disease organisms. These materials have been effective and easy to apply. The cost of fumigant treatments has usually been recouped through dramatically higher yield and quality of produce, healthier and longer-lived permanent crops, certification of pathogen-free nursery stock, and reduced costs of other production practices such as weed control (Chen et al., 1991).

In the current climate of strict environmental and human safety regulations, however, it appears that the era of widespread disinfestation of agricultural soils by synthetic chemical fumigants is coming to a close. Alternative methods of soil disinfestation must be developed and implemented if current levels of crop production, quality, and phytosanitary certification are to be maintained. One such method is soil solarization. Heat accumulation in solarized soil causes physical, biological, and chemical changes which normally result in greatly reduced pest and pathogen numbers and increased yield in subsequent crops. Disadvantages of solarization include dependence on favorable climatic and weather conditions, treating soil for several weeks during the growing season, lack of control of certain heat tolerant pests, and generally, decreased efficacy with increasing soil depth (Chen et al., 1991).

Another alternative for disinfesting soil is to incorporate into the soil fertilizers and plant residues that have pesticidal properties. This practice has received renewed attention, and numerous studies have shown that amending soil with various cover crops, plant residues and extracts, animal manures and composts, and inorganic fertilizers can provide some degree of pesticidal activity (Rodriguez-Kabana, 1986). Studies in which soil sealing and/or heating with plastic mulches was combined with soil amendments generally concluded that, like fumigants, levels of soil disinfestation were better than with either method alone (Brown et al., 1989; Gamliel and Stapleton, 1993a;

Gamliel and Stapleton, 1993b; Ramirez-Villapudua and Munnecke, 1988; Stapleton et al., 1991).

This article summarizes recent experiments done with combinations of composts, inorganic fertilizers, or cruciferous residues and solarization with polyethylene film or liquid spray mulch to test improved pathogen control, and to determine relationships of soil heating and sealing on concentrations of biotoxic volatile compounds emanating from treated soil.

Recent Research

Solarization and fertilizers. Laboratory and field experiments in different soil types were done in 1991 and 1992 near Fresno, California, to determine the effects of organic and inorganic nitrogen sources. Commercially-composted chicken manure and inorganic ammonium-nitrogen were applied at rates equivalent to 80 kg NH4-N per hectare with and without soil solarization with clear polyethylene film. The length of the treatment was four weeks during August 1991. Measurements were taken on fungal (*Pythium ultimum*) and nematode (*Meloidogyne incognita*) pathogens in the rhizosphere and roots of lettuce (*Lactuca sativa* cv. Parris Island).

Solarization and crop residues or fertilizers. Another replicated field experiment was done in sandy loam soil near Fresno, in 1993 to compare the effects of amending soil with composted chicken manure (40 kg NH4-N per ha) or dried cabbage harvest residues (500 kg per ha), with and without a four-week period of soil solarization. Solarized soils were treated in July 1992, with either clear polyethylene film or black spray mulch; data were collected on the survival of *P. ultimum*.

Evolution of volatile compounds from amended and heated soil. Additional experiments were conducted in the laboratory to analyze evolution of volatile compounds by gas chromatography from soil amended with cabbage residues under various levels of soil heating, and to correlate the presence of these compounds with pathogen control.

Results and Discussion

Solarization and fertilizers. Preplant incorporation of ammonium phosphate fertilizer or composted chicken manure slightly reduced galling of lettuce roots by M. incognita (3-24%); solarization was more effective (74% reduction). Ammonium phosphate combined with solarization was no better than solarization alone, but compost plus solarization reduced nematode galling to undetectable levels (figure 1). With regard to *P. ultimum*, incorporating fertilizer or compost alone reduced propagule numbers in lettuce rhizosphere by 0 to 25 percent; solarization alone reduced their number by 80 to 100 percent. Due to the high activity of solarization, combination with soil amendments did not give increased control (figure 1).

Solarization and crop residues or fertilizers. In this experiment, neither soil amendment had a fungicidal effect when used alone. Solarization with polyethylene film or spray mulch, on the other hand, was very effective, resulting in reduction of fungal propagules ranging from 82 to 100 percent. No interaction was found between soil amendments and solarization.

Evolution of volatile compounds from amended and heated soil. Relative concentrations of several volatile compounds emanating from cabbage-amended soil were increased by soil heating. These compounds included various alcohols, aldehydes, isothiocyanates, and sulfides. Others (e.g., CO_2) were generally higher in nonheated soil. The levels of isothiocyanates and aldehydes generated in heated soil were significantly correlated with reduced propagule numbers of *P. ultimum*. Both soil heating and amendment with cabbage residue and chicken compost increased the lethal effect on *P. ultimum*.

Summary

Results of these experiments indicate that sealing animal and plant residues containing biotoxic volatile compounds into soil and using materials such as polyethylene film and spray mulch can provide at least partial soil disinfestation, especially when combined with soil heating. Under present laws, use of these soil amendments, even when intended for pesticidal activity, do not carry regulatory requirements when the materials are produced on-farm. However, additional research will be necessary to develop guidelines for optimal usage. As interest and experimental results increase, it may be possible to develop "customized" soil amendments. which will have greater activity on specific pest organisms found in particular fields. Crop managers will require more intensive soil sampling to identify and enumerate threshold levels of soilborne pests as the broad spectrum fumigants become unavailable.

Figure 1. Field effect of soil solarization, chicken compost , and ammonium phosphate fertilizer on (A) galling of leaf lettuce (Lactuca sativa cv. Parris Island) by Meloidogyne inognita, and (B) numbers of Pythium ultimum in the rhizophere if lettuce plants. Columns tended by different letters are different (P<=0.05) according to factorial ANOVA.

[Not Available]

References

Brown, J.E., M.G. Patterson and M.C. Osborn. 1989. Effects of clear plastic solarization and chicken manure on weed control. Proc. Natl. Agr. Plastics Congr. 21:76-29.

Chen, Y., A. Gamliel, J .J. Stapleton and T. Aviad. 1991. Chemical, physical, and microbial changes related to plant growth In disinfested soils. In: Catan, J. and J.E. DeVay (eds.) *Soil Solarization*. CRC Press, Boca Raton. pp. 103-129.

Gamliel, A. and J.J. Stapleton. 1993a. Characterization of antifungal volatile compounds evolved from solarized soil amended with cabbage residues. Phytopathology 83:899-905.

Gamliel, A. and JJ. Stapleton. 1993b. Effect of chicken compost or ammonium phosphate and solarization on pathogen control, rhizosphere microorganisms, and lettuce growth. Plant Disease 77:886-891.

Rodriguez-Kabana, R 1986. Organic and inorganic nitrogen amendments to soil as nematode suppressants. J. Nematology 18:129-135.

Ramirez-Villapudua, J. and D.E. Munnecke.1988. Effect of solar heating and soil amendments of cruciferous residues on *Fusarium oxysporum* f. sp. *conglutinans* and other organisms. Phytopathology 78:289-295.

Stapleton, J.J., J.E. DeVay and B. Lear 1991. Simulated and Held effects of ammonia-based fertility and soil solarization on pathogen survival, soil fertility and crop growth. In: DeVay, J.E. et al. (eds.) *Soil Solarization*. Plant Production and Protection Paper 109, UN Food and Agriculture Organization, Rome. pp. 331-342.

Acknowledgments

The authors thank R.A. Duncan, S.T. Koike, D.M. May, C.M. Schaefer, and H. Yunis for technical assistance; Petoseed, inc., Foster Farms, and Trical, Inc. for provision of vegetable seed, chicken compost, and plastic mulch film, respectively; and we gratefully acknowledge BASF Corp., and the UC Statewide IPM Project for financial support.

For more information write to: J. Stapleton, University of California, Kearney Agricultural Center, Parlier, CA 93648.

Contributed by J.J. Stapleton

(DEC.520)

Summer 1994 (v6n3)

Sills Farms long-term rice experiment: Summary.

G. Stuart Pettygrove

Article written for Sustainable Agriculture/Technical Reviews. 1994

In a 15-acre field experiment started in 1988 at Sills Farms in Sutter County, we have shown that winter cover cropping in a continuous, high-yielding rice rotation provides a significant benefit (table 1). Improvements in rice yields with the cover crop were found with less-than-ideal conditions (acid soil pH 4.5, poor drainage, presence of unchopped rice straw) and occurred across the three different residue management systems: fall disced, fall burned, and spring disced.

Conventional practices have been used on this field and rice has been planted each year. The system is, therefore, quite different from the typical organic rice system in which one crop of rice is followed by one or more years out of rice with cover cropping. The production of the cover crop has not required any special equipment or inputs other than the seed for the cover crop.

During three years (1990-1992), cover cropping with purple vetch reduced the nitrogen requirement of the rice by 60 to 105 pounds per acre. These figures were determined by fertilizer nitrogen rate plots established each year in the experiment's main plots. This reduction in the amount of fertilizer needed represents a savings of between 2 and 3.5 million BTUs of energy per acre annually (equivalent to 1425 gallons diesel fuel per acre). The resultant energy savings outweighs the small amount of energy required to produce and harvest the cover crop seed and broadcast it in a rice field.

The profitability of green manuring is also being assessed. Calculating the difference in net income between the green manure and non-green manure rotation depends on a number of factors including the cost of vetch seed and the seeding rate. If the grower produces his or her own vetch seed, the land charge or opportunity cost must also be factored in. In our calculations, we have assumed that: 1) purple vetch seed was produced by the grower at a cost of 10 cents per pound including land charges; 2) vetch was planted as a green manure crop at 50 pounds per acre; 3) rice was fertilized each year in all plots at the optimal nitrogen rates determined in the fertilizer sub-plots. With these assumptions, the cost of green manuring comes to $18 per acre.

The fertilizer value of the nitrogen contained in the vetch ranged from $4 to $22 per acre (1990-1992). In 1993, wet winter conditions resulted in extremely poor vetch growth, so little nitrogen value was realized. In reality, a farmer would respond to this poor growth by fertilizing rice at an appropriate rate.

In all three straw management systems, we have observed a slightly better maximum yield on the vetch plots than on non-vetch plots (table 1). This effect is not related to nitrogen levels since, even at the highest nitrogen rates, grain yield on non-cover cropped plots did not reach maximum yields on the cover cropped plots. We have not so far observed any obvious effects of green manuring on rice diseases or on rice straw decomposition, and cannot otherwise explain the higher yields on the vetch plots. When these higher yields are combined with the nitrogen fertilizer effects, the overall net gain (of green manuring compared to winter fallow) in four years is $6 per acre on the fall disced system, $47 for the spring disced system and $104 for the burned system.

This research was funded through grants from the Rice Research Board, the California Energy Commission, and UC SAREP. Cooperating investigators include Stuart Pettygrove and Kate Scow (UCD Land, Air and Water Resources), Jack Williams (UC Cooperative Extension, Sutter-Yuba) and Jim Hill (UCD Agronomy and Range Science).

For more information write to: G.S. Pettygrove, Department of Land, Air and Water Resources, University of California, Davis, CA 95616.

(DEC.519) Contributed by G.S. Pettygrove

Table 1. Maximum rice yields and required fertilizer nitrogen rate. Sills Farms, 1990-1993.

	1990	**1991**	**1992**	**1993**	**4-year average**
		-cwt/acre @ 13% moisture-			
No vetch					
Fall burn	90.7(104)	104.3(168)	101.8(120)	84.8(60)	95.4
Fall disc	93.7(118)	107.6(204)	104.1(90)	92.1(90)	99.4
Spring disc	92.8(124)	106.8(>180)	102.5(90)	86.8(90)	97.2
Vetch					
Fall burn	95.3(30)	100.7(60)	105.2(30)	92.6(60)	98.5
Fall disc	95.2(30)	112.1(114)	105.2(30)	88.0(90)	100.1
Spring disc	95.3(30)	106.9(158)	104.9(30)	89.6(60)	99.2

Maximum yields were determined by linear regression of yields vs. fertilizer rate.

N rates in pounds per acre required for maximum yields are shown in parentheses.

Summer 1994 (v6n3)

Seeds of change: Strategies for food security for the inner city.

Linda Ashman, Jaime de la Vega, Marc Dohan, Andy fisher, Rosa Hippler and Bill Romain Southern California Interfaith Hunger Coalition, Los Angeles, CA. 1993

Food security in the inner city is a serious problem. The premise of this report is that the lack of food security in inner cities is due not just to inadequate resources, but also to inadequate planning. This report advocates new mechanisms for food security planning that integrate disparate actions and policies into a comprehensive food policy. The authors start with two basic assumptions: 1) food is a basic human right; and 2) food security is a crucial community concern. Building on these, effective food policy requires an integrated, whole systems approach (grower to consumer) coordinated at the municipal level.

This research project was supervised by Robert Gottlieb and Peter Sinsheimer of the UCLA Graduate School of Urban Planning. The project team had five objectives: 1) to evaluate the problems of food security in the inner city from national and local contexts, 2) to assess the adequacy of the federal response to these problems, 3) to analyze how the structure of the food industry has contributed to food insecurity, 4) to identify and evaluate community-based strategies for change, and 5) to propose a framework for food security planning that is equitable, economically efficient and environmentally sound.

Methodology

This project integrated a number of disciplines, including nutrition education, public health, hunger advocacy, economics and community development, food retailing, agriculture, urban ecology and public policy. The study was organized into four phases: focus, research, publicity and advocacy. In phase one (summer/fall 1992), a series of meetings was held with community people to clarify food access issues and to sketch out the dimensions of the study and the complexity of the food network.

In phase two, extensive research and analysis of the food system was done with an emphasis on the local level. More than 1,000 policy, industry and academic documents were reviewed and more than 200 interviews were conducted. The research involved assessments of the food system at the local, the regional and the state/national levels. At the **local level,** a comprehensive case study was done of a 2-square mile area in South Central Los Angeles. At the **regional level,** studies were done of the location of supermarkets over time, of consumers and growers at farmers' markets in the county, of low-income community gardeners, and of the structure of the food retailing industry from the grower to the store. The study also evaluated urban agriculture programs, land use in the region, policy and local government activities and transportation routes. At the **state and national level,** the project reviewed food support programs, analyzed eight Food Policy Council initiatives in the U.S. and Canada, examined the public health literature on nutrition and food security issues, did an analysis of the supermarket industry over the past decades, and reviewed community development initiatives with regard to new supermarket investments.

In the third phase, all of the research was synthesized and the report was written. The fourth phase will include dissemination of the report and the development of an implementation strategy based on the reports recommendations.

Key Findings

The report summarizes its findings in five key areas: hunger and nutrition, the food retail industry, transportation, alternative food strategies and policy.

Hunger and nutrition. Hunger and nutrition are substantial problems in the inner city. The project's survey found that 27 percent of residents of a South Central L.A. neighborhood did not have enough money to buy food. The emergency food network was overwhelmed, with the amount of food distributed increasing from 25 million pounds in 1979 to over 450 million pounds in 1990.

Food retail industry. The food retail industry has abandoned the inner city. Recent supermarket investments are driven by the market and not community needs. The industry has not adequately examined creative solutions to improve communities.

Transportation. There is a lack of adequate transportation in the inner city. Thirty-eight percent of the households surveyed in the case study area do not have cars and three out of ten people surveyed have problems bringing home large amounts of groceries.

Alternative food strategies. There is much interest among consumers in urban agriculture programs. Sixty-eight percent of those surveyed in the case study area reported interest in participating in a community gardening program in their neighborhood. Urban agriculture provides significant economic and community development possibilities but receives very little municipal support. A 64-square-foot plot can save a family up to $600 in food purchases per year. Farmers' markets can also provide tangible social and economic benefits to communities; 83 percent of the farmers' market growers surveyed reported economic benefits from participating in farmers' markets.

Policy. There is no overall food policy in Los Angeles City ox County. This situation has hindered the development of an adequate food delivery system, and created inefficiencies and inequities in the food distribution system.

Recommendations

The report concludes with a range of new initiatives and strategies based on its findings. They include both substantive and procedural actions to provide a basis for planning for food security.

1. One of the project's primary recommendations is for Los Angeles to establish a Food Policy and Planning Council with the vision to develop and integrate food policies at the municipal, regional and state levels. At the national level, the report suggests that the USDA integrate food policy councils and urban food system initiatives across the country.
2. Increased funding should be directed to federal and state food assistance and nutrition education programs.
3. The supermarket industry should establish joint ventures for community participation in inner city markets. The Food Policy Council could create incentives for supermarkets to participate in these ventures.
4. Transportation planning should be part of planning for the food needs of the community. The Food Policy Council should develop a transportation plan that integrates transportation routes with food distribution outlets.
5. More local and state support should be directed toward farmers' markets, the WIC Farmers' Market Program, a statewide direct marketing program, and urban agriculture. The Food Policy Council could help coordinate urban agriculture and farmers market programs. They could also provide technical support for urban agriculture projects.

The report ends with a "Call to Action." The authors suggest that with the Clinton administration, Los Angeles and the nation are politically ripe for a new food policy. In addition, economic forces are pushing supermarkets to reinvest in the inner city. This influx of political and economic capital could provide the encouragement needed to address the urgent food security needs of urban areas.

For more information write to: Southern California Interfaith Hunger Coalition, 2449 Hyperion #100, Los Angeles, CA 90027.

(GWF.015 5) Contributed by Gail Feenstra

Earthworm update

Robert L. Bugg

Article written for Sustainable Agriculture/Technical Reviews. 1994

Earthworms are increasingly recognized as indicators of agroecosystem health and as important tools for ensuring soil improvement and efficient nutrient cycling. In the past, SAREP has highlighted both historical and recent research on earthworms (see *Sustainable Agriculture News* 3(1): 5,11 and *Components* 1(4):6-9). The literature has since proliferated rapidly; here we present additional findings from more recent or underexposed research, and include observations from an ongoing demonstration project, Biologically Integrated Orchard Systems: BIOS (see *Sustainable Agriculture* 5(5):2).

Tillage Effects

Parmelee et al. (1990) conducted a "piggyback" study in long-term research plots at Horseshoe Bend in north-central Georgia. The long-term trial involved a sandy clay loam soil planted to a soybean-cereal rye-sorghum rotation and managed with vs. without tillage. *Aporrectodea caliginosa* was the dominant annelid earthworm, and *Lumbricus rubellus* was also present. No-till management led to a 1.42-fold increase in annelid density and biomass over those observed with conventional tillage. Detailed sampling indicated that densities of Enchytraeidae (a family of small earthworms) were higher under no-till, which contradicted earlier preliminary sampling of the same plots (Hendrix et al., 1986). When the pesticide carbofuran was used on the long-term treatments, it resulted in a 47 percent increase in *particulate* organic matter under the no-till regime.

Organic Matter and Nitrogen Cycling

Kretschmar and Ladd (1993) conducted a laboratory study of the decomposition of subterranean clover (*Trifolium subterraneum*) foliage incubated in columns of loamy sand. Clover foliage was incorporated at varying depths and soil was compacted at varying pressures. The earthworm *Aporrectodea trapezoides* was then added to some columns, but not to others. Results suggested that if herbage was deeply incorporated or the soil highly compacted, the earthworm alleviated the problems of decreased oxidation rates, and thereby promoted decomposition of the residues.

Ruz Jerez et al. (1988) conducted a study on organic matter breakdown and nitrification as influenced by the earthworms *Lumbricus rubellus* or *Eisenia fetida*. The study was conducted in 2-liter laboratory glass incubation chambers containing soil (fine sandy loam) and earthworms (10 per chamber). (*Reviewer's note: 5 earthworms per liter corresponds to high* *worm densities in the field.*) Dried wilted or senescing clover or grass residue was incorporated into the upper 1 cm of soil in each chamber

Following an initial amount of litter that would correspond to 700 kg dry matter (DM) per hectare, additional litter was added at a rate of 350 kg DM per hectare per week for 10 weeks thereafter. The total addition of clover or grass herbage during the 11 weeks of the study was 4,200 kg DM per hectare. *(Reviewer's note: This is about the amount of organic matter that would result from one fairly close mowing of a cover crop of annual grasses. clovers, or medics in a Californian orchard.)*

The researchers observed an approximately 50 percent increase in mineral nitrogen after 11 weeks' incubation with earthworms as compared to without; mineral nitrogen was 9 percent higher in chambers that were held at 22.5C than in those that were held at 15C. When results were pooled over both temperatures, only 0.6 percent of the clover residue remained, whereas 9 percent of the grass residue was recoverable; this difference is probably related to differences in the residue's carbon-to-nitrogen ratio as well as its palatability to earthworms. In chambers without earthworms, 11.3 percent of the clover residue remained, and 13.7 percent of the grass residue. Microbial biomes was reduced in chambers with earthworms. No information was presented comparing results obtained for *Lumbricus rubellus* vs. *Eisenia fetida.*

Test plants (ryegrass [*Lolium* sp.]) grown in the various treatments following incubation suggested a 25 percent increase in nitrogen uptake following incubation of herbage and soil with, as opposed to without, earthworms. The authors suggested that prior laboratory studies may have underestimated earthworm respiration rates.

Marinissen and de Ruiter (1993) assessed data on the cycling of nitrogen and organic matter from a study in the Netherlands, and from the long-term study in Horseshoe Bend, Georgia (described above under Parmelee et al., 1990). As in the Horseshoe Bend study, the dominant annelid at the Netherlands site was *Aporrectodea caliginosa* (constituting 92 percent of the wet biomass of annelids). Other species observed at the Netherlands site were *Lumbricus rubellus* (6%) and *Aporrectodea rosea* (296). The researchers developed projections for nitrification based on both direct and indirect effects of earthworms. Direct effects were calculated based on varying assumptions concerning production rates of dead tissue, casts, urine, and mucus. Other assumptions that were varied concerned the carbon:nitrogen ratios of the earthworms themselves and of the organic matter being processed. Indirect effects of earthworms were also evaluated, based on the possibilities that: 1) increased grazing by earthworms on microbes stimulates microbial regrowth, and 2) earthworm-induced improvement of soil structure promotes microbial activity.

Projections from the Netherlands data suggested that earthworms are directly or indirectly responsible for nitrification of from 10 to 100 kg nitrogen per hectare per year Data from Horseshoe Bend, where earthworm densities were higher, suggested corresponding figures of from 82 to 364 kg nitrogen per hectare per year. These widely varying projections reflect a need for more precise assessment of the parameters employed in the models.

Soil Structural Changes

Lee and Foster (1991) composed a review article suggesting that earthworm burrows are important for water infiltration only when irrigation or rainfall exceeds the soil capacity for capillary uptake. Moreover, anecic earthworms (those that make deep, permanent, vertical tunnels) may block burrow entrances with soil or plant material, or position their bodies to obstruct flow down the burrows. Any of these phenomena make earthworm burrows less effective in promoting water infiltration.

Other research has indicated that earthworm casts are frequently more stable than aggregates composed of clay-organic matter complexes. The authors point out that this is not always the case, but they provided no explanation for the discrepancy.

Zhang and Schrader (1993) conducted laboratory studies on the aggregate stability of "natural," worm-induced, and pressure-induced aggregates. Worm-induced aggregates from castings and burrow linings were less stable than "natural"" aggregates, but more so than those formed by human agency through mere compression. The authors considered it unlikely that earthworms rupture mineral particles by compression, but did suggest that the chemical bonds of natural aggregates may be ruptured during ingestion by earthworms. The tensile strength (resistance to crushing) of aggregates formed by the three species of earthworms assessed was as follows: *Lumbricus terrestris>Aporrectodea longa>Aporrectodea caliginosa*. Tensile strength was positively correlated with organic matter content in the worm-formed aggregates.

Toxicology

Martin (1986) conducted a toxicological study that indicated that *Aporrectodea caliginosa* is as sensitive or more so to pesticides than are other agriculturally important earthworms. The author suggested that this species would be a logical choice for screening pesticides intended for use in pasture crops or crops grown in rotation with pasture.

Fertilizers

Ma et al. (1990) assessed the effects of turfgrass fertilization with six types of nitrogenous fertilizers, including mineral ammonium sulfate, nitrochalk (ammonium nitrate with lime), sulfur-coated urea, organic-coateddurea, isobutylidenediurea, and ureaformaldehyde. There were three rates of application for each of the six fertilizers, corresponding to 60, 120, and 180 kg nitrogen per hectare per year The trial was carried out in a loamy sand soil in Haren, Netherlands, on a turf that included various annual and perennial grasses. Plots were 2.5 x 3.0 m and arrayed in a randomized complete block with two replications for each of 18 treatments.

Results suggested profound reductions caused by ammonium sulfate and by sulfur-coated urea in the endogeic earthworms *Aporrectodea caliginosa caliginosa* and *Aporrectodea rosea*. By contrast, the endogeic earthworm *Aporrectodea caliginosa tuberculata* and the *epigeic Lumbricus rubellus* showed less reduction. The observed reductions were believed by the authors to have been caused by acidification. (Editor's note: Endogeic species forage below the soil surface in horizontal, branching burrows; epigeic species live in the superficial soil layers and feed on undecomposed plant litter.) *Aporrectodea caliginosa tuberculata* and *Lumbricus rubellus* have in the past been noted as tolerant of acid soils, whereas the types of worms showing reductions have been regarded as doing best near neutral pH. Nitrochalk had little effect on earthworm densities, and the other fertilizers had intermediate effects.

Collections From Merced County Almond Orchards

As part of the BIOS project in Merced County, California, seven growers collected earthworms from their orchards. These worms were identified by specialists Matthew Werner of the UC Santa Cruz Agroecology Program and Sam James of Maharishi International University, Iowa.

The endogeic earthworm *Aporrectodea caliginosa* was the most widely-distributed species, having been collected in all the orchards sampled. This nominal species is now regarded as a complex of three closely related species (Matthew Werner, pers. comm.). As noted in the above synopses, *Aporrectodea caliginosa* is frequently encountered in other farming systems. It is regarded as having agricultural importance, and diverse feeding habits, including feeding on soft tissue of plant litter at the soil surface or on dead roots below the soil surface (reviewed by Lee, 1985).

Werner noted that specimens of *Aporrectodea caliginosa* from three of the orchards were unpigmented, indicating a strictly subterranean existence. One of these farms also included *Aporrectodea turgida* and was the only orchard at which the epigeic species *Lumbricus rubellus* could be found. Specimens of *Aporrectodea caliginosa* from the remaining four farms had moderate to heavy pigmentation, suggesting at least occasional above-ground feeding, casting, or travel. On one of these farms, the endogeic species *Amynthas diffringens* and *Microscolex dubius* were also collected.

No anecic earthworms were found, nor have obvious middens been seen at any of the BIOS farms. In light of the apparent lack of anecics, Werner has suggested inoculative release of the anecic earthworms *Lumbricus terrestris* or *Aporrectodea longa* to promote more rapid litter incorporation. It is striking that three of the four species collected recently at BIOS farms (*Aporrectodea caliginosa*, *Lumbricus rubellus*, and *Microscolex dubius)* are renowned as "peregrine or "wandering" earthworms, because they have frequently been transported by humans to new locations (Lee, 1985).

References

Hendrix, R.E., R.W. Parmelee, D.A. Crossley Jr., D.C. Coleman, E.R. Odum and R.M. Groffman. 1986. Detritus food webs in conventional and no-tillage agroecosystems. Bioscience 36:374-380.

Kretzschmar, A. and J.N. Ladd. 1993. Decomposition of 14C-labelled plant material In soll: The Influence of substrate location, soil compaction and earthworm numbers. Soil Biology and Biochemistry 25:803-809.

Lee, K.E. 1985. Peregrine species of earthworms. In: Pagliai, A.M. Bonvicini and R Omodeo (eds.) *On Earthworms*. Selected Symposia and Monographs, 2 Collani U.Z.I. Mucchi Editore, Modena, Italy. pp. 315-327.

Lee, K.E. and R.C. Foster. l991. Soil fauna and soil structure. Australian Journal of Soil Research 29:745-775.

Ma, Wel-Chun, L. Brussard and J.A. De Ridder. 1990. Long-term effects of nitrogenous fertilizers on grassland earthworms (Oligochaeta: Lumbricidae): Their relation to soil acidification. Agriculture, Ecosystems and Environment 30:71-80.

Marinissen, J.C.Y. and RC. de Ruiter. 1993. Contribution of earthworms to carbon and nitrogen cycling in agro-ecosystems. Agriculture, Ecosystems and Environment 47:59-74.

Martin, N.A.1986.Toxicidty of pesticides to *Allolobophora caliginosa* (Oligochaeta: Lubriddae). New Zealand Journal of Agricultural Research 29:699-706.

Parmelee, R.W., M.H. Beare, W. Cheng, P.F. Hendrix, S.J. Rider, D.A. Crossley Jr., and D.C. Coleman. 1990. Earthworms and enchytraeids in conventional and no-tillage agroecosystems: A biocide approach to assess their role In organic matter breakdown. Biology and Fertility of Soils 10:1-10.

Ruz Jerez, B.E., R.R. Bail, and RW. Tillman. 1988. The role of earthworms in nitrogen release from herbage residues. In: Jenkinson, D.S. and K.A. Smith (eds.*) Nitrogen Efficiency in Agricultural Soils*. Elsevier Applied Science, New York, NY. pp. 355-370.

Zhang, H. and S. Schrader. 1993. Earthworm effects on selected physical and chemical properties of soil aggregates. Biology and Fertility of Soils 15:229234.

For more information write to: R.L. Bugg, Information Group, SAREP. University of California, Davis, CA 95616.

(DEC.521) Contributed by Robert Bugg

Resources

Citrus Groundwater Publication

Protecting Groundwater Quality in Citrus Production, 38 pages, 1994, by **Chuck Ingels**, SAREP This book details the seriousness of the groundwater contamination problem in California, how chemicals move from farms to groundwater, and the history of nitrogen and weed management in the state's citrus industry. It presents diverse management strategies for both protecting groundwater and maintaining yields and fruit quality. Practices discussed include wellhead protection and creative techniques for managing nitrogen, weeds and irrigation. The book also provides the most thorough coverage available about cover cropping in citrus. It examines the limitations of cover cropping and suggest strategies that can be used to overcome these drawbacks. To order the book, send checks or money orders for $5.00, payable to UC Regents, to ANR Publications, University of California, 6701 San Pablo Avenue, Oakland, CA 94608-1239 (510) 642-2431.

Grower's Guide

Sell What You Grow, 304 pages, 1994, by **Eric Gibson**, New World Publishing. This comprehensive book on high-value marketing for specialty growers and market gardeners offers practical guidance for making a living from the land. Topics covered include marketing plans; sales at farmers' markets, restaurants, roadside stands and consumer-pick operations; subscription farming, mail-order and retail outlets; processed products; customer service; pricing; insurance; sales calls and advertising. To order the book, send checks or money orders for $22.50 plus $2.50 shipping (California residents add $1.63 sales tax) payable to New World Publishing, 3701 Clair Dr., Carmichael, CA 95608; or call (916) 944-7932 for Visa/MasterCard orders or for free brochures.

Subscription Farms Toll-Free Number

Information on the locations of community supported agriculture (CSAs, or subscription farms) in North America is available by calling a new toll-free number: **(800) 516-7797.** Sponsored by the Bio-Dynamic Farming and Gardening Association, Inc., the toll-free number is a way for consumers to get a free list of CSAs and biodynamic farms and gardens in their area, and a free brochure *Introduction to Community Supported Farms and Farm-Supported Communities*. The Association also offers a free resource catalog featuring publications and audio/video tapes about CSAs, and a selection of CSA related resources.

Bat Boxes

Farmers and others interested in attracting bats to aid in insect control may obtain free instructions for building bat boxes and detailed information on bats from Bat Conservation International, Inc., PO Box 162603, Austin, TX 78716; tel: (512) 327-9721. The diet of bats includes mosquitoes, cucumber beetles, May beetles or June bugs, stinkbugs, leafhoppers and many moth species. Bats pose virtually no health risks, as they do not attack humans and Dose little danger for rabies.

American Livestock Census

Taking Stock: The North American Livestock Census, 1994, 182 pages, American Livestock Breeds Conservancy. This book provides an inventory of North American breeds and describes the status of livestock genetic diversity. It considers the impact of current agricultural trends on these genetic resources, the significance of livestock for sustainable agriculture, and the case for livestock genetic conservation. Also included are registration numbers for breeds, graphs of genetic status, breed association addresses, appendices on breed extinctions and data on feral livestock populations. (Poultry will be the subject of a 1994-95 census; a 1987 survey of 17 poultry production breeds is available for S 6.) Taking Stock is available for $14.95 plus $2 shipping. Send check or money order to ALBC, P.O. Box 477, Pittsboro, NC 27312; or call (919) 542-5704 for MasterCard/Visa orders.

Global Genetic Resources Series

The National Research Council's four-book series on managing global genetic resources is available from the National Academy Press. Prices are for the U.S., Canada and Mexico; a $4 shipping and handling charge applies for the first copy, S0.50 for each additional copy. U.S. checks or money orders are payable to National Academy Press, 2101 Constitution Ave., NW, Lockbox 285, Washington, DC 20055; VlSA/MasterCard/American Express orders available by calling (800) 642-6242 or (202) 334-3313. Call or write for information on international orders. The series includes:

- *Agricultural Crop issues and Policies*, 1993,480 pages, $49.95.
- *Livestock*, 1993, 296 pages, $34.95.
- *The U.S. National Plant Germplasm System*, 1991, 192 pages, $19.95.
- *Forest Trees*, 1991, 248 pages, $24.95.

Free Fertilizer Proceedings

Proceedings: Second Annual Fertilizer Research and Education Program Conference, December 9,1993, UC Davis, 81 pages. Sponsored by the California Department of Food and Agriculture; California Fertilizer Association; and Public Service Research Program, University of California, Davis, the conference provided an update on the projects and products of the CDFA's Fertilizer Research and Education Program (FREP). The proceedings includes the keynote address by **George Hallberg**, Iowa Department of Natural Resources, who spoke about Iowa farmers' voluntary efforts to reduce their rate of fertilizer by nearly 20 percent, and the state's 1992 EPA Administrator's Award for Pollution Prevention for their efforts. It also includes summaries of on-going and completed projects funded by FREP, addresses of speakers, and a resource guide. Copies are available free while supplies last by contacting FREP, California Department of Food and Agriculture, 1220 N St., Sacramento, CA 95814; tel: 653-5340.

Farmer/Caretaker Connection

The Caretaker Gazette, $18/year (sample issues $3.50), edited and published by **Gary C. Dunn**. This bimonthly newsletter links farmers and caretakers. Write 221 Wychwood Road, Westfield, NJ 07090; tel/fax: (908) 654-6600. _

SAREP Publications

For a complete list of SAREP publications, call (916) 7527556 or send an electronic mail request to bbwetzel@ucdavis.edu.

Sources of Funding

UC SAREP RFP

SAREP is requesting grant proposals for new and continuing research and education projects, including whole systems comparisons, monitoring innovative producers, critical component research, and seven areas within economics and public policy (public policy, labor policies and practices, land use, rural community development, decision-making and the transition, consumers and the food system, and regional food system) The deadline for applications is September 7, 1994. Graduate students awards (maximum $2,000 per student) and meetings and field demonstrations (maximum $1,000 per event) are also being solicited in separate requests, with the same due dates. The Requests for Proposals have been sent to everyone on UC SAREP's mailing list. If you have not received them, contact SAREP at (916) 752-7556.

Organic Research Grants

The Organic Farming Research Foundation is offering funds for organic farming methods research, dissemination of research results to organic farmers and growers interested in making the transition to organic production systems, and education of the public about organic farming issues. Projects should involve farmers in both design and execution, and take place on working farms whenever possible. Proposals of $3,000 $5,00.0 are encouraged. Most projects will be less than $10,000. Matching funds from other sources and/or in-kind contributions from cooperators are encouraged but not required. Proposals are considered twice a year The next round of proposals must be received by July 31, 1994. To receive copies of grant application procedures and the "OFRF Research and Education Priorities" which describes target areas, write Grants Program, Organic Farming Research Foundation, P.O. Box 440, Santa Cruz. CA 95061 or call (408) 426-6606.

Funding Resource Note:

Funding-seekers may want to investigate *Environmental Grantmaking Foundations* 1993 Directory (October 1993), published by Environmental Data Research Institute, 1655 Elmwood Ave., Suite 225, Rochester, NY 14620; tel: (800) 724-1857; fax: (716) 473-.0968. The 600-page directory, with information on 417 grantmaking foundations, is available for $55 plus $5 shipping and handling.

UC Cover Crops Workgroup Forms - Reports Available

The UC Division of Agriculture and Natural Resources (DANR) has focused new attention on cover cropping by forming a systemwide Cover Crops Workgroup, Its purpose is to bring together Cooperative Extension farm advisors and specialists, faculty and others to share information, determine the highest priority research and extension needs, and coordinate activities to fulfill these needs. **Chuck Ingels**, SAREP perennial cropping systems analyst, chairs the workgroup, which includes 68 DANR personnel.

The first workgroup meeting was at UC Davis in May and was attended by 55 people. Twenty researchers presented information on their continuing research projects in annual and perennial cropping systems. The reports covered a broad range of topics including plant nutrition, water infiltration, pest management, cover cropping systems and management, and education.

"The meeting demonstrated that University researchers are clearly addressing critical research needs related to cover cropping and sustainable agriculture, but many questions remain unanswered," said Ingels.

In addition to the reports, the speakers prepared abstracts of their research; SAREP is now making these abstracts available to the public. To receive a copy of the 20-page collection, send $5 (checks payable to UC Regents) to: SAREP (CC Workgroup), University of California, Davis, CA 95616. To receive the abstracts free through . electronic mail or for questions, contact Chuck Ingels, Information Group-SAREP, University of California, Davis,) CA 95616; tel: (916) 757-3276; fax :(916)757-3281; e-mail: caingels@ucdavis.edu.

Western Ag Meeting Invites Farmers, Nonprofits

Farmers, nonprofit organizations and others interested in sustainable agriculture in the western states are invited to participate in the August 18-20 meeting of the Western Region Coordinating Committee (WRCC) 67 in Cheyenne, Wyoming. WRCCs are committees set up by researchers at land grant universities and the United States Department of Agriculture (USDA) to work cooperatively within a region on specific topics. WRCC 67 began in 1988 when the USDA Sustainable Agriculture Research and Education (SARE) program began to help direct this new effort in the West.

The committees are comprised primarily of researchers, but representatives of a broad range of interest groups involved in sustainable agriculture have attended WRCC 67 over the years, according to **David Granatstein**, committee chair based at Washington State University. He notes that state representatives report on relevant activities, specific SARE projects are spotlighted, and members discuss SARE goals and priorities. Field tours usually take place on the final day.

Granatstein notes that WRCC 67 members would like to broaden the committee's role in the western region. This year the committee will conduct a more formal review of six SARE projects in progress. Additionally, the committee hopes the meeting will serve as a forum for the exchange of information about sustainable agriculture activities, particularly for universities and nonprofit organizations. For more information about participating in the August meeting, contact Granatstein at (509) 663-8181, ext. 222.
