# *Winter 1994*

**In This Issue:**



**Technical Reviews:**



---

Winter 1994 (v6n1)

***From the Director***

# Legitimate Sources of Information

(*Editor's Note: **Jill Shore Auburn**, SAREP associate director, is the program's acting director during 1993-94 while **Bill Liebhardt** is on sabbatical.*)

It's often said that the role of the university is to convey scientific information to farmers and consumers. But we rarely question what is meant by "scientific information," and whether the information that we convey is most relevant to the people we serve.

To many of us, "scientific" means "based on replicated research, "where comparisons are made of experimental treatments applied in a systematic manner to different animals or plots of land. Well-accepted experimental designs for assigning treatments and analyzing results help to ensure that results can be accurately judged to be due to treatments versus chance. These methods have been very successful, and we highly recommend that farmers use them in their own on-farm trials [see Auburn and Bugg, "On-Farm Research and the Transition," *Sustainable Agriculture News* 3(2), Winter 1991], rather than dismissing them as irrelevant "number crunching."

There is, however, a broader view of scientific method that comes from the social sciences, where experimental manipulation of people is often not as easy as it is with plots of land. Systematic observations without manipulation, and comparisons of treatments that are only partially under the experimenter's control, are a part of "quasi-experimental designs" that have their own methods for analysis. A book on these methods by two prominent social scientists (Cook, T.D. and D.T. Campbell, *Quasi-Experimentation: Design and Analysis Issues for Field Settings*, 1979, Rand-McNally College Publ. Co.) includes a thoughtful discussion of how both experimental and quasi experimental designs can help, but not guarantee, that our observations are free of bias and error.

In reality, we gain our knowledge of the world through a continuum of methods ranging from observation to experimental manipulation. If we restrict ourselves to using information derived from the latter only, we are giving the public a fraction of what they need. Education based on "decision cases" has long been popular in business and law schools. It is just now being explored by agricultural schools, most notably at the University of Minnesota (see M.J. Stanford et al., *Decision Cases for Agriculture*, 1992, College of Agriculture, Univ. Minnesota, St. Paul). **Ann Drescher Mayse,** SAREP analyst, has begun exploring the perception of case studies by farmers and farm advisors in California (see p. 6).

The Sustainable Agriculture Network, a national cooperative effort to make

information available has declared "experiential" information (that which comes from practical experience rather than scientific experiments) to be an equally valuable, although different, data source on sustainable agriculture. It makes many of us uncomfortable because there are relatively few accepted methods for collecting and sharing it, compared to experimental knowledge. Information from a poorly-designed and executed experiment is just as worthless as unsubstantiated anecdotal information, but we have a long-standing system for conducting and reporting the former that helps us identify research that is, or is not, credible or useful. Can we develop a similar system for collecting and sharing experiential information that will help us do the same with the great wealth of experience that farmers and other citizens are developing from their day-to-day observations?-*Jill Shore Auburn, associate director, UC Sustainable Agriculture Research and Education Program.*

---

[ Back | Search | Feedback ]

Winter 1994 (v6n1)

# Second Transitional Organic Cotton Conference

*by Robert Bugg, SAREP*

Some 250 farmers, fabric and garment 0 manufacturers, scientists, agricultural consultants, entrepreneurs, and environmentalists assembled in Visalia, California for the *Second Transitional Organic Cotton Conference* September 7-8,1993. The meeting reflected the high degree of vertical integration within the organic cotton movement. The lead 0 organization was the California Institute for Rural Studies, with financial support from fabric and garment companies, an industry coalition and UC SAREP. The program included over 40 speakers on topics including labor practices, marketing, organic production and manufacturing techniques, and administrative issues such as the transition to organic production, certification and tracking processes. A fashion show featuring clothing made of organic cotton was one of the conference highlights.

According to speaker **Melanie Moore** of the National Cotton Council, more than 40,000 acres of certified organic cotton are now grown in the U.S., representing about one percent of the national crop. Organic acreage is projected to increase substantially in the next three years, because many acres are currently in transition to organic production.

**Robert Bugg**, SAREP, facilitated a press session, and the "Discussion of Sustainable Growing Practices." The press session was run as a facilitated panel discussion, rather than as a more typical "free for all," with questions by reporters prompting statements by, and exchanges among, resource people.

SAREP staff in attendance were impressed by the excitement of the conference, the unusually broad constituency represented, and the alliances that were being forged. In these respects, the event and the movement as a whole may serve as models for other sustainable agricultural programs. Organizer **Will Allen** of the California Institute for Rural Studies expressed overall satisfaction with the conference. He noted that important agricultural labor issues were highlighted by attorney **Bill Monning** of Salinas, and merit additional attention at future cotton conferences.

---

# Briefly Noted

*Compiled by David Campbell, SAREP*

## FDA Approves Bovine Growth Hormone

On November 5, 1993 the U.S. Food and Drug Administration announced approval of bovine growth (bGH or bST), ending a nine-year regulatory review of the controversial biotechnology product. In addition, the FDA indicated that it will not require milk produced with the synthetic hormone to be labeled as such. A 90-day moratorium on commercial sale of the product took effect immediately, as approved by Congress during the 1993-94 budget bill negotiations. During the moratorium period, the Office of Management and Budget is studying the potential economic effects of bGH on dairy farmers. Many dairy processors, including the processors of 80 percent of California's milk, have planned a "voluntary moratorium" on milk produced with bGH.

## Washington State Suspends Mevinphos Use

The state of Washington recently suspended use of the insecticide mevinphos in fruit orchards after 18 farm workers were poisoned by the chemical. Most of the victims were involved in mixing or spraying the chemical, which is also known by its brand name Phosdrin. The pesticide is commonly used to control aphids on apple and pear orchards. Washington Department of Agriculture officials noted that the toxicity of the chemical is so high that it cannot be washed off fast enough if it gets on the skin. Amvac, maker of the product, stood by the safety of the product. Farm worker advocates hailed the ban as one of the few times a pesticide has been banned due to farm worker health rather than harm to consumers. Mevinphos is currently registered for use in California orchards, but the California Department of Pesticide Regulation is sending a notice of impending suspension to the manufacturers, who will be required to do toxicity studies by next spring. The U.S. EPA is considering a nationwide ban on the product. For more information see "EPA's Region 10 Issues Warning to Prevent More Poisoning Incidents From Exposure to Pesticide Phosdrin," EPA Press Release, August 20, 1993

## USDA to Double School Produce Purchases

The USDA has announced a new "fresh start" program intended to improve the nutritional quality of school meals. The department pledged to double its purchase of fruits and vegetables for school meals, for a new total of 18 million pounds per year. Despite the increase, fresh produce will still account

for a small percentage of the 1 billion pounds of commodities purchased by the USDA for school lunches. For more information or to make written comments on the Fresh Start Program, contact "Nutrition Objectives," **Stanley C. Garnett**, USDA/FNS/CND, 3101 Park Center Drive, #1007, Alexandria, VA 22302. (703) 305-2590

## Herbicide-Tolerant Crops and California Farmworkers

A recent survey of the Organization for Economic Cooperation and Development found that herbicide tolerance is the most commonly field-tested trait in genetically engineered crop trials. For example, Monsanto has sought to develop genetically engineered canola to tolerate glyphosate. Glyphosate is one of the top ten chemicals in terms of worker illness in California agriculture. Calgene has recently asked for permission from the USDA to begin large scale field testing of bromoxynil-tolerant cotton. Bromoxynil, a proven mutagen, is readily absorbed through the skin, and both the California and U.S. Environmental Protection Agencies have increased worker protection requirements for its use. For more information see *The Pesticide Action Network* Updates Service, August 31,1993, or call PANNA at (415) 541-9140.

## Genetically Engineered Food Labeling

Last August the Chicago City Council passed an ordinance requiring "any food product that is or contains material that has been genetically engineered through such techniques as recombinant DNA, cell fusion, or somoclonal variation" to bear the label: "This food is genetically engineered." It was rescinded in November after a coalition of food and biotechnology industry representatives told the aldermen that their definition of genetically engineered foods could have included as much as 80 percent of the cheese sold in Chicago, and many soft drinks and baked goods. Aldermen who had supported the ordinance cited the desire of their constituents to know when a product has been genetically altered. This debate about the definition of genetically engineered foods and labeling is becoming more common as individuals and groups seek to alert the public about food production methods.

---

Winter 1994 (v6n1)

# Year-Round and Extended Employment for Agricultural Workers

*by David Campbell, SAREP*

Seasonal employment is considered a fact of life for California's farmworkers, but a SAREP-sponsored project concludes that extended and year-round employment for farmworkers can be both feasible and profitable. The two-year study, headed by research agricultural economist **Suzanne Vaupel** and San Joaquin County Cooperative Extension director **Gary Johnston**, examines the benefits and challenges for farmers who keep workers employed "year-round" by leveling out the peaks and valleys of seasonal employment. The results are available in a workbook, *Year-Round and Extended Employment for Agricultural Workers: Why any How?* (available for $8 from UC SAREP, 916/752-7556).

"It turns out that strategies such as crop diversity, which are introduced for agronomic reasons, can also improve labor conditions for both farmers and farmworkers," says Vaupel. "With some imagination and planning, farmers can find diverse crops and other strategies which spread out the work and avoid the problems of layoffs and rehires, while workers can find stable employment in a single location."

The researchers gathered their information from a variety of sources. With the help of **Franz Kegel**, San Joaquin County emeritus farm advisor, they interviewed 32 San Joaquin County fruit, nut, field crop and vegetable farmers. They also conducted in-depth case studies of three innovative growers, one each in Riverside, Yolo, and Mendocino counties. Results from this work were then presented to focus groups of farmers in the Fresno and Stockton areas and at major farm conferences for comment and feedback.

According to the study, the path to year-round worker employment is different for each farmer. One began year-round employment because he wanted to stay in the market with a constant supply of fresh produce. Another started extending his farming/employment sea son by growing winter crops because he had limited water to irrigate summer crops. Still another saw profitable opportunities for diversifying into alternative crops and practices.

Most of the strategies used to extend the season and employ workers year-round fall into the following categories:

- Diversifying crops and crop varieties, as well as farm enterprises;
- Pacing the work by staggering planting, spreading tasks over a longer period of time, and saving work for the off-season;

- Selective mechanization to avoid labor-saving technologies that do not help to stabilize employment of workers or to avoid labor peaks;
- Use of new technologies such as plastic tunnels, hot caps, and greenhouse starts to extend the Season
- Use of break-even or marginal return crops for both agronomic reasons (crop rotation) and to fill in employment gaps;
- Connecting with other farmers and local industries that offer off-season employment.

Farmers using these strategies experience immediate and tangible benefits, including lower training costs, availability of workers when they are needed, increased productivity and dependability, lower unemployment and workers' compensation insurance rates, less damage to equipment, and a year-round cash flow. These same farmers report feelings of personal satisfaction from a closer and more supportive relationship with their workers

"One farmer went so far as to offer interest free new auto loans to his workers because he was sick of seeing them pay 25 percent interest," says Johnston.

More than 90 percent of the farmers interviewed for the study regularly provide interest-free short-term loans and advances to their regular workers.

The workbook also notes the challenges for farmers who would like to move toward year-round employment. While climate and soils provide some limitations, the biggest challenges are human. One farmer noted that some workers wanted the freedom to travel to Mexico to visit family during peak season, and had to be told they could not if they wanted the job. Another noted that a closer relationship with workers meant a greater sense of responsibility toward their problems, including the difficulties of finding housing and negotiating bank loans.

Although farmers with year-round employees pay somewhat higher wages and benefits than if they were using seasonal workers hired through a farm labor contractor, they believe that their bottom-line is higher. "Profitability is the main answer farmers give to why they hire workers for extended and year-round employment," says Vaupel. Indeed, the creative strategies described in this workbook are an excellent example of how an integrated approach to farming operations can be, simultaneously, economically viable, environmentally sound, and socially responsible.

For more information, contact either Suzanne Vaupel, Vaupel Associates, 5864 13th Street, Sacramento, CA 9582Z, (916) 395-6836; or Gary Johnston, County Director, UCCE, 420 South Wilson Way, Stockton, CA 95205, (209) 468-2085. The Vaupel/Johnston project was funded for $19,795, 1991-93. It is one of ten economic and public policy grants funded by SAREP since 1991.

Winter 1994 (v6n1)

# Are Case Studies Useful?

*by Ann Drescher Mayse, SAREP*

Case studies-descriptions of real-life businesses and the challenges that they face-are often used by business schools to teach students practical, holistic problem-solving skills. The same approach may be useful in learning how to apply sustainable agriculture's environmental, economic and social principles to practical farming situations. But many of us at UC are more comfortable talking only about information that comes from experimental trials, rather than case studies and other information based on farmers' experiences.

## Recent Study

In spring of 1993, I explored the pros and cons of case studies with five farmers and four farm advisors throughout California. Eight sample case studies from a wide range of sources were shared with participants well in advance of the individual telephone interviews. The sample case studies included: 1) descriptive, magazine-style articles; 2) research case studies (including on-farm research and detailed economic analyses); and 3) decision case studies (a specific type of case study used to analyze an actual problem to be solved).

Reactions to these case studies varied widely. In general, participants agreed that farmers trust and are able to relate to other farmers, and that farm-generated information is often more relevant and "reality" based. Also, case studies can be generated more quickly than formal, replicated research. For practical, site-specific information, farmers are the best source. But for theoretical information, including explanations of why certain practices work, and how universal the information may be to other sites and circumstances, a researcher's perspective is often better. Most participants agreed that every observation, whether from farmers' experience or from research, should be evaluated on-site, and qualifying statements about where and how the information was obtained are important.

## Different Formats

The preferred format for case studies depends on the person and the application. Most participants preferred descriptions written in a personal style that includes photographs and direct quotes from farmers, as well as information about the farm family and its goals. Several participants considered the case studies written in an academic format (as opposed to

magazine-style) to be dry and sometimes boring. While these more academic case studies contain valuable information, they probably won't hold a grower's interest long enough to convey that information. The cases written in journalistic style lacked substance and credibility with some participants, although most readers found them attractive and interesting. The decision cases appealed to some for their focus on a particular problem, but appeared too academic to others.

Most participants recommended developing case studies and other educational materials in several formats and styles to be tailored to different audiences. For general audiences, short, concise, well-written articles without too much detail are recommended. These articles can address a large audience: farmers, policy-makers, community leaders, and consumers. Growers seeking alternatives are looking for more information that they find in general articles, and will be disappointed with case studies that are too short and general. They will read longer articles on subjects that interest them, but they still must be written in a friendly, concise manner. Case studies with detailed information and references are most useful to these readers. Growers and farm managers seeking specific information on a single subject may benefit more from a technical publication including theoretical knowledge and grower experiences.

## Choose Good Growers

When asked to design a case study for their own areas, most participants felt it was important to choose a grower with a good farming reputation and of a representative size for the area. They recommended including theoretical information presented in a practical manner; basic information about weather, location, soil, and farm size; broad information on farming and marketing practices; ranges of costs, cash flow, and profitability; and personal information about the family and the farmer's "vision." A narrative style, including quotes from the farmer and photographs of the farmer and family, was recommended. Case studies might be distributed within existing newsletters and magazines, or used more interactively as part of meetings and field days.

---

Winter 1994 (v6n1)

# Variables associated with corky root and Phytophthora root rot of tomatoes in organic and conventional farms.

*F. Workneh, A.H.C. van Bruggen, L.E. Drinkwater and C Shennan*

Phytopathology 83:581-589. 1993

Previous studies comparing different organic and conventional farming systems have shown that soil organic matter and polysaccharide content, microbial biomass, soil bulk density, soil erosion, and available water are higher in organic or ecologically-managed systems than in conventional farming systems (Doran et al., 1987; Lockeretz et al., 1981; Reganold et al., 1987). The purpose of this comparative study was to see if the same conclusions could be drawn for a California cropping system. Specifically, this study was conducted to determine the effects of different management practices on soil physical, chemical and biological properties and to relate these effects to disease severity in tomatoes. Agronomic differences were reported in a previous publication (Shennan et al., 1991); this paper focuses on two important tomato diseases in California. corky root and Phytophthora root rot.

## Methods Summary

Twenty sampling locations were randomly selected at each of nine farms in 1989 and 18 farms in 1990. Of the nine farms selected in 1989, two were organic, three were transitional and four were conventional. The 18 farms sampled in 1990 were evenly split, nine organic and nine conventional. Two to three days after irrigation at the green fruit stage, 810 soil cores were taken at each sampling location. These cores were used to determine ten soil variables: water-stable aggregates, percent clay, organic carbon content, nitrate and ammonium, soil pH and electrical conductivity, total nitrogen content, nitrogen mineralization potential, and fluorescein diacetate hydrolytic activity. Two to three weeks after these soil samples were collected, researchers returned to the same sampling sites to collect data on plant biomass and tissue nitrogen content, and the incidence and severity of Phytophthora root rot and corky root.

The use of simple statistical techniques such as analysis of variance would have required the selection of paired organic and conventional farms. This selection was not possible. Therefore, multivariate statistics were used to relate the different measurements to each other for each individual sample. Samples could not be combined per field, because roughly ten times as many

observations as variables are required for multivariate analyses. Three types of discriminant analyses were performed on the data: discriminant function, canonical discriminant, and stepwise discriminant analyses. These analyses are described in detail in the original paper

## Disease Incidence

The disease organism *Phytophthora parasatica* was detected by leaf bait assay in soil samples from five of the nine conventional farms; disease symptoms were observed on three of these farms. Phytophthora was not found on any of the organic farms. Corky root. on the other hand, was found on most plants in most locations, but the incidence and severity of the disease were higher on conventional farms than on organic farms (table 1).

## Influence of Soil Variables

Corky root-severity values, estimated populations of *P. parasitica*, and Phytophthora root rot-severity values were grouped into classes for use in stepwise and canonical discriminant analyses with the ten soil variables and plant tissue nitrogen. These analyses "indicated that corky root severity was positively associated with nitrogen in tomato tissue and nitrate concentrations in soil, which were higher in conventional farms than in organic farms....In addition to the positive association of corky root of tomato with inorganic nitrogen concentrations in soil and plant tissue, there was a negative association between this disease and microbial activity in soil (as expressed by FDA hydrolytic activity and nitrogen-mineralization potential)." Microbial activity (FDA hydrolytic activity and nitrogen mineralization potential) in both years was higher in the organic farms where compost and green manure had been incorporated prior to planting.

In contrast to corky root, the severity of Phytophthora root rot and the presence of *P. parasitica* in the soil were associated with variables other than nitrogen. Clay content, soil water content, organic carbon, and water-stable aggregates were the major factors that distinguished between the presence and absence of the disease organism in the soil.

In summary, corky root severity was primarily affected by biological factors and tissue nitrogen, while Phytophthora root rot was affected mainly by factors related to soil texture, structure, and chemistry. This conclusion is supported by consistent results over two years of study.

The authors caution that other factors may have affected the development of the two diseases. Preliminary results from greenhouse tests in which the corky root pathogen was added to various soils showed that corky root was suppressed in organically-managed soils. Nonetheless, lower corky root severities on organic farms may have been partially the result of lower levels of disease inoculum. In the case of Phytophthora root rot, the disease organism may not have been introduced in some of the organic fields, or different methods of irrigation on the organic farms could have controlled the disease. "Results obtained in this study cannot be considered conclusive but

have led to hypotheses about the mechanisms that suppress corky root and Phytophthora root rot in organic relative to conventional farms. Additional greenhouse experiments will be needed to test these hypotheses."

**Table l.** Incidence (percentage of plants affected) and severity (percentage of root system affected) of corky root and Phytophthora root rot of tomato in soil in organic, transitional, and conventional farms in 1989 and 1990.

| | | | Corky root[a] | | Phytophthora[a] | |
|---|---|---|---|---|---|---|
| **Year** | **Management type** | **Number of farms** | **Incidence (%)** | **Severity (%)** | **Incidence (%)** | **Severity (%)** |
| 1989 | Organic | 2 | 0.1 | 0.0(0-0.1)[b] | 0.0 | 0.0(0-0)[b] |
| | Transitional | 3 | 51.6 | 1.0(0-7) | 0.0 | 0.0(0-0) |
| | Conventional | 4 | 91.1 | 3.9(0-25) | 0.0 | 0.0(0-0) |
| 1990 | Organic | 9 | 23.3 | 0.49(0-8) | 0.0 | 0.0(0-0) |
| | Conv. (small) | 4 | 72.5 | 2.2(0-13) | 7.5 | 0.3(0-8) |
| | Conv. (large) | 5 | 88.0 | 11.0(0-40) | 17.0 | 2.1(0-32) |

[a] Incidence and severity values are means of the corresponding farms.
[b] Range

## References


Doran, J.W., D.G. Fraser, M.N. Culik and W.C. Liebhardt. 1987. Influence of alternative and conventional agricultural management on soil microbial processes and nitrogen availability. Amer. J. Altern. Agric. 2:99-106.

Lockeretz, W., G. Shearer and D.H. Kohl. 1981. Organic farming in the corn belt. Science 211:540-546.

Reganold, J.P., L.F. Elliott and Y.L. Unger. 1987. Long-term effects of organic and conventional farming on soil erosion. Nature 330:370-372.

Shennan, C., L.E. Drinkwater, A.H.C. van Bruggen, D.K. Letourneau and F. Workneh. 1991. Comparative study of organic and conventional tomato production systems: An approach to on- farm systems studies. In *Sustainable Agriculture Research and Education in the Field*. National Academy Press. Washington, DC pp. 109-132.



For more information write to: A.H.C. Van Bruggen, Department of Plant Pathology, University of California, Davis, CA 95616.


(DEC.518)

*Contributed by David* Chaney

---

Winter 1994 (v6n1)

# Cultural control of ring nematode (*Criconemella xenoplax*) with pre- and postplant groundcovers.

*A.R Nyczepir, RF. Bertrand, B.M. Cunfer, R.W. Miller and R.C. Gueldner*

6th Stone Fruit Decline Workshop, USDA-ARS, Byron, GA. (In Press)

Researchers in Georgia have tested numerous cover crops for their effect on ring nematode populations (*Criconemella xenoplax*) and a related disease of peaches known as peach tree short life (PTSL). Of the species tested, 'Stacy' wheat showed the greatest promise in suppressing the nematode. This paper summarizes results of on-going research into pre and postplant uses of this wheat variety to reduce the disease.

## Peach Tree Short Life and Bacterial Canker

In the southeastern U.S., the second largest peach producing region, PTSL is taking a huge toll on trees just coming into production. In South Carolina alone, the disease killed 1.5 million trees between 1980 and 1990, resulting in a loss of about $6.3 million per year In California, the disease is known as bacterial canker, or bacterial blast. While not as serious as in the southeast, bacterial canker does reduce production. It also affects other stone fruits, almonds, and pears.

**Symptoms**. The disease is expressed in several different ways. Darkened cankers may appear on the Internal bark, which often exude balls of amber-colored gum. In severe cases, the entire tree may collapse, during which time the bark emits a vinegarlike odor In the blast phase, buds in the lower portion of the tree may fail to grow in the spring, or young shoots or blossoms may die suddenly.

**Control.** Control of this disease has been based on choice of rootstock and fumigation. Plum on peach (especially 'Lovell') rootstock is less susceptible than on plum rootstock. Georgia researchers have developed a peach rootstock that appears to be highly resistant to PTSL. Ring nematode predisposes trees to PTSL, so orchard soil is usually fumigated before planting. However, with the impending loss of methyl bromide and the rising interest in sustainable farming practices, nonchemical means of controlling the nematodes (in this case cover crops) are being explored.

## Cover Crop Research

This paper presents preliminary results from several three-year research projects.

**Small Grain Replant Study.** In this experiment, from 19861989, plots were planted to: 1) 'Stacy' wheat (no fumigation), 2) 'Lovell' or 'Nemaguard' rootstocks (fumigated vs nonfumigated), or 3) fallow-disked (no fumigation). In 1990, all plants were removed and 'Loring'/'Nemaguard' peaches were planted to all plots. In 1991 and 1992, nematode densities and incidence of PTSL were substantially greater in nonfumigated peach plots than the other treatments (table 1). The data also showed that, while ring nematodes were found in all plots in the second year, growing 'Stacy' wheat for three years was comparable to preplant fumigation in reducing incidence of PTSL.

**Rotation Study.** The purpose of this study was to the effects of three-, two- and one-year plantings of 'Stacy' (prior to peach planting) on ring nematode densities. Treatments included: 1) Wheat+fallow, 2) a wheat+sorghum double crop (using a sorghum cultivator that is a poor host to ring nematodes), and 3) peach alone, nonfumigated. The 3-year, 2-year, and 1-year sequences were initiated in the late fall of 1990, 1991, and 1992, respectively. In order to provide a food source for nematodes before the 2- and 1-year rotations were initiated, peach seedlings were planted in the first year of the study; they were removed before initiating each of these treatments. The entire test site will be planted to peaches in the winter of 1994.

Initial results show that both two years and one year of each wheat planting greatly reduced nematode densities compared to peach alone (table 2). (*Reviewer's note: In the rotation plots, nematode densities remained at a level that could be economically damaging in a fumigated orchard. The reason is that, in fumigated soil, ring nematode densities may increase drastically with little competition or natural enemies and ample peach roots for food. The effects of these nematode densities on trees in an unfumigated, cover-cropped orchard may be less because natural enemy populations would likely be higher*.)

**Wheat Interplanting Study**. The researchers tested the ability of 'Stacy' wheat to control nematodes as a postplant management strategy. The treatments used were wheat, herbicide alone, and herbicide plus postplant nematicide (phenamiphos). The wheat was planted in five-foot strips on either side of the tree row. After two years, none of the treatments were adequately reducing nematode populations.

**Root Exudate Study.** This study evaluated attraction and/or repulsiveness of 'Stacy' wheat and 'Nemaguard' peach root extracts to ring nematodes. Root extracts were prepared, freeze-dried, and redissolved in water. The solution was poured onto a paper disc, which was placed on either end of a rectangular strip of water agar in a petri dish. Seven nematodes were then placed on a drop of water in the center of the agar strip. Nematodes were subjected to the following choices: peach vs. water, peach vs. wheat, wheat vs. water, water vs. water. Wheat extract was not repulsive to nematodes, since more nematodes migrated toward wheat when presented with wheat or water. Peach, however, was more attractive than either wheat or water.

After two years of the study, it appears that 'Stacy' wheat is demonstrating more potential as a preplant rather than a postplant management strategy for the ring nematode and PTSL.

**Table 1.** Postplant population density of ring nematodes and incidence of PTSL in small grain plots replanted entirely to peaches ('Nemaguard' rootstock).

| Previous | | | Number of nematodes per 100 cm $^3$ soil | | Incidence of PTSL(%) | |
|---|---|---|---|---|---|---|
| **plant species** | **Cultivar** | **Fumigation** | **Mar. 1991** | **April 1992** | **May 1991** | **May 1992** |
| Peach | Nemaguard | no | 134 a[1] | 310 a | 46 a[2] | 50 a |
| | | yes | 0 b | 18 b c | 8 b | 8 b |
| | Lovell | no | 108 a | 138 a | 58 a | 67 a |
| | | yes | 0 b | 4 c | 8 b | 13 b |
| Wheat | Stacy | no | 0 b | 49 b | 4 b | 13 b |
| Fallow | | no | 0 b | 39 b c | 8 b | 13 b |

[1] Mean separation by Duncan's Multiple range test ($P \leq 0.05$).
[2] Mean separation by Fisher's Exact test ($P \leq 0.01$)

**Table 2.** Results from the first two years of wheat rotations on ring nematode population density.

| Rotation sequence | | Number of nematodes | |
|---|---|---|---|
| | | per 100 cm3 soil | |
| **First two years of** | | | |
| **three-year rotation** | | | |
| W + S - W + S | | 23 | b |
| W + F - W + F | | 30 | b |
| **First year of two-year rotation** | | | |
| W + S | | 20 | b |
| W + F | | 38 | b |
| **One-year rotation** | | | |
| *no data as of publication* | | | |
| Peach (continuous) | | 399a | |

## References


Nyczepir, A.P. and P.F. Bertrand. 1990. Host suitability of selected small grains and field crops to *Criconomella xenoplax*. Plant Dis. 74:698-701.

Stanley, D. 1993. Preserving Georgia's peach pride. Agric. Research

41(5):10-15.

For more information write to: Southeastern Fruit & Tree Nut Research Laboratory, P.O. Box 87, Byron, GA 31008.

(Cl-FMCC.085)

*Contributed by Chuck Ingels*

---

[ Back | Search | Feedback ]

Winter 1994 (v6n1)

# Preventing pesticide-related illness in California agriculture.

*James C. Robinson, Rachel A. Morello-Frosch, David S. Albright,*

*Amy D. Kyle and William S. Pease*

California Policy Seminar, University of California, Berkeley, CA. 1993

This report was researched and written by the Center for Occupational and Environmental Health at the UC Berkeley School of Public Health. It is the first part of a project designed to assess the environmental health impacts associated with pesticide use in California. This report focuses on pesticide-related illnesses for agricultural workers. Future reports will focus on how pesticides affect community health and California's ecosystem. The goal of this project is to identify high-risk pesticides and pesticide use patterns. Information that ranks various pesticides on the basis of their impacts on worker health, community health and the ecosystem can then help inform policies that develop improved risk management and prevention strategies, including the development of nontoxic alternatives.

Pesticides pose significant health risks to the people who harvest our food. Although California leads the nation in its regulatory program to protect agricultural workers, effective use of these controls has been severely limited. Each year, the application of over 160 million pounds of pesticides in California has led to approximately 1,000 cases of acute occupational illnesses and contributed to chronic health concerns such as cancer, adverse reproductive outcomes, respiratory and neurological diseases. Farmworkers frequently lack the training to understand the risks they face or to act effectively in the political sphere to affect changes in the system. The farm economy perpetuates worker risks through its seasonal nature, its reliance on farm labor contractors and the fact that it is now exempt from much of the social legislation that protects worker' interests in other employment sectors.

Recognizing the ineffectiveness of the traditional regulatory approach, this report suggests that a fundamentally new strategy is needed with three basic components: **a new risk assessment** approach that will identify the most hazardous pesticides using available data on farmworker risks, community health risks and risks to the ecosystem; **a new risk management approach** that focuses attention on high priority problems and enforces controls; and most importantly, **a new risk prevention approach** that promotes the reduction of chemical use and substitutes less toxic alternatives. The report suggests that new pesticide policy must make a paradigm shift "from 'safe use' to a socially and environmentally 'sustainable' agriculture."

## Risk Assessment: Setting Health-Based Priorities

As a first step to setting priorities for intervention, the report brings together data on volume use, worker poisonings, and acute and chronic toxicity for 70 high-profile pesticides in California. For each pesticide, the report provides a ranking based on several risk attributes including: worker poisonings, acute toxicity, chronic toxicity and cancer potency. One clear result from this analysis is that, for some pesticides, the rankings are not consistent among the various categories; pesticides listed as 'high-risk under one attribute, are low on the list for another attribute. The ranking also reveals that acute toxicity, a common measure of health risk, is not always the best predictor of high human illness burdens. Finally, volume of use was not highly correlated with toxicity or illness measures.

Based on the deficiencies apparent in single attribute rankings, the report goes on to organize available illness data by principal crops and by occupational activities associated with exposures. This helps focus regulatory attention on the most important problems. For example, the report examines data on six California agricultural commodities that ranked high in reported illnesses between 1984-90: grapes, oranges, cotton, almonds, lettuce and tomatoes. Each crop had a different pattern of pesticide use and illnesses. The analyses helped point to problems in regulatory controls. The report shows that workers in *every* job category can be exposed to daily doses of pesticides that significantly exceed levels determined to be safe.

Recent legislation has generally selected only a few attributes as the priority-setting mechanisms for targeting pesticide use reduction; for example, based on percentage of pounds applied, on laboratory measures of acute toxicity, on food residue levels or on cancer risks. This report suggests that each of these approaches *alone* suffer from limitations; but together, they provide a reasonable assessment of a range of pesticide-related health problems and can be used to establish a more informed pesticide policy.

Risk Management: Reforming the Regulatory Framework

The report reviews the state and federal government's efforts to control farmworker exposure to toxic chemicals through four major strategies: pesticide use controls, safe work practices, worker education and training, and compensation. Although each offers some benefits, they also suffer from limitations. Safe work practices, for example, are "woefully under enforced"; worker education and training programs have only been modestly beneficial. The compensation system has also been difficult to implement. Farmworkers who are transient, undocumented and do not speak English, are reluctant to file for compensation. Further, their chances of overcoming a legal defense by the agricultural or insurance industries are very small. This shows up in the statistics: "In agriculture, on-the-job death benefits average $600 per worker, while accidental deaths in all other industries average over $39,000. For workers in agriculture, the average compensation for accidental injuries is less than $6, while workers in other industries receive over $230."

The report encourages several efforts to reform the regulatory system including: 1) the acceleration of the state and federal registration process to bring the most hazardous pesticides under certification and labeling requirements; 2) the wider application of reentry intervals, hazard communication and mandatory training to cover all major sources of

farmworker illnesses; and 3) targeted and strengthened enforcement of pesticide-related and other worker protections.

## Risk Prevention: Transition to a Sustainable Agriculture

According to the report, prevention of hazardous exposures by eliminating use of a toxic pesticide has never been a major goal for the regulatory system. There has been more focus on risk mitigation than on risk prevention. The traditional risk assessment and risk management system, along with farmers, are caught in the pesticide treadmill. The only solution to getting off of this treadmill is to move towards a completely new paradigm that emphasizes the reduction of pesticide use and the substitution of less toxic alternatives. For public policy makers and regulatory agencies, this requires developing broad incentives that simultaneously discourage the use of toxic pesticides and encourage the use of alternative farming practices. The report suggests that the foundation of this approach would be a steep sales tax on pesticides adjusted according to the risks posed by particular pesticides. Revenues from the proposed tax would fund a range of socially desirable activities including farmworker protections and research into nontoxic production practices. Currently, "research on the institutional and social constraints limiting the adoption and diffusion of alternative methods is particularly underfunded." Funds from a risk-based pesticide fee could not only support university based research efforts on alternative agricultural practices, but could help finance positive incentives to farmers to switch to alternative methods, i.e. provide crop insurance, develop marketing programs and facilitate the distribution of information through the Extension Service and other organizations. Finally, resources should be devoted to ensuring that occupational health and safety of agricultural workers is taken into account during the development of alternative pest control methods.

*Preventing Pesticide-Related Illness in California Agriculture* is available for $12.00 from: California Policy Seminar, 2020 Milvia Street, Suite 412, Berkeley, CA 94704. Tel. (510) 642-5514

(GWF.014)

*Contributed by Gail Feenstra*

---

Winter 1994 (v6n1)

# Soil management for sustainability.

*R. Lal and F.J. Pierce (Editors)*

Soil and Water Conservation Society, Ankeny, IA. 1991

Increasing awareness of the problems of soil and environmental degradation have made sustainable soil management an important topic of research. The rate of soil degradation is estimated at five to seven million hectares per year. This book describes soil management issues that pertain to increasing agricultural sustainability. The book is dedicated to DL William E. Larson who was a pioneer in sustainable soil management research.

The 14 papers that make up the book were presented at a workshop, "Soil Management for Sustainability" in Edmonton, Alberta, in August 1989. The workshop examined soil management from three perspectives. This review highlights a chapter from each of those perspectives. The first involves soil processes including soil structure, compaction, and erosion. The second considers management options including conservation tillage and planting systems, wastewater sludge use, farming by soil, energy efficiency and agricultural sustainability. The third perspective takes into account natural resource assessment policy and research priorities.

**Erosion Productivity Impact Prediction** (F.J. Pierce). This chapter asserts that it is presently extremely difficult to predict the effects of soil erosion and productivity. The author recommends three actions for improving the capability for making predictions. First, there needs to be standardization of measuring the effects of soil erosion on productivity and a program to measure the changes over time. Next, worldwide policies affecting natural resources need to be monitored to make certain there are incentives for adopting conservation practices. Finally, there must be efforts to restore degraded land.

**Farming by Soil** (W.E. Larson and P.C. Robert). This paper describes a method of customizing the management of different soil types in a field to best suit each type. The authors use data collected from Jackson County, Minnesota, to illustrate their point. Because all fields show field variability regarding water drainage, soil texture, organic matter content and other factors, different treatments for different "soilscape units" are often necessary. New technologies are making farming-by-soil easier. For example, computers in the cabs of spreaders can show field conditions to the farmers as they spread chemicals, enabling them to customize the treatment of fertilizers and herbicides for the different soils. Managing treatments on a soil-specific basis also can potentially reduce water and environmental contamination, and soil erosion. The author sees farming-by-soil technology as one of the greatest innovations in soil management in the last ten years.

**Sustaining the Resource Base of an Expanding World Agriculture** (B.A. Stewart, R. Lal and S.A. El-Swaify). The authors of this chapter describe how soil productivity and sustainability are affected by world agricultural practices. They make recommendations for the roles soil scientists must take for achieving more sustainability. Government policies and adoption of new production technologies need to also support sustainability in terms of land use and appropriate technology. The chapter focuses on dryland agriculture and discusses climate and soil as the factors most important in determining a sustainable system.

Other chapters include: The Vanishing Resource; Soil Structure: Processes and Management; Soil Stresses Important to Management; Soil Compaction Mechanisms and Their Control; Soil Erosion: Processes, Impacts, and Prediction; Adoption of Conservation Tillage and Associated Planting Systems; Management of Agricultural Land Receiving Wastewater Sludges; Energy Efficiency and Sustainability of Farming Systems; Natural Resources Assessment and Policy; Soil Management Research in the Search for Sustainable Agriculture; Soil Management in the 21st Century.

*Soil Management for Sustainability* is available for $15.00 from the Soil and Water Conservation Society, 7515 Northeast Ankeny Road, Ankeny, IA 50021-9764.

(RDR.001)

*Contributed by Ruth Peckham*

---

[ Back | Search | Feedback ]

# Cover crop management of polysaccharide-mediated aggregation in an orchard soil.

*Emily B. Roberson, Shlomo Sarig and Mary K. Firestone*

Soil sc. Soc. Amer. J . 55: 734- 73s . 1991

Cover cropping may affect soil structure by supporting the growth of soil microbes. Some of these microorganisms produce polysaccharides that in turn promote the formation of water-stable aggregates, particles of soil resistant to erosion by water. This phenomenon leads to improved soil structure and increased rates of water infiltration. In the present study, various understory-management regimes were applied to experimental plots in a flood-irrigated prune orchard in Gridley, Butte County, California, in order to determine various effects on the loam soil. Understory management regimes were as follows: 1) permanent cover with perennial ryegrass, *Lolium perenne*; 2) annual cover occasionally mowed, using the fall-sown cereals barley, *Hordeum vulgare*, or wheat, *Triticum aestivum*; 3) fall-sown barley or wheat killed in May using glyphosate (this substantially decreased the biomass provided by the cereals); and 4) clean-cultivation using occasional disking to break surface crusts and reduce weeds.

Soils were sampled after the treatments had been applied for two growing seasons. Soil samples were taken in the crusted layer (0-2 cm deep), and in a deeper stratum (2-10 cm deep). The following response variables were assessed in the laboratory:

1. saturated hydraulic conductivity (a measurement of water permeability);
2. mean weight diameter of soil particles (the weighted average of soil mass occurring in four size classes);
3. aggregate slaking resistance of particles ranging in diameter from 0.3-2.0 mm (this property was assessed using two methods, both of which gauge the proportion of soil remaining in a 0.3-mm sieve after water is poured over the soil);
4. organic carbon (all forms, including carbohydrates);
5. microbial biomass carbon;
6. heavy-fraction carbohydrates (which are believed to be to a large extent of microbial origin and to include a high proportion of the polysaccharides associated with aggregates);
7. light-fraction carbohydrates (removed by flotation from the heavy-fraction carbohydrate, and including most of the undecomposed plant residue).

Data were assessed using appropriate analysis of variance (ANOVA) models followed by mean separation by single degree of freedom linear contrasts. Results are summarized in table 1. Response variables are listed in column headings; treatments followed by the same letter are deemed not significantly different for the relevant response variables. Results indicated that permanent cover and mowed barley led to especially high values for saturated hydraulic conductivity, aggregate slaking resistance, and heavy-fraction carbohydrate. Correlation analysis showed that both microbial biomass carbon and heavy-fraction carbohydrates were highly correlated with aggregate slaking resistance

and saturated hydraulic conductivity. Multiple regression showed that heavy-fraction carbohydrates were a better predictor of aggregate slaking resistance and saturated hydraulic conductivity than were light-fraction carbohydrates, organic carbon, or microbial biomass carbon.

The higher amounts of carbon available to microbes in the permanent cover and mowed barley treatments appear to translate into improved soil structure. This effect was related to short-term increases in the heavy-fraction carbohydrates, but was not reflected in statistically higher concentrations of total organic carbon or microbial biomass carbon.

The loam soil in this study had low organic matter, little structure, and was very prone to crusting. Thus, it was more susceptible than some other soils to rapid improvement through additions of organic matter Also, in other soil types, clay, humified organic matter, or iron oxides may be more important in the aggregation process.

For more information write to: M. Firestone, Department of Soil Science, 108 Hilgard Hall, University of California, Berkeley, CA 94720.

**Table 1.** Effect of orchard floor management practices on soil response variables as indicated by single degree of freedom linear contrasts. Treatment effects followed by the same letter are not significantly different for the relevant response variable (a = 0.05).

| Treatment | Saturated Hydraulic Conductivity | | Mean Weight Diameter | Aggregate Slaking Resistance | | Organic Carbon | Organic Microbial Biomass | Heavy-Fraction Carbohydrates | | Light-Fraction Carbohydrates |
|---|---|---|---|---|---|---|---|---|---|---|
| Permanent Cover | a | | a | a | | a | a | a | | a |
| Mowed Barley | a | | a | a | | a | a | a | | a |
| Clean Cultivated | a | b | a | | b | a | a | | b | a |
| Herbicided Barley | | b | a | a | b | a | a | | b | a |

(DEC.51 7)

Contributed by Robert Bugg

## ***Resources***

### Sustainable Ag Movement

*FOOD FOR THE FUTURE: Conditions and Contradictions of Sustainability* (0-471-58082-1), 1993, 318 pages, John Wiley a Sons, Inc. Edited by **Patricia Allen**. Details the social, economic and political aspects of the sustainable agriculture movement. The authors examine the theoretical and practical aspects of a transformation to sustainability, issues that have been ignored by an emphasis on production-level technical solutions. To order, send $39.95 to John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158 (attn: **Barbara Timmerman**).

### Vineyard Manual

*Vine Management Practices: An Environmental Approach to Development and Maintenance,* Southern Sonoma County Resource Conservation District & USDA Soil Conservation Service. A technical manual including standards and guidelines for good vineyard development and management practices, funded by the EPA's Estuary Project. The manual was compiled in response to growers' needs for a technical reference which addressed watershed maintenance and erosion control. Available for $29.95 plus tax and shipping ($35.70 total) from Southern Sonoma Resource Conservation District office, 1301 Redwood Way, Suite 170, Petaluma, CA 94954: phone: (707) 794-1242.

### Sustainable Research

*Agricultural Research Alternatives,* 1993, 248 pages, by **William Lockeretz** and **Molly D. Anderson,** University of Nebraska Press. This book analyzes research strategies associated with sustainable and alternative agriculture, including multi- disciplinary research, ecology as a foundation for designing agricultural systems, and on-farm and participatory research. The authors propose institutional changes in departmental organization, the professional reward system, funding mechanisms, and agricultural education. Available for $30 plus $1.50 postage and handling from University of Nebraska Press, 901 North 17th St., Lincoln, NE 68588-0520; phone: (800) 755-1105

### Dairy Book

*THE DAIRY DEBATE: Consequences of Bovine Growth Hormone and Rotational Grazing Technologies,* 1993,372 pages, UC SAREP Edited and co-authored by **William C. Liebhardt**, UC SAREP director. Compares the effects of bovine growth hormone and rotational grazing on the dairy industry and society. To order, send $31.50 (includes postage, handling and applicable

taxes) to ANR Publications, University of California, 6701 San Pablo Ave., Oakland, CA 94608-1239; tel: (510) 642-2431; FAX: (510) 642-5470. Checks are payable to UC Regents; MasterCard and VISA may be used for FAX orders.

## Cover Crops Videos

*Creative Cover Cropping in Perennial Farming Systems*, 1993 (V93W) and *Creative Cover Cropping in Annual Farming Systems*, 1993 (V93-V), produced by **Robert Bugg,** UC SAREP. Cover cropping is a key tool in sustainable agriculture, and is especially useful in orchards and vineyards. The video covering perennial farming systems explains how to use cover crops to protect and improve soil fertility, enhance pest control, and provide other benefits. Cover cropping presents special challenges when used with annual row and field crops. The annual cover crop video depicts both opportunities and constraints in using cover crops with annual crops. Both videos present a wide array of plant materials and management options. The videos are $20 each (VHS format, includes postage, handling and applicable taxes). Checks should be made payable to UC Regents. Checks, VISA or MasterCard payment should be sent to UC Visual Media, University of California, Davis, CA 95616-8748; FAX: (916) 7578991. The videos maybe rented for $7 in California and $10 out of state. For other tape formats call (916) 757-8980.

## Soil Management Proceedings

Proceedings: Sustainable Soil Management Symposium, April 22, 1993. UC Davis. 90 pages Co-sponsored by UC SAREP and the UC Small Farm Program, the symposium addressed the rationale and methods for improving soil quality through periodic additions of organic matter Two research projects comparing conventional and alternative production systems were also presented. The proceedings includes articles submitted by symposium speakers as well as selected articles from peer reviewed journals. To receive a copy, send a check for S $10 to UC SAREP University of California, Davis, CA 95616. Checks are payable to UC Regents.

## Weed Video

*Cultural Weed Control in Vegetable Crops*, 1993 (V93-E), produced by **Tom Lanini**, UC Davis Botany Extension, funded by UC SAREP. The 18 minute video describing sustainable weed management is narrated by **Robert Bugg,** UC SAREP cover crops and restoration analyst. It examines California organic growers' row crops weed control practices from bed preparation prior to planting through the growing seasons. The videotape's technical narration explains why and how these practices work. Although it is aimed at growers interested in reducing herbicide use, the video is suitable for a general audience. The video includes two versions of the same information: the first is a straight-forward presentation, while the second is narrated in a light-hearted "down-home" style. The video may be ordered in VHS format for $40 (includes postage, handling and applicable taxes.) Checks should be made payable to UC Regents. Checks, VISA or MasterCard payment should be sent to UC Visual Media, University of California, Davis, CA 95616-8748; FAX: (916) 757-8991. The video may be rented for $7 in California

and $10 out of state. For other tape formats call (916) 757-8980.

## SAN Products

*Sustainable Agriculture Directory of Expertise*-1993, 300 pages. Lists hundreds of people and groups with information on building soil health, pest-control, diversifying cash flow and other topics. Produced by the Sustainable Agriculture Network (SAN), a project of USDA's Sustainable Agriculture Research and Education program, the directory's seven indexes are organized by state, person, organization, enterprise, expertise, product/ service, or management method. Contains 717 entries. $ 14.95.

*Showcase of Sustainable Agriculture Information and Educational Materials* is also available from SAN. It's a 79-page booklet with names, addresses and summaries of publications, videos and other materials from 65 universities, government, business and non-profit organizations that have displayed materials at four "share fairs" of sustainable agriculture information since 1991. $4.95.

*Managing Cover Crops Profitably,* a 124-page handbook for farmers on more than 40 legumes, grasses and legume-grass mixtures that can be used to build soil and cut chemical costs, is also available from SAN. $9.95.

For any SAN publication, send check or money order payable to Sustainable Agriculture Publications, Hills Building, Room 12, University of Vermont, Burlington, VT 05405. Prices include postage/handling. Payment must accompany order

## Organic Cost Studies

Cost-of-production studies for organic vegetables, wine grapes, almonds and rice funded in part by UC SAREP are available from UC Cooperative Extension. The most recent publication is the 100-page booklet *Production Practices and Sample Costs for a Diversified Organic Vegetable Operation in the Central Coast.* It includes an overview of production practices, cover crops, crop rotation and diversification, pest management, marketing and regulations for organic crop production, and budgets for 15 vegetable crops and two cover crops grown on the Central Coast. The studies were coordinated by researcher **Laura Tourte** and involved UC Davis Extension economist **Karen Klonsky**, SAREP annual cropping systems analyst **David Chaney** and perennial cropping systems analyst **Chuck Ingels,** agricultural economics researcher **Pete Livingston** and several UC Cooperative Extension farm advisors. Two different studies each are available for wine grapes (with a cover crop or with resident vegetation), rice (aerial seeding versus non-tillage seed drilling), and almonds (flood irrigation versus sprinkler Irrigation). The vegetable study is $4; all other studies are #1 a piece. Contact: Department of Agricultural Economics, University of California, Davis, CA 95616; (916) 752-9376. The publications are also available in selected Cooperative Extension offices.

## Citizen/Policymaker Guide to Biotech

*In Our Back Yard,* 1993, by The Biotechnology Working Group, Minnesota Food Association. This handbook for citizens and policymakers is designed to help those interested in enacting

legislation at the state or municipal level to assure the safe introduction of genetically engineered organisms into the environment. The handbook includes principles of state regulation; the pros and cons of state regulation; case studies; model state laws; and lists of individuals and organizations nationwide who can provide assistance on biotechnology issues. The cost is $5 per handbook, or $3.50 per handbook plus postage on orders of ten or more. Checks are payable to Minnesota Food Association, 2395 University Ave., Room 309, St. Paul, MN 55114; tel: (612) 644-2038.

## Environmental Comics

*Environmental Adventures*, full-color illustrated 16-page booklets targeted for 9- to 11 -year-olds, are available with corresponding Teacher's Guides that feature hands-on activities. Titles: Dracons Visit Earth: To Study Food and the Land; The Story of Land: Its Use and Misuse through the Centuries; Make Room for Monsters...and Wildlife on the Land; Plants: Improving our Environment; Water in Your Hands (English and Spanish versions); Robots of Cave Alpha: Creating a Liveable Land. Sample sets of all seven booklets plus Teacher's Guides are $5.50 prepaid. Booklets are 50 cents per single copy, or as low as 17 cents per copy with large quantity orders. To order, contact Soil and Water Conservation Society, 7515 N.W. Ankeny Rd., Ankeny, IA 50021-9764: tel: (800)-THE-SOIL.

## Sustainable Ag Video

*Sustaining America's Agriculture: High Tech and Horse Sense*, 1992, produced by USDA Soil Conservation Service and US Environmental Protection Agency in cooperation with Winrock International. The 29-minute video describes how farmers and ranchers minimize environmental impacts while maximizing production. Narrated by the late actor and farmer **Raymond Burr,** the video profiles successful farmers and ranchers including a citrus/vegetable farmer in Florida, a cattle feeder with customized farm equipment, and a farmer who uses terraces, cover crops and contour farming. To order, send $10 check or money order to NACD, PO Box 855, League City, TX 775740855; tel: (800) 825-5547. The video is also available on loan from conservation district offices, EPA regional offices and SCS state offices.

## Cut Chemicals

*What Really Happens When You Cut Chemicals*? 160 pages, softcover, Rodale Institute, 1993. Illustrated and indexed book includes information from farmers who use low-input farming practices, results of farmer surveys, breakthroughs in scientific research, 91 information contacts throughout the U.S. and Canada. To order, send check or money order for $21.95 (includes shipping and handling) payable to New Farm Library, 222 Main St., Emmaus, PA 18098. Payment must accompany order. Pennsylvania residents

add 6 percent sales tax. Discounts available on bulk orders.

## Organic Supplier Directory

*Organic Suppliers Directory: A Directory of Suppliers Serving Organic Farms, Gardens, Orchards and Homesteads*, 1993, second edition, 123 pages. Published by the Ohio Ecological Food and Farm Association (OEFFA), it includes an index of 1,000 businesses and organizations providing products and services in 56 states and provinces of the U.S. and Canada. Includes both a "geographic" and "products and services" index. To order, send check payable to OEFFA for $15 to The Organic Suppliers Directory, PO Box 02247, Columbus OH 43202.

## Audio Tapes

Audio tapes from agricultural conferences throughout the nation are now available from agAccess, a Davis-based agricultural mail-order catalog. Tapes include those from the National Farmers' Direct Marketing Conference, the Ecological Farming Conference, and the Organic Farming Symposium. Tape subjects include specialty crops, expanding the customer base, community supported agriculture, adding value, managing employees, organic fruit tree production greenhouse operation, water policy, advanced organic fertilizers, composting, and promoting products. For a complete list of tapes call or write agAccess, 603 Fourth St.. Davis. CA 95616: tel: (916) 756-7177: FAX: (916) 756-7188.

---

# Sources of Funding

## USDA Sustainable Systems Research

The USDA National Research Initiative Competitive Grants Program (NRICGP) is supporting a new competitive awards program for agricultural systems research in fiscal year 1994. It is seeking innovative systems research that integrates knowledge of individual system elements into a larger framework for use in analyzing or developing improved agricultural practices. The proposed research should fit in either of two categories: 1) identification and adoption of integrated, resource efficient, and economical agricultural systems that maintain productivity and profitability, and safeguard the environment and human health; or 2) identification of agricultural systems and policies that strengthen and revitalize rural communities and regions. To receive a copy of the 1994 Request for Proposals for the National Research Initiative call (202) 401-5022. Ask for parts 1 and 2 of the program description. The proposal deadline for ag systems grants is February 22, 1994.

## Fertilizer Research Awards

A Request for Proposal will be out January 30 from the California Department of Food and Agriculture's Fertilizer Research and Education Program. Funding will be available for projects directed toward the environmentally safe and agronomically sound use and handling of fertilizer materials. Proposals will be due April 30, 1994. For details and to be put on the proposal request mailing list, contact **Jacques Franco** or **Gwen Cristoni** at CDFA, (916) 654-0574.

## 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 and appropriate. Proposals of $3,000-$5,000 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. Proposals must be received by January 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.