Whole Farm Case Studies of Horticultural Crop Producers in the Maritime Pacific Northwest

Agricultural Experiment Station
Oregon State University
in cooperation with
Washington State University

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EXECUTIVE SUMMARY

This study applied the whole farm case study method (WFCS) to an examination of 16 north-west maritime farms in western Oregon and Washington that produced vegetables and small fruit using conventional or organic methods. The WFCS was a systematic examination over time of the biological, social, and economic factors of an entire farming system.

The study, funded by the Western Region Sustainable Agriculture Research and Education (SARE) Program, sought to improve and understand sustainable farming methods and increase the mutual exchange of scientific and applied knowledge to the benefit of both farmers and scientists.

Guided by a set of criteria, interdisciplinary teams of scientists from Oregon State University and Washington State University selected a variety of farms whose growers were willing to cooperate in the study for a period of one year. Growers were first interviewed using the sondeo appraisal survey, an informal, flexible, and mutual exchange of information, to rapidly and reliably establish a general profile of the entire farm system under study. After the initial sondeo, a minimum of three additional visits by interdisciplinary teams were made over the year to each of the 16 farms for informal interviews, structured in-depth interviews, observation, soil and plant tissue sampling, and the completion of information forms. A total of 43 people at the 16 farms were interviewed, involving one to 10 people at each farm.

The farms ranged in size from 8 to 3,000 acres, with annual gross sales of $10,000 to $4 million. Some findings of the WFCS study follow: Self-identified commitment to farming, measured on a scale of 1 to 10 (1 being low, 10 being high), averaged 8.3. Only half of the farms took annual soil samples to a laboratory; the others either never took samples or sampled infrequently. The growers sampling infrequently or not at all expressed frustration over widely varying laboratory results from the same soil. Few growers took tissue samples. Most of the growers used some type of cover crop on a limited basis; four of the growers used a non-leguminous cover crop, 10 used a mixture of leguminous and non-leguminous cover crops. Some growers seeded cover crops into their fields in ways that minimized tillage cost; one used the natural growth of annual chickweed as a cover crop. Weed control, a major problem for all farmers, was accomplished by a combination of methods: herbicide banding, mechanical and hand cultivation, and crop rotation; caneberry growers also used living mulches and mowing. Some conventional farmers, unsatisfied with pre- and post-emergence herbicides, augmented control with hand or tractor cultivation. Most farmers did not use integrated pest management methods due to a lack of time for trap monitoring and preference for the ease and dependability of insecticides. Organic growers used either organic pesticides (e.g., exclusion techniques with synthetic row covers), planting date manipulation, and selected crop mixes or varieties to avoid infestations. To control plant diseases, growers used resistant varieties, crop rotation, irrigation timing, crop residue removal, chemical controls, and crop residue removal.

Business organization of the farms included three corporations, three formal partnerships, and 10 proprietorships. None of the farmers had formal succession plans for their farms in case of retirement or death. Ten of the 16 farms used computers to manage financial or production information, however, production record-keeping needed improvement on most farms. Most farmers carried some form of business, life, and health insurance. The 16 farms used a wide variety of financing to meet operational needs.

Finding sources of information was a concern for farmers, especially organic growers who found the Extension Service to be of little help. Larger scale growers relied on consultants and field representatives for information.
growing cost, related paperwork, and scarcity of good farm labor was the foremost problem faced by all the farmers. Marketing outlets ranged from wholesalers or processors for all the farm’s produce, to a mixture of outlets, including on-farm market stands. Among the many problems reported by farmers, cost and availability of land was a growing concern, along with urban encroachment and complaints from non-farm neighbors about noise, dust, and pesticides.

A survey was conducted of the interdisciplinary team members to gather their opinions about the interdisciplinary approach. Most respondents felt it was “useful.” Several members believed the study tried to do too much and that the study required a huge time commitment.

Research and educational needs of the farmers were ascertained. Farmers needed more information in less scientific language in which the practical applications are made clear. Farmers needed more information about estate, retirement, and insurance planning. More research was needed on viable alternatives to chemical control of certain pests and other integrated pest control methods. Growers faced increasing loss of chemical control options. It was recommended that new ways to incorporate the valuable collective knowledge of farmers, extension personnel, researchers be developed and that representatives of environmental and consumer groups be included in the process.
Introduction

How can scientists and farmers incorporate their collective knowledge to make agricultural research more applicable to “real world” conditions? One approach is through the use of whole farm case studies.

A whole farm case study (WFCS) is a systematic examination over time of the biological, social, and economic factors of an entire farming system. Factors such as production practices, economic status, business management, and interpersonal relations between farmers and farm employees are examined. Because whole farm case studies are designed and conducted to understand entire systems, they are best conducted by interdisciplinary teams of farmers and scientists from a diversity of disciplines within the biological and social sciences. Whole farm analysis acknowledges the interactions between the farm and farm family in the decision-making process when determining the suitability of farming practices. Often, farming practices that appear to be profitable or advantageous on a per acre basis may prove to be less attractive from the perspective of the whole farm or family needs (Madden and Dobbs 1990). Case study research may reveal that traditional agricultural research cannot, making it an excellent complement to quantitative research and economic analysis. It may also reveal what factors farmers manage—along with productivity and economics—that contribute to their personal vision of “quality of life.”

Closely tied to a farmer’s productivity and economic decisions are issues of documented or perceived deforestation, soil erosion, increased resistance to pesticides, accumulation of chemicals in soil and water supplies, and food safety; issues that are causing a re-examination of current farming systems in the United States. A provision of the 1985 Farm Legislation instructed the United States Department of Agriculture (USDA) to pursue a program of research and educational activities in the area of low-input sustainable agriculture (LISA). Now known as the Sustainable Agriculture Research and Education (SARE) Program, SARE is designed to assist agricultural producers in the United States in providing an affordable, plentiful, and safe food supply while addressing the social, environmental, and economic concerns of producing agricultural commodities. One of the major goals of the SARE program is to examine entire farming systems, not just problem-specific components such as weed or insect management. This approach is justified by the recognition that problems do not manifest themselves in isolation, but rather in a system of complex interactions. To accomplish this goal, SARE emphasizes greater farmer participation in technology development and transfer.

Agricultural scientists recognize that farmers’ knowledge and experience can provide important contributions to the development of new agricultural technologies. However, because this knowledge and experience is difficult to quantify and evaluate, insufficient use has been made of this valuable resource. Some agricultural...
scientists argue that farmers' experiences and observations are unique to a specific site or situation and therefore do not provide quantifiable information that can be reliably useful to other farmers or researchers. Scientists prefer to rely on research-based information derived from replicated, small-scale experiments conducted on research stations. Farmers, on the other hand, often question the relevance of this research, conducted as it is, without normal farm constraints (Rzewnicki 1991; Watkins 1990; Thornley 1990).

In western Oregon and Washington, several projects were developed to provide an understanding of the complex interactions of selected farming systems. The western Oregon and Washington project included the WFCS, Farmer-Scientist Focus Sessions (Lev et al. 1993; McGrath et al. 1993), a diverse agro-environmental interest focus group (Butler et al. 1993), and complimentary on-farm and Experiment Station research. Figure 1 shows the Oregon/Washington model used to increase farmer involvement in research and educational activities. Figure 1: The western Oregon and Washington model for increasing farmer involvement in research and educational activities.

METHODOLOGY

The western Oregon/Washington study focused on 16 vegetable and small fruit farms. The farms were located between Skagit County in northwestern Washington and Lane County in west central Oregon (see map below). Eight of the participating farms were in Oregon and eight were in Washington. The overall procedures used for the WFCS are shown in Table 1. The two phases of the study were: (1) participant identification and (2) data collection and analysis.

The study did not compare farms within the study group, but rather identified different approaches to solving similar problems. The case studies also prompted discussion and development of educational methods and research in western Oregon and Washington.
Table 1. An overview of the procedures used in the western Oregon and Washington whole farm case study (WFCS)

<table>
<thead>
<tr>
<th>Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Form an interdisciplinary implementation team</td>
</tr>
<tr>
<td>2. Achieve team agreement on overall study design</td>
</tr>
<tr>
<td>3. Conduct sondeo to identify farmer participants</td>
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<tr>
<td>4. Select farms for the WFCS</td>
</tr>
<tr>
<td>5. Plan information needs and determine appropriate methods to obtain the desired information</td>
</tr>
<tr>
<td>• Production system information</td>
</tr>
<tr>
<td>• Social and economic information</td>
</tr>
<tr>
<td>• Identify areas of expertise needed to analyze information collected</td>
</tr>
<tr>
<td>6. Schedule visits to farms</td>
</tr>
<tr>
<td>7. Perform preliminary data analysis</td>
</tr>
<tr>
<td>8. Conduct farmers' forum to present preliminary findings and solicit ideas and reactions to findings</td>
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<tr>
<td>9. Prepare written report</td>
</tr>
<tr>
<td>10. Determine whether to continue farm monitoring or end project</td>
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</tbody>
</table>

Identification of Participants

Participant identification had two components:

1. formation of an interdisciplinary team of scientists—the implementation team; and
2. identification of farmer participants.

The OSU/WSU project implementation team consisted of 25 research and Extension personnel in the biological and social sciences including: agricultural economics, agronomy, anthropology, ecology, entomology, family studies, farming systems research and extension, home economics, horticulture, marketing, plant pathology, soil science, and weed science. This wide range of disciplinary expertise was sought to achieve a broad understanding of the complex interactions of diversified farming operations west of the Cascade Mountains. Because the study was conducted in two states, we formed a team in each state representing similar areas of expertise. Although a single team would have been preferable, travel time and expense ruled out this option.

A project coordinator oversaw the logistics of the study, organized meetings, arranged appointments and transportation, distributed project materials, and completed other organizational tasks. Responsibilities of team members included:

1. designing and implementing the WFCS project and procedures;
2. selecting farms for the study; and
3. identifying and coordinating data collection needs and analyses during the course of the project.

A sondeo, a type of rapid appraisal survey commonly used in Farming Systems Research and Extension (FSRE), was conducted in March and April 1989 to identify farmers willing to participate in the whole farm case study. A sondeo is often one of the first steps in the FSRE process (Chambers 1981; Hildebrand 1981; Beebe 1985). The FSRE approach was developed to improve the focus and efficiency of agricultural research and extension activities (Byerlee et al. 1982). Although first employed in developing countries, FSRE methodologies also
A sondeo is intended to provide a rapid, preliminary sketch of the farming systems under study.

have gained favor in the United States. Several of our implementation team members had previous FSRE experience.

Translated from Spanish, "sondeo" refers to the act of sounding, exploring, and fathoming. The term was first applied to FSRE work by the Guatemalan Institute of Agricultural Science and Technology (Hildebrand 1981). In a sondeo, interdisciplinary teams of social and biological scientists conduct informal, unstructured interviews with farmers. A sondeo is intended to provide a rapid, preliminary sketch of the farming systems under study, and does not seek to provide the same type of statistical data commonly reported by more conventional research methods. For instance, rather than quantifying crop growth parameters and input levels, the sondeo technique broadly categorizes strategies and responses, and classifies respondents within these categories. Researchers have reported that no major results from rigorous sondeo-type surveys have been contradicted by later, more formal follow-up surveys (Collinson 1981; Crawford and Franzel 1987).

The sondeo approach has several demonstrated advantages over more traditional survey or interview approaches.

1. It allows quick implementation and analysis.

2. It involves the farmer in a flexible interview process, permitting in-depth consideration of issues within a whole farm context.

3. It fosters interdisciplinary team interaction, thus providing the expertise to deal with the complex issues facing farmers.

4. It gives farmers an opportunity to help set research priorities, improving the responsiveness of agricultural research institutions.

5. And most importantly, it fosters opportunities for participants who share diverse perspectives to continually challenge their personal assumptions and actions (Senge 1990).

A sondeo is generally a component of broader research efforts. The western Oregon and Washington sondeo was preceded by a structured, statistically valid telephone survey quantifying specific components of the sondeo (Brophy et al. 1991). A second telephone survey of respondents was conducted one year later (Cordray et al. 1992; Cordray et al. 1993). The western Oregon/Washington sondeo was followed by more data- and time-intensive whole farm case studies, and was also part of a larger sustainable agriculture research and education program in the region (Figure 1).

The implementation team selected farmers to interview based on the following criteria:

1. the crops grown had to include caneberries (Rubus species, including raspberries and blackberries) or vegetables;

2. the grower must have been involved in production agriculture for a minimum of three years;

3. the grower appeared to be using or attempting to adopt innovative agricultural practices;

4. the grower was potentially willing to cooperate in future project activities; and,

5. the farms for the sondeo had to include a broad range of crop management and marketing strategies.
Using the criteria outlined above, county Extension agents and other agriculturalists submitted initial lists of farmers to interview. The set of farms selected was a purposeful sample, and was not intended to provide a statistically representative sample of western Oregon and Washington horticultural producers. Rather, the farmers for the sondeo were selected so the team could focus on farmer innovation.

The sondeo interview team, for most farms visited, included the local county Extension agent, a social scientist, and one or more biological scientists. Team size was kept to a minimum number to facilitate informal discussion. The team followed an outline of questions as a flexible guide to the sondeo interview process (Table 2). The flexible interview guide permitted a relaxed but focused interview, revealing details that might not have been obtained in a more structured format.

The sondeo conducted in western Oregon and Washington:

1. identified factors influencing farm management decisions among innovative farmers;
2. examined how innovative farmers with farms of different sizes and production methods responded to these factors;
3. examined the usefulness of the sondeo as a research and extension tool, and,
4. identified collaborating farmers for longer-term project participation.

Table 2. Outline of questions asked about each farm during the sondeo visits

Specific wording of questions asked during each farm visit varied, but covered the following topics:

1. What crops were grown (e.g., types and acreage)? Were there livestock or other enterprises such as processing? What was the farm's general production history, length of time in agriculture? What approach was taken to pest problems (to help determine the spectrum of production practices in use)?

2. Was farming a full-time, year-round occupation for the primary operator or other household members? (Obtain a profile of household members and their involvement in the operation and off-farm activities.) Hired labor? Seasonal labor changes? Off-farm employment?

3. Some of the following questions were used to get a sense of how the farmer was coping with change:

   Have production practices changed in the past five years? What new practices have been tried and were in continued use? What practices were tried and not found useful? (One approach to obtain the above information was to ask what major factors have affected the way the farming operation was run.)
   How have production practices changed in relation to neighbors' practices?

4. How was produce marketed (e.g., fresh market, direct, processed)?

5. Involvement in grower organizations or community activities?

6. What was the greatest problem in the operation?

7. How were records kept? Computer, hand ledger system?

8. Were they willing to participate with the OSU/WSU LISA/SARE project in a whole farm case study for approximately one year?

9. Any additional questions or comments?
farms were those with a mixture of organic and conventional production. The sondeo interviews lasted about two hours each. Farmers were asked to discuss production system problems and constraints, the role of family members in the operation, research needs and environmental issues, and changing agricultural policies and consumer preferences.

Additionally, farmers were asked if they would be willing to participate in a longer-term study of their total farming operation to help set research priorities and activities for the OSU/WSU sustainable agriculture project. Farmers were told that if they agreed to participate in the WFCS, teams of university personnel would visit the farm three to four times during the course of a year for no more than four hours per visit; and that the purpose of these visits would be to observe in greater depth different aspects of the farming operation. In return for their cooperation, farmers were promised that information collected during the course of the study would remain anonymous; that is, no direct reference would be made to them personally or to their farm without their permission. Additionally, farmers would have the opportunity to ask questions of team members with a wide range of expertise and would have the opportunity to recommend areas requiring further research.

All 25 farms in the sondeo agreed to participate in the whole farm case study project. A summary of sondeo findings is available (Brophy et al. 1991). Ultimately, the implementation team selected 16 of the 25 farms for further study.

Data Collection and Analysis

After identifying farms for the WFCS, data was collected using multiple approaches and methods. The implementation team relied on: informal interviews; in-depth structured interviews; observation; forms completed by farmers and implementation team members; soil and plant tissue testing results; photographs of production practices; and, when available, popular press articles and other written materials about the farm, farm family, or specific production practices. Field notes were the primary means of documenting interviews and observations. Use of multiple sources of information, known as triangulation of sources (Marshall and Rossman 1989; Patton 1990; Rossman and Wilson 1985;
Table 3. List of topics discussed during first two farm visits, June through September 1989, after initial sondeo visits, to 16 farms in western Oregon and Washington

<table>
<thead>
<tr>
<th>Farm and Household Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• farm size</td>
</tr>
<tr>
<td>• cropping mix and history</td>
</tr>
<tr>
<td>• soil types and topography</td>
</tr>
<tr>
<td>• marketing strategies</td>
</tr>
<tr>
<td>• family profile</td>
</tr>
<tr>
<td>• farming background</td>
</tr>
<tr>
<td>• perceived strengths and weaknesses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Production Practices Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>• cropping history and current mix</td>
</tr>
<tr>
<td>• crop rotation strategies</td>
</tr>
<tr>
<td>• livestock management</td>
</tr>
<tr>
<td>• pest control measures and prevention mechanisms</td>
</tr>
<tr>
<td>• sources of information</td>
</tr>
<tr>
<td>• perceived problems and barriers</td>
</tr>
<tr>
<td>• equipment access</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social and Economic Information Collected About Each Farming Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• roles of family members in the farming operation</td>
</tr>
<tr>
<td>• off-farm employment of family members</td>
</tr>
<tr>
<td>• changes in roles, responsibilities, and allocation</td>
</tr>
<tr>
<td>• commitment to and identification with farming as an occupation</td>
</tr>
<tr>
<td>• sources of business management information</td>
</tr>
<tr>
<td>• personal and business goals</td>
</tr>
<tr>
<td>• household management</td>
</tr>
<tr>
<td>• food procurement, utilization and consumption habits</td>
</tr>
<tr>
<td>• involvement in community and agricultural organizations</td>
</tr>
<tr>
<td>• land holdings (leased, rented, owned)</td>
</tr>
<tr>
<td>• equipment, building and land values</td>
</tr>
<tr>
<td>• capital sources</td>
</tr>
<tr>
<td>• labor</td>
</tr>
<tr>
<td>• business organization - proprietorship, incorporated, etc.</td>
</tr>
<tr>
<td>• business record-keeping system</td>
</tr>
<tr>
<td>• insurance coverage</td>
</tr>
<tr>
<td>• estate plans</td>
</tr>
</tbody>
</table>

Webb et al. 1966), contributed to the validity of the study.

At least three visits were made to each farm during the course of the study, beyond the sondeo interview. To assure continuity, the project coordinator participated in every farm visit. Three other team members visited all 16 farms at least once during the study.

The first two visits to each of the 16 farms were made by an interdisciplinary team of biological and social scientists. The first visit, between June and July 1989, focused on production practices, equipment access, decision-making strategies, and sources of information. The second visit, between August and September 1989, focused on production practices and decision-making strategies during the peak of the growing season. Marketing approaches and strategies also were discussed during the first two visits. Team members recorded data as they toured the farm with the primary operator or other member of the farm family.

Team members developed a list of topics for discussion during the first two visits (Table 3), although interviews were always flexible to allow exploration of new topics. The flexible interview process enabled team members to explore topics and ideas in depth.

The household and business management interview (visit 3) was more structured. Team members developed a questionnaire to gather specific information about household management, economic status of the farm, labor issues and management, and other business and household issues. Most of the questions were "open-ended," allowing respondents to elaborate on topics and interviewers to ask for clarification or more detail. These interviews were conducted between November 1989 and February 1990 by groups of two to three team members, including at least one biological and one social scientist. We interviewed the principal operator and, when possible, other family members involved in the farming operation.
Most of the questions were “open-ended,” allowing respondents to elaborate on topics and interviewers to ask for clarification or more detail.

The coordinator, sometimes accompanied by the local county Extension agent or another team member, made additional visits to collect soil or tissue samples and to note production practices.

Implementation team members met after each series of farm visits to discuss findings, observations and impressions, and to identify areas requiring clarification. Interview data was analyzed throughout the study period. In most cases, team members met in person, although a few meetings were conducted as telephone conferences. These debriefings were either tape-recorded and transcribed or documented with detailed notes.

In addition to the farm interviews, participating farmers provided farm labor data through monthly report forms. The questions included the number of labor hours (paid and unpaid), and electricity and fuel usage on a monthly basis. While all farmers agreed to cooperate with this part of the study, not all of them did.

A total of 43 people were interviewed, formally or informally, during the course of the study at the 16 participating farms. We spoke with 1 to 10 people at each farm.

A farmers’ forum was held mid-way through the study to bring all WFCS participants (farmers, researchers, and Extension personnel) together to:

1. Introduce all WFCS participants to each other;
2. Share production, marketing, and management ideas and experiences;
3. Obtain feedback on preliminary findings; and
4. As a group, to refine and set priorities for future research and education programs.

Growers from 13 of the 16 farms, implementation team members, and university administrators interested in the progress of the WFCS (40 people in all) attended the half-day farmers’ forum. Overall, farmers supported the research needs identified through the WFCS and proposed by implementation team members. The farmers expressed particular interest in sharing ideas with each other and in continued involvement with shaping research priorities. The preliminary data analysis provided by the implementation team at the farmers’ forum guided future research and extension activities and provided specific ideas to work on during the remainder of the WFCS.

FINDINGS

Descriptions of Farms and Farm Families

The 16 vegetable and small fruit farms in the WFCS ranged in size from 8 to 3,000 acres. The farms and farm families were representative of the diversity of Pacific Northwest maritime agriculture, producing small fruit crops (primarily caneberries and strawberries) and mixed vegetable crops. Seven were certified organic farms, eight were conventional farms, and one had both certified organic and conventional production. Gross sales ranged from $10,000 to $4 million annually. A brief profile of each farm is shown in Table 4.

Three farms were owned or managed by two generations of family members. The younger generations investigated other options before committing to the family farms. They said they felt good about their decisions and the contributions they made to the operations.

Nine farms were owned by married couples, but at three of them one spouse was not directly involved in agricultural production. In two of
Table 4. Description of farms participating in the western Oregon/Washington whole farm case study.

<table>
<thead>
<tr>
<th>Size</th>
<th>Primary Crops</th>
<th>Primary Market(s)</th>
<th>No. of Adult Family Members</th>
<th>Farming Method of Production</th>
<th>Typical Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>675 acres</td>
<td>vegetable crops</td>
<td>processing market</td>
<td>husband &amp; wife + adult son</td>
<td>conventional</td>
<td>No &quot;typical&quot; rotation. Keeps crucifers out of a field for 3-4 years.</td>
</tr>
<tr>
<td>500 acres</td>
<td>vegetable crops</td>
<td>processing market, some fresh marketing</td>
<td>husband &amp; wife</td>
<td>conventional</td>
<td>No &quot;typical&quot; rotation. Keeps crucifers out of a field for 3-4 years.</td>
</tr>
<tr>
<td>100 acres</td>
<td>small fruit production, vegetable crops</td>
<td>fresh market, some direct marketing</td>
<td>single operator, wife works off farm</td>
<td>conventional</td>
<td>4-5 years broccoli, 4 years strawberries, 8 years raspberries</td>
</tr>
<tr>
<td>500 acres</td>
<td>small fruit production</td>
<td>processing market</td>
<td>single operator, 2 adult sons</td>
<td>conventional</td>
<td>2 years cucumbers...2-3 years strawberries... 8+ years in raspberries</td>
</tr>
<tr>
<td>3,000 acres</td>
<td>vegetable crops, small fruit, livestock</td>
<td>processing market</td>
<td>2 generations of family (14 adults)</td>
<td>conventional</td>
<td>No &quot;typical&quot; rotation. Keeps crucifers out of a field for 3-4 years.</td>
</tr>
<tr>
<td>60 acres</td>
<td>vegetable crops</td>
<td>fresh market</td>
<td>single operator, wife works off farm</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation. Keeps crucifers out of a field for 3-4 years.</td>
</tr>
<tr>
<td>13 acres</td>
<td>market garden, small fruit production</td>
<td>direct marketing, processing market for berries</td>
<td>husband &amp; wife</td>
<td>conventional</td>
<td>No &quot;typical&quot; rotation.</td>
</tr>
<tr>
<td>22 acres</td>
<td>small fruit production</td>
<td>processing market</td>
<td>single operator</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation.</td>
</tr>
<tr>
<td>850 acres</td>
<td>vegetable crops</td>
<td>processing market</td>
<td>single operator, wife works off farm</td>
<td>conventional &amp; certified organic</td>
<td>No &quot;typical&quot; rotation. Keeps crucifers out of a field for 4 years.</td>
</tr>
<tr>
<td>250 acres</td>
<td>vegetable seed, small fruit production</td>
<td>seed contracts, processing market, some direct marketing</td>
<td>husband &amp; wife</td>
<td>conventional</td>
<td>5-6 year plan, depends on field and crop. No &quot;typical&quot; rotation. Keeps crucifers out of a field for 5-6 years.</td>
</tr>
<tr>
<td>250 acres</td>
<td>small fruit production, potatoes</td>
<td>processing market, some direct marketing</td>
<td>single operator</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation.</td>
</tr>
<tr>
<td>30 acres</td>
<td>vegetable crops, orchard crops</td>
<td>fresh market, some direct marketing</td>
<td>single operator</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation.</td>
</tr>
<tr>
<td>9 acres in production, plus 18 acres in woodland</td>
<td>small fruit production, sweet corn</td>
<td>direct marketing</td>
<td>husband &amp; wife, wife also works off farm</td>
<td>conventional</td>
<td>No &quot;typical&quot; rotation.</td>
</tr>
<tr>
<td>70 acres</td>
<td>vegetable crops</td>
<td>fresh market, some direct marketing</td>
<td>husband &amp; wife; unrelated partner</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation. Keeps crucifers out of a field for 4 years.</td>
</tr>
<tr>
<td>40 acres</td>
<td>vegetable crops</td>
<td>fresh market</td>
<td>single operator</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation.</td>
</tr>
<tr>
<td>20 acres</td>
<td>vegetable crops</td>
<td>fresh market, some direct marketing</td>
<td>single operator</td>
<td>certified organic</td>
<td>No &quot;typical&quot; rotation. Keeps potatoes out of a field for 4 years.</td>
</tr>
</tbody>
</table>
these three cases, the spouse provided record-keeping and bookkeeping support. Six of the farms were run by unmarried individuals. Of the 16 farms, seven individuals at six farms had gone through divorce; two of them had remarried. Five of the seven farmers whose marriages ended in divorce were certified organic growers. Individuals who had divorced attributed part of the blame for their broken marriages to the stress of farming. Two of the farmers had never married.

Nine of the farms were started by the individual or family then operating the business; six of these were owned by people with little or no farming background. One of these farmers managed farms for many years before beginning his own operation. Interestingly, only three of the nine people in this category grew up on farms. Some of the people who became farmers with no farming background described their decision to own a farm as an “accident.”

“I never made a conscious decision to become a farmer, it just sort of happened. The choices I made just sort of pulled me into farming without a lot of conscious effort.”

“I got into farming by accident. We bought the land, and I started a big garden that turned into a farm. It is important to me to be able to work independently, and farming fits the bill.”

Other growers always wanted to farm:

“I always wanted to be a farmer. I didn’t even want to graduate from high school because I couldn’t see, at that time, how it would help me to be a better farmer. However, in my family that was not an option. We all graduated from high school.”

The farmers were asked to describe their level of commitment to farming on a scale of one to 10, one being low and 10 being high. In total, 23 farmers at the 16 farms responded to the question. Answers ranged from 4 to 10. The average was 8.3. Farmers stating a commitment level of 4 to 5 had the following responses:

“I’d say it is 4. If we didn’t have children the answer would likely be higher, more like 8. We live so far out of town, as the kids get more involved in school activities I see having to spend more time getting them to sports practice and other activities.”

“My answer is 5. I don’t enjoy farming. It has ruined my life...I’ve had no personal life since 1980.”

“I say 5, primarily because I don’t know if we farming five years from now. Land tenure in my area is a huge issue. Maybe 50 years from now people will wake up and change their attitudes [about the value of farming], but not now. It’s going to kill us if we don’t somehow change.”

Farmers rating their commitment to farming as 7-8 had different answers:

“I like the flexibility associated with farming. It allows me to spend more time with my children than I could if I were employed elsewhere. And farming is fun and enjoyable, but I think I could leave it if I had to.”

“I enjoy farming, but I wish it were less complicated. The amount of paperwork and complying with regulations can be difficult and time consuming.”

“The financial security in farming is low.”
"While I like the independence, I am concerned about the lack of financial security. I would sell tomorrow if someone offered me enough money."

Ten of the 23 farmers answering this question had a "high" level of commitment to farming (9-10 on the scale). Reasons for this included:

"Self-employment is important to me. I can't imagine working for someone else."

"It [farming] is addicting."

"I like being where the kids can find us."

"I like living in the country, it is an appropriate lifestyle for me. Farming provides me with a lifestyle I don't feel guilty about. I like to work hard and I enjoy being my own boss."

Regardless of their self-identified commitment to farming, farmers in the study consistently identified three "trade-offs" associated with farming: lack of financial security, limited social opportunities, and no time off during the summer. Some of their comments on these trade-offs were:

"Farming doesn't provide financial security. We are land rich, but money poor."

"Farming is a low margin, high dollar requirement business. Farmers live poor and die rich."

"[Farming] is a shitty lifestyle. It is very stressful. We have no social life between June and November."

"There are easier ways to make money. It is a job, but one I enjoy."

"I miss summer vacations."

While several farmers said they enjoyed the independence they felt being a farmer, others disagreed:

"We don't feel independent at all. We have too many contracts [with processors] and there are too many regulations for us to really be able to do what we want. We aren't just farmers anymore, this is a business."
Soil and Soil Fertility Management

Eight farmers had soil samples analyzed yearly. Four said they took soil samples for testing “infrequently;” four said they had not had a soil test done in many years. When asked why they did not have soils analyzed more frequently, some growers expressed frustration with analysis results:

“The results from soil testing labs don’t give me very applicable information. I mostly decide fertilizer rates based on experience.”

“Last year I sent samples to two different labs and got completely different results. One lab said I was deficient in phosphorus, the other said I had an excessive amount. I ended up ignoring both reports and doing what I thought was appropriate.”

Some of the conventional farmers appeared to be over-fertilizing their crops. In some cases, these farmers depended on a consultant to make fertilizer recommendations. In general, high application rates were viewed as “insurance” to maximize yields. However, one farmer emphatically stated: “the ground is not your banker.”

Most of the growers did not take tissue samples for nutrient analysis. Recommendations were not available for many crops grown in western Oregon and Washington, particularly vegetable crops. However, good tissue analysis information was available for potatoes and caneberries, and a few of the growers regularly sent in samples for these crops.

Organic farmers depended, for the most part, on animal manures to supply nutrients to their crops. Three growers primarily used composted dairy manure, while three others primarily used composted chicken manure. All growers using manure purchased it from local sources, although one grower had a few head of livestock to provide some of the manure required for field fertilization. With the exception of one grower who stored composted manure on a cement pad, all had the manure delivered and spread directly on the fields and then incorporated it themselves. All of these growers noted that prices for manure were increasing. One organic grower used fish bones from a nearby fish processing plant to fertilize raspberries. Another organic grower relied exclusively on commercially available organic sources of nutrients such as Chilean nitrate because of their ease of application and more consistent, known nutrient content. The conventional farmers primarily used commercially available, synthetic sources of nutrients. One conventional grower experimented with composted grass straw on some fields but abandoned it because of the expense.

None of the farmers were using annual legume winter cover crops on extensive acreage, although several growers expressed an interest in doing so:

“I would like to be able to supply nearly all of my nutrients through cover crops, but I don’t have enough information. I find it frustrating [the lack of information about legume cover crops].”

“If I could figure out how to control the slugs, I would use clovers and other legumes more extensively.”

“We’d consider using leguminous cover crops if we didn’t also grow peas, but we can’t because of the potential for disease carry-over [from cover crop to peas].”

Four of the farms used some type of non-leguminous cereal cover crop extensively, while 10 used non-leguminous and leguminous cover crops on a limited number of acres. Two growers never planted cover crops.

Of the four growers using cereal cover crops extensively, one had used wheat as a primary cover crop for several years. The growers using wheat cover crops acknowledged that wheat did not provide an extensive root system (compared
with other cover crops such as cereal rye), but they liked the flexibility it gave them. For example, at one farm the main crop was vegetable seed, and the growers were never sure how many acres they would have in seed contracts from year-to-year. Wheat provided them with two options: they could kill and incorporate it and plant a seed crop, or let it mature and harvest the grain. Wheat also had several weed control options, a critical concern in growing quality seed crops. Over the past few years, these growers noted many more farmers in their area were beginning to plant cover crops.

Another grower had developed a system to overseed cereal rye at the rate of 65-70 lb/ac in broccoli fields just prior to the last harvest. Rather than incorporating the broccoli crop after harvest and preparing the land for planting the cereal rye, the grower saved money and fuel, and got an early start on establishment of his cover crop.

Although crop rotation plans could have improved soil fertility, the smaller farms found it difficult to put in a cover crop that did not provide a quick cash return. Several farmers reported difficulty acquiring enough land to accommodate rotation plans:

"Ground is harder to come by than it used to be. There is lots of competition for less and less farmland. It is also more expensive than it used to be."

"There are less resources and more people using them than there used to be. There are a lot of nurseries going in near here. I am concerned about this because it permanently takes the land out of farming because they haul out the top soil and put gravel down. I am concerned also about some of the adverse environmental aspects of nursery stock. For instance, chemicals in run-off water."

**Plant Protection**

**Vegetation Management** Weeds were clearly one of the major problems all the farmers faced. Conventional farmers were able to control weeds with some degree of success, but the loss of registration for some key herbicides, for example, dinitro (dinoseb), had caused major problems. Some farmers expressed dissatisfaction with herbicide results. For example, broccoli growers commonly used the pre-plant incorporated herbicide, trifluralin (Treflan), to help control weeds. But they frequently ended up doing some hand-hoeing or cultivation to control weeds not killed by the herbicide. In some cases, Treflan was known to adversely...
All the growers used a combination of measures to control weeds.

Weeds affect crop growth and yield. To overcome this, one conventional grower eliminated all herbicides in his broccoli crop and substituted a combination of cultivation, hand weeding, and winter cover crops. The grower soon noticed a shift in weed species. Chickweed, *Stellaria media*, a winter annual normally suppressed by Treflan, began to appear at about the time of harvest. The grower sought information about chickweed and determined that it would not interfere with crop growth or harvest. It also had potential as a “free” winter annual cover crop. The grower encouraged chickweed to grow by timing the final cultivation to not interfere with its establishment. After the last crop harvest, the broccoli plants were mowed off just above the height of the chickweed. This allowed it to become the dominant field species over winter. The chickweed died off as warmer spring weather arrived and was easily disked into the soil during seedbed preparation. Because of involvement in the WFCS, the grower and university scientists were discussing and examining possible positive and negative interactions between chickweed, plant disease, crop growth, and management.

Two broccoli growers grazed sheep in the field after the last harvest. The sheep were fed and the stalks did not have to be mown or incorporated.

All the growers used a combination of measures to control weeds. Most conventional growers applied pre- and post-emergence herbicides on the majority of their crops, depending on the crop and weeds present. Several growers banded herbicides where possible to reduce the quantity of herbicide they applied per acre. “Banding herbicide over the crop row enables us to use one-third the amount of herbicide we use when we broadcast [herbicide in a field],” said growers at one of the farms. Both conventional and organic growers also relied on crop rotation, cultivation, and hand-hoeing. Because most farmers used mechanical cultivation in most fields, crop row spacing options were dependent upon available equipment.
Most of the organic farmers achieved good control of weeds by mechanical and hand weeding. Two growers used weeder geese. A few growers used flame weeders, and two other farms also were considering them. Some of the conventional and organic farms were learning to become more weed tolerant. However, growers that managed u-pick operations or farm stands were very concerned about the appearance, as well as the productivity, of their fields.

“We have been using a straw mulch in our strawberry beds and living mulches in our blueberries. We think these make the farm look good, more appealing to customers. The straw mulch is a lot of work though, and we may try another strategy there, but we will stick with the living mulch. I just wish it didn’t need to be mowed so often [5-7 times per growing season].”

“A weedy field doesn’t look very appealing to customers. Who wants to fight weeds to pick strawberries? I try and keep my u-pick fields as weed-free as possible.”

Caneberry growers reported great diversity in vegetation management practices between berry rows, including cultivation with a rototiller or disk, or no-till, which minimized sucker development. Growers’ individual systems included mowing indigenous vegetation, managing a hard fescue (Festuca longiglume 'Aurora,' or perennial rye grass (Lolium perenne, cv. Manhattan II) living mulch, applying herbicides, or mulching with black plastic. One grower was experimenting with planting an annual barley living mulch that could be cut and blown into the plant rows. It was hoped that the cut barley mulch would provide weed control in the plant rows, increase organic matter, and encourage earthworm activity.

Conventional caneberry growers suppressed primocanes primarily through the use of chemicals. Some growers reduced the amount of herbicide applied by spraying only one side of the row, rather than both sides. Growers using this technique noted it missed 10-20 percent of the primocanes, but overall, they were pleased with the results. Conventional growers, who previously used dinitro (dinoseb) to control primocanes and weeds, expressed concern that slugs could become a problem, since the herbicide also killed this pest. One organic grower used weeder geese to control primocanes in raspberries. The geese were kept in a given area of the field by placement of the watering trough. The grower said the geese were effective in controlling primocanes up to 3 to 4 inches tall, but taller primocanes had to be removed by hand.

**Insect Management** Most farmers were not fully utilizing an integrated pest management (IPM) approach because of the time required to monitor pests and the ease and dependability of regular applications of insecticides. A few farmers, however, reported using pheromone traps and field sweeping to monitor insects. Conventional farmers in the study tended toward a prophylactic approach to insect control, spraying some specific pesticides on a calendar basis. Preventative spraying was more likely to be done by those growing for the processing market. Conventional growers decided to use synthetic pesticides either on their own, or with the help of a field representative, or by hiring a private consultant.

Organic farmers used organically certified pesticides (e.g. pyrellin, rotenone, soaps, etc.), exclusion techniques (e.g. floating row covers), planting date manipulation, and selected crop mixes or varieties to avoid insect infestations. Organic pesticides were limited in number and effectiveness and were often very expensive. Continued use of these organic pesticides, like conventional pesticides, could also lead to pest resistance. At least one caterpillar pest had developed resistance to *Bacillus thuringiensis* (Bt), the only organic option for lepidopteran pest control. For aphid control, organic growers...
Predator insects raised for release

generally used soap sprays. With cabbage crops, they selected varieties with growth habits that tended to choke out aphid populations.

Organic control options for cabbage maggot were limited to floating row covers (spun-bond polyethylene nets), planting date manipulations, and growing crops other than brassicas. The cost of material and labor to place and remove the row covers was a deterrent to its widespread use. Growers noted they could re-use the floating row covers for two to three years if they were handled carefully. On a commercial scale, row covers were a relatively new practice. The row covers might have created micro-habitat changes that encouraged some plant diseases, but little was known at the time about these potential adverse effects.

One grower experienced severe weed problems with floating row covers after rains prevented crews from getting into the fields to remove the row covers soon enough. One potato grower used floating row covers to increase the soil’s heat units immediately after planting tubers. Growers noted row covers were difficult to use in areas subjected to high winds.

Several growers, primarily fresh market (not just organic), used planting dates to minimize some insect pest problems. For example, cabbage maggot control was unnecessary for farmers who planted cole crops after May 15. Although this was an effective method, farmers producing for an earlier market or meeting processor schedules needed to use other control measures. Organic and conventional fresh market farmers often planted pest resistant varieties, while farmers producing for the processing market had little or no choice regarding varieties.

Growers using synthetic pesticides reported very good control of all pests. Organic growers were happy with planting date manipulation as a way to avoid cabbage maggot, and said that the growth habit of cabbage plants did indeed generally reduce aphid problems. If we judge the effectiveness of insect control practices by grower satisfaction, then the practices employed by all groups of farmers were effective.

**Plant Disease Management** Although many growers stated weeds were their number one problem, most of the growers focused their attention on elaborate measures to control plant diseases. Growers’ approaches to disease control included: resistant varieties, crop rotation, irrigation timing, plant spacing, planting date manipulation, adjusting soil pH, chemical controls, and crop residue removal.

Crucifer crop growers had to contend with club root (*Plasmodiophora brassicae*), a widely distributed, persistent soil-borne disease associated with the mustard family. In the normal course of the disease, affected plants show almost normal vigor at first, then gradually become stunted. Young plants may be killed within a short time after infection, while older plants sometimes survive but fail to produce marketable heads (Agrios 1978). Club root caused serious damage and crop loss when susceptible varieties were grown in infested fields. Crop rotation and
As an alternative to regular crop rotation, one grower used a combination of soil liming and modified irrigation to control the club root organism.

soil liming to raise pH were the primary means of controlling the disease. Nearly all the growers used a crop rotation of 3-4 years as the number one means of control. A few growers used a longer crop rotation of 5-6 years between crucifer crop plantings.

One broccoli and perennial berry grower had limited crop rotation options because perennial berries would be in a given field for many years; four years for strawberries, 20 years or more for raspberries. The grower had developed a strong market for these crops and was not interested in growing another crop mix.

As an alternative to regular crop rotation, the grower used a combination of soil liming and modified irrigation to limit problems with club root. Knowing that the club root organism tends not to be a major problem in fields with a pH of 6.8 or above (it is not found at all above pH 8, Agrios 1978), the grower applied 2 tons of lime per acre per year. For the lime to have time to affect the pH, it had to be incorporated at least six weeks prior to planting. Some growers, however, reported little success in altering pH with standard incorporation techniques.

Since saturated soil is required for the club root organism to germinate, the grower modified irrigation timing and quantity. The fields were irrigated only when the soil was dry and at intervals of 1/2 hour on, 1/2 hour off until enough water was applied. The timed irrigations limited standing water in the field, and subsequently the opportunity for the flagellated club root organism to infect plants. The grower had used this liming and irrigation system for five to six years and had experienced no major losses to his broccoli crop, even after growing it for five years in the same field. After four years in strawberries, the grower then planted broccoli.

A complex of soilborne organisms that causes damping-off disease, characterized by seed rot and seedling collapse, was responsible for poor and uneven stands. Historically, fungicides had been used by both conventional and organic growers to protect seed and seedlings from this problem. However, as of 1990, organic growers were no longer allowed to use fungicides in certified organic seedling production. Unless alternative control measures are found, early planted crops (which generally bring higher prices) may suffer significant losses. Methods to speed the warming of pre-germinated seed or transplants, and biological protectants need to be evaluated to possible solutions to this problem.

Root rots (Phytophthora species) of raspberry and strawberry concerned both conventional and organic growers. Limiting planting to only well-drained soils was essential. Crop rotation and use of less susceptible varieties in marginal soils were also helpful. One grower had to remove red raspberries from his u-pick operation because poor soil and a high water table were causing severe root rot problems. Most of the growers used only certified planting stock to help limit root rots. Conventional growers in the study reported using the fungicide metalaxyl (Ridomil) to control Phytophthora root rot of raspberries.

Botrytis gray mold was seen on strawberry, caneberry, and snap bean crops. The severity of the disease on strawberries greatly limited the potential of this crop for the organic growers. For the conventional growers, fungicide applications offered some, but not 100 percent relief. Proper use and timing of fertilizer applications, row spacing, and picking frequency helped
reduce disease pressure.

Downy mildew (*Peronospora parasitica*) disease was observed on several crops, including lettuce and broccoli. Significant losses on lettuce crops were reported, particularly among the organic growers, who had few effective organically certified alternatives and had to use resistant or tolerant varieties to minimize the problem. Conventional growers used fungicide applications to keep losses to a minimum. In broccoli crops, the greatest economic damage from downy mildew occurred when broccoli heads became infested. Use of resistant or tolerant varieties was the primary control measure used.

Evaluation of additional resistant varieties needs to be made in western Oregon and Washington.

*Rhizoctonia scurf*, a fungus disease, caused potato crop losses for both conventional and organic growers by reducing the grade and marketability of the tubers. Black resting structures, called sclerotia, contaminate the potato surface and cannot be removed by washing. Although *Rhizoctonia*’s wide range of hosts made crop rotation an ineffective control measure, some control with fungicide has been possible. Pulling vines prior to harvest, as opposed to burning with either flame or chemicals, has been suggested as a control, although the feasibility and effectiveness of this measure has yet to be proven in this area. One grower, however, had imported equipment to perform this operation.

Virus diseases also threatened various vegetable and berry crops. The strawberry virus complex was common and was responsible for significant losses. Use of certified planting stock and aphid control were essential to prolonging the life of growers’ strawberry plantings. One celery grower rogued virus-infected celery plants in an attempt to contain a virus problem. Virus-resistant pea varieties were used by most pea growers in the study because the pea virus complex could totally eliminate a susceptible variety. Conventional growers also used insecticide sprays to keep pea aphid populations down in an attempt to limit the spread of the virus complex. However, if pea aphid sprays become inefficient or ineffective, growers may experience a higher incidence of viruses, increasing the need for additional resistant varieties.

**Business Management**

**Family Participation** Farms where multiple family members participated in the day-to-day farm operation had a variety of ways of approaching the management of the family business. While personal and business roles were merged in several of the operations, other families preferred to keep those roles separate. For example, one of the sons of a two-generation farming operation referred to his father by first name when conducting business but called him “Dad” when discussing family and personal matters. He said it relayed professionalism to clients and kept some of the personal and business issues between father and son to a minimum in the office or field. Several farmers said that although they tried to keep personal and business roles separate, they did not always succeed. Some farmers kept a physical distance between home and work by having an office separate from their residence. Other farmers had an office in their home.

In farms owned by married couples, work tended to be divided along field and office responsibilities. Women tended to be responsible for managing the books, payroll, paperwork, and general organizational responsibilities, while the men were generally responsible for production management. However, these were not strict divisions of responsibilities. Major decisions regarding the overall business tended to be made jointly. All farmers, regardless of gender or marital status, reported that as time went by they spent less time in the field, and more time on managerial matters.

Divorce in any of the family businesses was a complex matter. As a team, we discovered it was inappropriate to make assumptions about what would happen to a business after a divorce. Ex-
spouses, in some instances, continued to be involved in farm operations because of their investment in the farm.

Three farm families organized their business as a corporation, 10 were proprietorships and three farms were formal partnerships among family members. One of these farms had a set of rules regarding who, how, and when someone could become a partner in the farm. None of the farmers had formal succession plans for their farms in case of retirement or death. However, one of the partnership agreements included details about what would happen to the shares when a partner died.

Sources of Farming Information Finding accurate, easily accessible and useful information was a major concern for the farmers. All but two growers in the study stated that "other growers" were a major source of information regarding farming practices and farm business management. Talking with and observing other farmers' practices provided ideas, but nearly all farmers noted that there were not many ideas or practices they could implement on their own farms without modification. The two individuals who did not rely on other growers for information tended to rely on written materials and consultants.

Nearly all of the organic growers said they found their university Extension Service to be of limited help. One grower was initially reluctant to ever be a part of the WFCS because of past lack of assistance from the university: "Philosophically, though, I agree with the goals of the project [sustainable agriculture and increasing farmer input in research and extension activities]." The primary complaint made by organic growers regarding the Extension Service was the lack of information applicable to the standards set by the organic industry. Both conventional and organic growers who used Extension's resources said they did so when they had specific, production-oriented questions.

The large-scale processing market growers relied on consultants and field representatives for information. The growers who used consultants also depended on their own experience to guide them in making pest management and fertilizer decisions. These same growers tended to cooperate with university and private company field representatives conducting trials at their farms. These field trials primarily involved the farmers providing land or other physical resources to the researchers.

Only two growers consistently relied on crop production records as a source of information to plan and guide current field operations. Said one grower, "Records on each crop are critical to our operation. We use them for planning rotations, cultural practices, and to monitor pest problems."

Several growers said they always intended to keep better records, but other things on the farm usually took precedence: "Every year I vow to keep better crop records, but when I'm in the middle of the growing season I just don't have the time."

Most WFCS participants attended some type of agricultural meeting each year. However, only four growers considered this as a primary source of information. Commodity commission meetings were attended by many of the conventional growers but not many of the organic growers. Several organic growers were members of wholesale cooperatives and relied on meetings with cooperative members for information. Regardless of the type of meeting, most growers said that if they got just one piece of information they could use they considered the time well spent.
Several WFCS participants had attended courses at community colleges or universities to learn computer and record-keeping skills. Five growers had completed university degrees in agriculture; several others had university degrees in non-agricultural fields.

Newsletters, newspapers, books, and journals were a primary source of information for the majority of growers. Several growers said they read “everything I can get my hands on,” although one grower noted that scientifically-presented information was difficult to understand and was of limited value.

**Labor** Farm labor was a major issue for farmers in the study. Their concerns included: availability of skilled workers, wages and associated costs of hiring workers, complying with state and federal regulations, and managing crops to provide steady employment for hired laborers.

Farmers were asked to describe their labor needs in terms of changes over the previous five years. Four farmers said their need for labor had slightly decreased because of fewer acres under production or a change in crop mix. One farmer said the number of laborers he needed each year had decreased because he now hired professional farm laborers. Only one farmer’s labor needs had remained the same. The other farmers had increased their need for farm laborers because they changed crop mixes, increased the number of acres they farmed, or expanded their operation to include packing lines or other forms of vertical integration. Universally, the farmers agreed that labor was more costly. Hourly and piece rates had increased, but more importantly to growers, the time required to confirm and document that they were hiring legal workers had become excessive and expensive.
Only one large-scale farm used a labor contractor to hire skilled workers. At the time of the study, the grower had been working with a labor contractor for three growing seasons, but was considering going back to doing it himself. The labor contractor cut down on time spent hiring and paying laborers, but the grower expressed concerns about the contractor’s integrity: “I am not certain he handles the paperwork properly. He may not be complying with all of the regulations and associated paperwork. I am also not certain he pays them a decent wage, he doesn’t tell me what the workers are paid.”

All other farmers hired workers directly. Approaches to assure the availability and quality of laborers differed depending on the scale of the operation. When necessary, growers learned another language or hired someone bilingual to work with non-English speaking labor crews. If there were problems getting paychecks out quickly, farmers looked for alternatives. For example, at one farm, the laborers’ piece work tallies were directly entered into hand-held field computers. This lensoned the time laborers waited to weigh and tally produce and sped the payroll process. Several farmers provided laborers with food produced on the farm; some provided housing or assisted farm workers in finding housing. One is described as “personal support,” that is, helping workers get information to distant relatives, helping family members of workers find non-farm employment, providing pay advances or loans, or helping workers with Immigration and Naturalization Service questions. One farmer provided a car and insurance, so workers would have transportation to and from work.

Several farmers also tried to provide a “fun” work atmosphere. Several growers bought pizza and soft drinks, or took crews out to dinner occasionally. One grower occasionally held impromptu contests, for example, having the crew guess how many boxes of produce would be harvested off the field. He usually provided a small cash prize to the winner.

The farmers also had major concerns about labor availability and management, particularly worker documentation requirements; how to best incorporate computers into their management system; development of value-added opportunities at the farm level; and the increased level of public interest in policies affecting food and agriculture.

Marketing: Aptitude, scale, and location appeared to be the driving factors in determining the selection of marketing strategies. Several farmers were most knowledgeable about production and chose to concentrate primarily on yield and quality. These production-oriented growers limited their attention to finding a niche for the good quality crops they produced. When asked why they marketed the way they did, they replied:

“This is easy to market through a cooperative.”

“It’s the most profitable.”

“I like to market through the cooperative because I can do a larger volume without the hassle of having to market it myself.”

“We want to be producers, not marketers. Our plan is to diversify horizontally, not vertically.”

In contrast, market-oriented growers sometimes neglected production aspects because of the emphasis and time spent on marketing. One grower chose to devote a tremendous amount of time and energy to marketing his crops through local grocery stores, farm stands, and the u-pick operation on the farm, even though proper fertility management, pruning and training would have phenomenally increased the yield and quality of his raspberries and strawberries. However, this was still a successful strategy for this grower.

The market-oriented producers found marketing enjoyable:
"I enjoy marketing. I like the direct involvement, the contacts, and it is challenging."

"I am very people-oriented. Marketing is enjoyable."

"We market some of our produce through the farm stand so we can showcase our operation to the public."

"Marketing is our strong suit. It is what we do best."

Only two growers used a single market outlet. Both were fresh-market growers. One was a small-scale grower (eight acres) who marketed solely as a u-pick operation. The other sold to a single fresh market organic produce cooperative. Both growers explained that they marketed this way because it was easy.

All but one of the 16 farms grew some fresh market produce. Eight of the 15 grew primarily for the fresh market, while seven grew primarily for the processing market. The eight fresh-market production farms ranged in size from 8 to 85 acres. Five of these eight were certified organic farms. The scale of operation also determined where and how farmers marketed their produce. The larger-scale farms in the study (100+ acres) tended to grow for the processing market. For example, one berry grower's operation was too large for the local strawberry market, but too small to compete with California strawberry growers in the national fresh market. As a result, nearly all of the strawberries this farm produced were destined for the processing market. The seven farms that grew primarily for the processing market ranged in size from 22 to 3,000 acres; the 22-acre farm sold strictly to an organic processing firm. The
Growers used commercially-available agricultural software programs or had developed programs of their own.

11 farms in the study producing some or most of their crops for the processing market ranged in size from 12 acres to 3,000 acres. Five of these 11 farms sold 75 percent or more of their production to processors.

Crop acreage decisions and subsequent marketing selections were based on a number of factors. Many farmers grew crops that were only marginally profitable in order to extend employment for laborers throughout the growing season. One farm continuously planted strawberries on a field near their farm market stand, which was adjacent to a major road. The growers recognized the importance of crop rotation but the field was such a boon to marketing their strawberries that they had not yet rotated the fields to another crop. Another grower was planning to add nursery stock to the operation in order to keep the “best workers” employed throughout the year.

Record-keeping Systems Methods for keeping records of farm finances and production practices ranged from computers and fax machines, to hand-written notes, to “in head” systems. Ten of the 16 farms used computers in some manner to manage financial or production information. Some growers used commercially-available agricultural software programs or had developed programs of their own.

Very few growers kept detailed production records, although several had intended to for some time. The primary reason for not documenting field by field or commodity inputs and yields was the time it took. One farmer only kept track of how much it cost to harvest each crop to help calculate cost and returns: “This system probably doesn’t make sense [to anyone else], but it helps me to get a handle on what goes on at my farm.” Growers who were members of cooperatives said they received yield information from processors or distributors.

The hand-held computer used on one farm to record picker tallies also tracked yield and labor needs by crop and by field.

Insurance Coverage Most married farmers in the study had life insurance, most unmarried farmers did not. Business property and business liability insurance were common, although often not well understood. Only five growers had disability insurance; three of these had coverage through their spouse’s employment. When asked if he had disability insurance, one farmer replied, “That would be a luxury.” A few farmers had accidental insurance, with the remaining farmers stating they would rely on workman’s compensation to cover expenses for work-related accidents. All but three farmers had health insurance. One farmer who had no insurance of any kind, said, “I don’t believe in it.” None of the farmers had federal crop insurance.

Land, Capital, and Equipment Of the 16 farms, 14 leased or rented some land. The two operations that farmed exclusively on their own property were small, 8 and 22 acres. Three growers farmed only leased or rented land, while another farm had over 95 percent of its production on leased land; all four were certified organic farms. One of these growers expressed concern about the lack of “loyalty” to agriculture in the area, saying the land market near the farm was highly volatile with a “highest bidder mentality.” This grower wanted to buy some farmland, but could not afford it until recently. If one of the neighbors decided to sell land, the grower intended to purchase it.
There were advantages to renting or leasing land; it freed up operating capital and provided some flexibility. But there were also some risks; especially in areas where farmland was being sold and converted to non-agricultural uses.

Six of the farms borrowed capital from friends or family members; all six of these were less than 65 acres. Three of the six did not borrow money from financial institutions, while the other three used a combination of bank loans and loans from friends or relatives. Two of the larger farms used no operational credit, relying on previous year’s sales to support the current operations. The remaining farms, ranging in size from 8 to 3,000 acres, relied on financial institutions for loans.

At six of the farms, off-farm employment contributed to the viability of the farm either by direct financial support or by providing benefits such as health insurance.

Access to and availability of equipment among the farms varied tremendously. Investment in equipment ranged from $10,000 to $600,000. With the exception of certain specialized equipment, growers preferred purchasing equipment over leasing or shared ownership. The decision to purchase new or used equipment varied. Some growers preferred to buy new tractors and used implements, while others preferred the opposite. Decisions were based on finances, mechanical repair skills, personal philosophy, and whether or not the choice of buying new or used was even an option. All the growers reported modifying pieces of equipment to meet particular needs on their farms. All the small-scale growers wanted to see equipment manufacturers produce equipment better adapted to small-scale operations.

Since the end of the data collection phase of this study, two of the participating farms have

Flame weeder

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Regardless of size of operation or type of production system, growers stated hired labor problems concerned them most.

gone out of business. One described the farm as over-extended in terms of financing. “We made some mistakes and the market was not very forgiving. We were paying way too much interest [12-14 percent] to be able to stay in business.” The other farmer could not be contacted after going out of business. During the course of the study, this farmer said cash flow was the most significant problem, along with low prices and high costs of operation. “I anticipate this to continue for the next five years. Farmers can’t control the situation.”

Problems and Challenges

The farmers were asked to identify what they believed to be the most significant farm business management, production, or marketing problems of the previous three to five years. Nearly all growers, regardless of size of operation or type of production system, stated hired labor problems concerned them most. Issues cited included: a lack of skilled laborers; expenses associated with hiring laborers such as wages, FICA, workman’s compensation expenses, and keeping track of piece work to ensure that laborers received at least minimum wage; the number of regulations associated with hiring laborers; the amount of paperwork associated with rules, regulations, and taxes (e.g., tax statements, Immigration and Naturalization Service paperwork, FICA, workman’s compensation forms); labor crew management, and worker productivity. A few growers feared labor issues would continue to worsen along with increasing competition for fewer and fewer professional farm workers.

Other problem areas cited were: the loss of registration for minor crop pesticides; production costs per acre increasing while farmgate prices stagnated; finances and credit, including high interest rates, cash flow, and low prices; and, having enough land to farm to accommodate crop rotation plans.

Not surprisingly, farmers were concerned about the weather. Excessively cold, hot, wet, or dry weather caused problems farmers could not anticipate. “I am not as concerned about things I can control,” said one farmer, “but I worry most about the weather.”

Farmers in the study also were asked to identify the problem or problems they thought were least likely to be resolved. Several farmers were concerned about land availability. “There appears to be no commitment to keeping agricultural land for farming, and there is not a critical mass of farmers in the area.” Other farmers expressed concern over urban sprawl. As the farming areas became increasingly urban and suburban, especially around the Portland, Seattle, and Olympia areas, farmers worried about neighbors complaining about agricultural noise, dust, and pesticides. Farmers producing for the organic market also were concerned about pesticide drift from conventional farms. Pesticides drifting onto their crops could potentially cost them not only that year’s crop, but their organic certification status, as well.

Other growers were concerned about specific pest management problems:

“We’ll never get the weed problems under control.”

“There will always be disease problems.”

However, farmers with more years of experience tended to be less concerned about production problems than those relatively new to farming.
SUMMARY

Implementation Team Interaction

Team members were surveyed about their impressions of the advantages and disadvantages of the interdisciplinary team approach, the usefulness of the process to the growers involved in the study, and if they would consider using the case study approach in future work.

The sondeo provided the team with an initial opportunity to work together and develop a common understanding of research and education priorities. In general terms, the sondeo required the social scientists to focus on the complex production issues that confront producers, and required the biological scientists to consider the equally complex social and economic issues. Subsequent farm visits and debriefing sessions provided additional opportunities for interaction among team members.

Team members responded to several questions on a brief written survey sent to all university participants near the end of the WFCS data collection phase. In response to the question about the usefulness of interdisciplinary team input during farm visits, team members rated it on average as “very useful.” Of the 17 surveys returned, on a scale of 1 to 5 (1 being non-productive, 5 being very useful), the average was 4.1; the range of responses was 3 to 5. When asked about the advantages of the interdisciplinary team approach, broadening disciplinary perspectives was the most common response.

Members of different disciplines think of questions to ask growers that others probably wouldn’t think of. Also, each team member has special expertise that she or he can share with growers. The learning was two-way. It gives team members a hands-on opportunity to see farming close up—maybe one of the only opportunities for some.”

“Forces one to broaden your outlook and learn about other disciplines. Have to relate your expertise to other disciplines and how your expertise fits within the overall system. Also, forces one to re-evaluate, or at times, explain your understanding of your discipline—this happens as a result of someone who knows nothing about your discipline asking a question.”

“Some of the biological scientists state they were not previously very aware of the implications of one discipline’s (e.g., weed science) practices on another discipline’s problems (e.g., pathology or entomology); therefore these visits created some new perspectives in their minds re: problem solving.”

“Helpful to have a number of people both observing and interviewing at the same time. Including a number of disciplines increases the likelihood that a holistic perspective (different interpretations of the same answer) will emerge from the data. It is also a richer learning experience for both researchers and growers.”

While the majority of university-based study participants stated that time was the biggest constraint, some commented about the lack of direction of the project, and expressed frustration with participating in a study for which few institutional rewards were granted.

“With this particular project, objectives were not clear nor was it clear how through participation, a researcher could get credit. I believe the project failed to take on the philosophical issues of sustainability, and from my perception, tended to do what was politically correct. By being politically correct, I mean the project at times tended to look like an advertisement for land grant institutions, to
It was important to understand farmers' motivations and circumstances before evaluating whether or not their actions "made sense." Not everyone perceived problems or motivation for actions in the same light.

inform the public on how 'aware and sensitive' big institutions are. This is probably important, but I am not sure where leadership on the issues of sustainability was to evolve from what has taken place."

We were not successful in getting participation from the range of faculty we believe could have provided useful contributions to the project. In general, researchers were more resistant to becoming involved than were Extension faculty. Some researchers viewed this project as being redundant with what Extension agents were expected to do (i.e., find out what farmers need and relay this information to researchers). In some cases, there was a clear philosophical reason for not participating in a sustainable agriculture project. Several researchers who were invited to participate in the study declined. Some researchers were not impressed by the inductive methodology: "I know what the problems are so why should I waste time on the farmers' fields?"

For some, the project's methodology essentially advocated an approach perceived as novel compared to the traditional training of some scientists.

Other faculty did not participate because they could not foresee adequate rewards (e.g., tenure and promotion criteria did not coincide with the project outputs). They perceived no administrative support and saw the study as an additional project for which they had no time. There was also no money for station or lab research at the beginning of the case study process. Some faculty did not participate because the project did not focus on their area of specialization. Comments related to these concerns included:

"If the project focuses on [the individual's area of specialization], I might consider involvement when funding [for research] becomes available." 

"I don't have time to participate. I am doing up for tenure in two years, and I need to get refereed publications in my field."

Several team members felt we tried to do too much, this having been the first time we attempted such a study. Although the team selected the 16 farms because they represented a broad spectrum of production practices, scale, marketing approaches, family involvement, opinions, and attitudes, the time needed to visit them all became the major disadvantage cited by nearly all team members. The number of farms and team members, and the distance between them all resulted in a lack of uniformity on visits to each farm and subsequently in the information collected at each farm. Team members indicated that uniformity of data collection across farms would have been increased if fewer team members and farmers had participated in the WFCS. Fewer participants would have enabled team members to better understand the farm systems under study. Still, the vast majority of team members stated they would consider using the case study approach for future research projects if the situation were appropriate. Reasons for this included:

"This is the first time in my career that I have been in a farmer's field along side of so many different disciplines."
"There are only two or three times in a person's career when you experience a high level of group excitement and creativity. This is one of them."

It was important to understand farmers' motivations and circumstances before evaluating whether or not their actions "made sense." For example, we visited a three-generation mixed vegetable and small fruit operation three times before learning that the operation also included 700 head of sheep. The family continued to raise sheep in spite of incompatible weather, inadequate pasture, lack of adequate fencing, and serious predator problems. To add to these problems, not everyone on the farm even liked sheep. According to one partner, "It is the oldest debate on the farm [whether to keep the sheep or get rid of them] but it gives us something to do in the winter." The family later built an expensive lambing barn, making it appear the sheep would remain part of the operation. Another farm family began growing broccoli several years ago to provide employment for teenagers in their rural area. They usually employed about 30 local high school kids to harvest broccoli from early July to the beginning of school. These examples emphasized the importance of talking with as many family members and other key people as was possible at each farm. Not everyone perceived problems or motivation for actions in the same light.

In terms of interdisciplinary work, team members had positive and negative experiences that would shape their future work. During the grant writing process, sondeo study, and WFCS there was a level of interaction among disciplines that was unusual among the various biological and social science fields represented in this project. Implementation team participants broadened their view of other disciplines, and gained valuable insights into the ways one discipline could complement another. For example, some team members had been working in their area of expertise for 10 to 20 years, and yet, through the WFCS, they were exposed to many new ideas, methods, and components of farming or marketing systems. The previous lack of direct exposure and involvement in interdisciplinary work could partially be attributed to the fact that when university personnel visited farms, it was usually to solve a specific production problem or to disseminate information. Some faculty might never visit a farm if their discipline was not perceived to be related to agricultural production. Home economists, for example, working in commercial or home food processing would rarely visit farms. With an interdisciplinary approach, however, the objective was to understand the system—not just solve a particular problem—through group interaction.

For those primarily involved in laboratory research, the case study provided a valuable opportunity to see the complexity of whole farm systems and the difficulty of applying research results directly to a real situation. For example, to learn that some farmers with less than 50 acres of taxable land might have 100 or more plantings per season was a revelation to many team members.

Although team members experienced significant benefits from being involved in an interdisciplinary, interstate project, there were many logistical problems. Team members rarely had enough time to devote to the project because they were not freed from other work responsibilities. The methodology was time consuming and required a lot of personal commitment. To be successful, the project required team members to meet to discuss plans, implementation procedures, analyze data, and synthesize information. Given the fact that this was a two-state project, the team approach made it difficult to schedule meeting times to enable all participants to attend. Travel time and costs were expensive. Maintaining team communications demanded considerable time and dedication. As a result, the team gradually learned to do more of the group work by conference call. Initially, conference calls were difficult to conduct, but became more productive as the group became better acquainted.
Farmers need information in commonly used, less scientific language where the practical uses of the information are clearly presented. There also is a need to provide farmers with information about estate, retirement, and insurance planning.

In later phases of the project, interdisciplinary research techniques were promoted through conferences and in-service workshops. Team members relayed their experiences in conducting the WFCS to other university personnel and encouraged them to use this approach to better understand problems and constraints at farms, and to better understand why and how to involve clientele in programs. A manual was developed to assist others interested in conducting a WFCS (Murray et al. 1993).

Research and Educational Needs

As a team, we learned much about educational needs and specific components of agricultural systems that lack a solid research base.

Universities are ill-prepared to answer many production and marketing questions posed by organic growers. This is partly because of a lack of scientifically-based information, but also because university researchers and Extension personnel lack exposure to organic farming and more innovative methods of learning from farmers. The 1990 Farm Legislation outlined a process to provide money for training Extension agents on sustainable agriculture topics, including organic farming. The money for this program is yet to be allocated, but if it becomes available, the Land Grant Universities should encourage and assist Extension agents to attend the training programs. Active involvement of farmers in the planning and implementation of the training programs will help insure that training is relevant to farms and farming communities.

Getting existing research-based information to farmers continues to be an important effort. Several researchers note that if farmers better understand specific biological interactions, they can better deal with the problems they face. Farmers need information in commonly used, less scientific language where the practical uses of the information are clearly presented. Educational program planning needs to address the needs of both experienced and less-experienced farmers.

There is a need to provide farmers with information about estate, retirement, and insurance planning. Extension personnel coordinate workshops on these topics, but generally only for owners of ranches and livestock operations, rather than for vegetable and small fruit growers. The target audience of existing programs should be broadened. Because farming is hazardous work and serious accidents may jeopardize the entire operation, farmers need to assess their need for disability and liability insurance.

Many farmers might benefit from enhanced production and financial record-keeping systems. There are courses at community colleges, through computer software companies, local consultants, and Extension workshops where growers may learn different methods of recording information. Informing farmers of these various options may encourage them to take steps to improve their record-keeping systems.

Another concern expressed by several farmers is a lack of familiarity with computers, along with the start-up costs to purchase the computer and software. Each farmer will need to determine the value of computerized record-keeping to their operation. Computers with modems can improve access to information and can foster increased learning among farmers, and between farmers and scientists.
Farmers have a strong interest in learning from other farmers. Researchers and Extension personnel can facilitate information exchange among farmers through programs such as focus sessions, conferences, farm tours, and electronic mail systems.

Farmers in western Oregon and Washington continue to express an interest in conducting on-farm research. A 1992 “Farming for Profit and Stewardship” workshop addressed on-farm research techniques, but written materials specifically for western Oregon and Washington’s diverse cropping systems are still needed. Developing a guide specifically for vegetable and small fruit producers to document the fundamentals of experimental design, analysis, and record-keeping should assist both farmers and Extension agents.

Farmers have a strong interest in learning from other farmers. Conventional farmers are interested in learning how organic growers manage specific pest problems. Researchers and Extension personnel can facilitate information exchange among farmers through programs such as focus sessions, conferences, farm tours, and electronic mail systems.

Farmers are greatly concerned about labor availability, paperwork associated with hiring laborers, and complying with complex Immigration and Naturalization Service requirements. Farmers need information and services that will enable them to spend less time on the paperwork and still be certain they are meeting the requirements of the law.

University scientists need to understand why farmers do not fully utilize diagnostic techniques such as insect population monitoring used in integrated pest management (IPM), soil testing, and plant tissue analysis. Data from these analyses may enable farmers to make better assessments of fertilizer and pesticide needs. Conventional farmers note that chemicals provide a level of security that reduces risk and, perhaps, management levels. In order to adopt alternative practices, these farmers tell us they need to be certain these techniques work and will not increase their risk.

Farmers and researchers are interested in learning more about cover crops. Research is needed on specific growth characteristics of species that are appropriate for the soil and climate conditions of western Oregon and Washington. For both winter and summer cover crops, information is needed on biomass accumulation, soil fertility interactions; abilities of different cover crops to capture residual soil nitrogen, nitrogen fixation rates of leguminous cover crops; planting techniques and seeding rates; interactions among insect pests and beneficial insects; effects of cover crops on weed populations; and the economic effects of cover crops on farm income and environmental quality. Cover crops using fall-planted combinations of spring grain with clovers or vetches also deserve further evaluation.

There is considerable scientific literature on the use of beneficial insects to control certain insect pests. However, farmers need information on practical cost-effective means of augmenting beneficial insect populations on farms. During the WFCS, entomologists noted significantly higher numbers of some beneficial predator insects in organic fields than were commonly found in conventional fields. Farmers in the WFCS expressed interest in developing on-farm management systems to encourage or augment native beneficial insects through use of in-field insectaries in vegetable cropping systems. In selected cover crops, insect dynamics and interactions among predators and insect pests should be investigated to determine whether cover crops can decrease pest incidence in vegetable cropping systems.

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systems. Studies of host plants grown adjacent to vegetable crops as habitat for insect predators also will be useful.

Currently there are few viable alternatives to chemical control of certain pests. Some organic farming operations experience significant decreases in yield or crop quality when chemical controls are not used. Many organic growers do not grow strawberries because they cannot control fungi problems in their fields. Biological control offers potential solutions to these problems, but there is still much to be learned. For example, research is needed on using entomogenous nematodes for maggot control; using new strains of Bt for cucumber beetle control and possibly for maggot control; controlling Rhizoctonia scurf in potatoes; development and evaluation of varieties resistant to specific diseases; protection of seedlings from fungal diseases; and coming up with pest-free planting dates for control of cabbage maggot and other pests.

Conventional growers face an increasing loss of chemical control options. Many agricultural chemicals have been removed from the market by regulatory and economic forces and this trend is expected to continue. This is of particular concern for the many specialty and minor crop growers in western Oregon and Washington. In light of this situation, heavy reliance on pesticides is risky. To minimize this risk, growers need production options that use integrated pest control measures. These options need to be evaluated for their effects on profit, the environment, and on social factors such as safety. While a practice may be sustainable from an environmental and resource management perspective, it might not be sustainable from an economic perspective. In the words of the growers, “it’s not a question of feasibility, it’s a question of cost” that dictates which practices will be implemented.

One lesson learned during the course of the WFCS is the importance of understanding what is important to clientele. For example, because labor crews are hard to attract and retain in some areas, many growers plant crops that provide a marginal economic return in order to offer steady employment for workers throughout the growing season. Several growers said that if they did not offer steady employment they would not be able to find skilled workers during the peak harvest periods.

Team members discovered it is often inappropriate to classify farmers by a single characteristic, such as organic or conventional farming techniques. In our experience, the production practices a farmer selects probably reflect a combination of philosophical preferences, marketing avenues, and economics. We also learned there is no “typical” farmer; each farmer and farm operation is unique.
components of systems. Otherwise, the final product may simply become a summary of many disciplinary projects.

Sustainable agriculture offers no magic formula for overcoming problems associated with farming. But it does point to known technologies that can be used by skilled management and labor to partially substitute for fertilizer and pesticide inputs; such technologies include crop rotations, cultural controls, and other integrated management practices.

Public concern over the effects of agriculture on the environment and the community, as well as concern about the long-term viability of our soil and cropping systems, is causing private and public institutions to re-evaluate the present agricultural system. The dominant political forces in our society are located in the urban areas. This often leads to a lack of understanding about where and how food is produced. Can farmers become more efficient? Of course they can. Efficiency is one of the highlights of American agriculture. It is why so few farmers are feeding so many non-farmers. Farmers have a tradition of modifying agricultural techniques and adopting new systems of production and marketing. By joining forces, farmers, researchers, and other affected interests can work together to address the issues of agricultural sustainability.

Implications and Conclusion

One of the continuing objectives of this whole farm case study project is to increase farmer involvement in research and education programs. The process of conducting a WFCS strengthens ties between university personnel and farmers. While our team has not been able to address all of the research and education ideas generated from the WFCS project at both Oregon and Washington State Universities, implementation team members continue to work with farmers and other agricultural interest groups on jointly identified applied research questions. For example, several on-farm and research station experiments are now examining cover cropping systems.

Farmer participation is a key element of these research projects. Farmers and researchers jointly identify projects, plan work, collect, and analyze information. Field tours and workshops are being coordinated as part of the on-going “Farming for Profit and Stewardship” conference series to share information among interested people. In both western Oregon and Washington, SARE projects are being augmented by private and other government funding, greatly increasing the scope and amount of work being conducted.

The project also verified the need for greater institutional encouragement for both research and Extension personnel to take a broader, more systems-oriented approach to agricultural and rural problem solving. Mechanisms are needed to foster interdisciplinary teamwork and train academic personnel to learn from farmers and others in the farming system.

We need to continue to look for new ways to incorporate the valuable collective knowledge of farmers, Extension personnel, and researchers. We also need to learn to include representatives of environmental and consumer groups in the process. New strategies to involve diverse clientele in programs will be needed to accomplish this goal. Agricultural-urban conflicts are likely to continue and become more heated and controversial. Understanding farming systems from diverse viewpoints helps all people involved identify ways to address some of these issues. The whole farm case study process provides a valuable tool for understanding the complex interactions within farming systems.
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