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Russell S. Karow

Calls for increased farmer involvement in research and extension programs have been numerous and well supported. One approach to integrate the collective knowledge and experience of agricultural scientists and farmers is through whole farm case studies (WFCS). An interdisciplinary team of 34 research and extension personnel at Oregon and Washington State Universities conducted WFCS of 16 vegetable and small fruit farms beginning in April 1989.

The objectives of the Oregon/Washington case study project were to: (1) increase farmer involvement in research and education programs; (2) develop an interdisciplinary team to address issues of agricultural sustainability in western Oregon and Washington; (3) examine the use of the case study approach in agricultural situations; (4) prepare a guide to assist other persons interested in conducting WFCS; (5) develop a better understanding of vegetable and small fruit farming systems in the region; and, (6) identify sustainable agriculture research and education needs in western Oregon and Washington.

The WFCS process proved useful in developing an interdisciplinary team, and the vast majority of team members participating in the study stated they would consider using the WFCS approach again in their work. However, the primary constraint cited by all team members was the amount of time required to conduct the study.

The process of conducting WFCS in western Oregon and Washington improved communication among a wide group of people. Team members gained a better understanding of the complexity of farms and identified several areas requiring further research. Farmers stated they enjoyed participating in the case study project and discovered new information that will assist them in managing their farming systems. Farmer-developed innovations were identified that are useful to other farmers and to the research process.

Included in this thesis are: (1) a guide for conducting whole farm case studies; (2) a summary of data collected from 16 farms in western Oregon and Washington participating in the WFCS, including a summary of interaction among interdisciplinary team members; and, (3) a profile of one of the farms participating in the WFCS.

WHOLE FARM CASE STUDIES:

An Interdisciplinary Approach to Systems Research

by

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PREFACE

Faculty from Oregon State University (OSU), Washington State University (WSU), and The Evergreen State College (TESC) have contributed field notes, ideas, and insights for the chapter summarizing the whole farm case study project. The interdisciplinary team members were:

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The chapter on how-to conduct whole farm case studies (Chapter 3) was jointly written by Helene Murray, Larry Lev, Daniel McGrath, and Alice Mills Morrow.

WHOLE FARM CASE STUDIES:
AN INTERDISCIPLINARY APPROACH TO SYSTEMS RESEARCH

Chapter 1

INTRODUCTION

Agricultural scientists recognize farmer knowledge and experience can provide important contributions to the development of new agricultural technologies. Because farmer knowledge and experience are difficult to quantify and evaluate, scientists often argue that farmers' experiences and observations are unique to a site or situation, and therefore the information is not necessarily transferable. Farmers, on the other hand, often question the relevance of small, controlled and replicated plot research conducted on research stations rather than on farms under normal farm constraints. How can farmers and scientists work together to incorporate their collective knowledge to make agricultural research and education programs more applicable to "real world" conditions? One approach is through whole farm case studies (WFCS).

A whole farm case study is a systematic examination over time of the biological, social and economic factors of an entire farming system. The process is an examination of interactions among production practices, economic status, business management, and inter-relations of farmers and employees. Because WFCS are designed and conducted to understand entire systems, they are best conducted by interdisciplinary teams representing farmers and a diversity of fields within the biological and social sciences[1]. Whole farm case studies can be used as a complement to, not a replacement for, other methods of research. WFCS contribute most when they are part of a larger research and education program. In Oregon and Washington, WFCS of 16 farms were conducted as part of an extensive research and education program that included conferences, workshops, publication of written educational materials, farmer-scientist focus sessions, surveys, and on-farm and experiment station research.

The work in this thesis describes using whole farm case studies as a means of incorporating farmer knowledge into sustainable agriculture research and education projects using an interdisciplinary team approach. The author of this thesis was the project coordinator for a WFCS project of 16 farms in western Oregon and Washington. Included in this thesis are:

(1) a guide for conducting whole farm case studies;

(2) a summary of data collected from the 16 farms in western Oregon and Washington participating in the WFCS;

(3) a profile of one of the farms participating in the WFCS; and

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[1] Ideally, reports generated from WFCS are written by the interdisciplinary team responsible for conducting the study. Results and findings are discussed and debated until consensus is reached or the team agrees to report conflicting information. The Graduate School of Oregon State University requires doctoral candidates to conduct independent research. Consequently, the work reported in this dissertation relies on team-collected data as a secondary source of information, with primary data collection and interpretation done by the author.

(4) a summary of interaction among interdisciplinary team members and of the overall findings of the study.

The objectives of the work described here were to:

(1) increase farmer involvement in research and education programs;

(2) develop an interdisciplinary team to address issues of agricultural sustainability in western Oregon and Washington;

(3) examine the use of the case study approach in agricultural situations;

(4) prepare a guide to assist other persons interested in conducting WFCS;

(5) develop a better understanding of a variety of vegetable and small fruit farming systems in western Oregon and Washington;

(6) document the process of conducting WFCS; and,

(7) identify sustainable agriculture research and education needs for vegetable and small fruit growers in western Oregon and Washington.

Chapter 2

REVIEW OF THE LITERATURE

In general, agricultural research at land grant universities has not been organized to involve farmers in the development and implementation of research programs and protocol (Gardner, 1990). Rather, research programs at land grant universities are designed to transfer information generated by researchers to extension agents, who in turn relay the information to farmers. The process utilizes extension agents and specialists as the middle link, providing information to farmers and back to researchers. While not all farmers, extension agents and researchers stay within the confines of this linear model, it does provide the overall structure for information exchange within the land grant university system (Dlott and Masumoto, 1992); however, work by Busch and Lacey (1983) shows that in reality extension feedback rarely enters in United States research decisions. Busch (1984) notes that researchers have a tendency to assume the farmers and agribusiness representatives they have regular contact with are typical of the larger population including consumers and farm laborers; however, he notes that because these farmers and agribusiness representatives have regular association with researchers they are, in fact, atypical compared to the larger population. He further notes that disciplinary and institutional goals, not input from farmers or extension agents, often dictate to scientists which problems are important, and by definition, which problems are not.

In the past several years, numerous calls for partnerships among farmers and researchers have been made by farmers, land grant university scientists, representatives of private non-profit groups and government officials to address systems research and issues of agricultural sustainability (Busch and Lacey, 1993; Francis, et al., 1990; Rzewnicki, 1991; Schaller, 1990; Thornley, 1990; Watkins, 1990). The majority of these calls have advocated an interdisciplinary and participatory approach to address: relationships among practices within farming systems; the affects of policies and management decisions on resource conservation; environmental stability; farm worker and consumer health issues; and economic sustainability. Rossini et al. (1979) note the strength of true interdisciplinary research lies in its ability to discover causal links that are impossible to detect through disciplinary work.

Several models of interdisciplinary and participatory research and education for agriculture exist including: Farming Systems Research and Extension (Byerlee et al., 1982; Hildebrand 1981); participatory research and extension (Francis, et al., 1990; Whyte, 1991); farmer first (Chambers, Pacey, and Thrupp, 1989); the Practical Farmers of Iowa on-farm research program (Thompson and Thompson, 1990); and the farmer-back-to-farmer model (Rhodes and Booth, 1983). These approaches rely on various combinations of quantitative and qualitative research approaches, and varying levels of participation by both farmers and scientists.

Qualitative research seeks to describe and understand a set of circumstances through observations, conversations, audio or video tapes, interviews, and other techniques in an attempt to put a given situation into context. Use of multiple sources of information, known as triangulation of sources, contributes to the validity of a study (Marshall and Rossman, 1989; Patton, 1990; Rossman and Wilson, 1985). Several authors have outlined the pros and cons of qualitative research approaches (Borman, LeCompte and Goetz, 1986; Bryman, 1984; Crawford and Franzel, 1987; Datta, 1982; Marshall and Rossman, 1989; Patton, 1990; Rossman and Wilson, 1985; Schwartz and Jacobs, 1979; Taylor and Bogdan, 1984; Yin, 1984). Qualitative research methods have been used primarily in the social sciences and until recently, were not commonly used in agricultural situations. The complexity of agricultural problems today suggests that adding qualitative methods to the "research tool box" will enable us to better address system-wide issues and problems.

Qualitative research can help to provide insights into how things work in "real life" settings. Case studies and rapid appraisals, two examples of qualitative research approaches, offer systematic means of compiling information in complicated areas of human endeavor, providing useful observations that go beyond the range of controlled experiments (National Research Council, 1989).

Among rapid appraisal methods, the sondeo process is particularly effective at forging effective working relations across the diverse disciplinary backgrounds of team members (Hildebrand, 1981). A sondeo is often one of the first steps in the Farming Systems Research and Extension (FSRE) process (Beebe, 1985; Chambers, 1981; Hildebrand, 1981). The FSRE approach was developed to improve the focus and efficiency of agricultural research and extension activities (Byerlee, Harrington and Winkelmann, 1982). Although first employed in developing countries, FSRE methods have also gained favor in the United States. 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 from more conventional research methods (Brophy et al., 1991). For instance, rather than quantifying crop growth parameters and input use levels, the sondeo technique is used to identify broad categories of strategies and responses, and to classify respondents within these categories. Researchers have reported that no major results from rigorous sondeo-type surveys were contradicted by later, follow-up formal surveys (Collinson, 1981; Crawford and Franzel, 1987).

In a 1987 Alternative Energy Resources Organization (AERO) study, farmers in arid regions of the northwest identified their preferred sources of information about alternative farming practices; they ranked other farmers as their first preference, and farm tours second (Matheson, 1989). Work by

Dillman, et al. (1989) and Risenberg and Gor (1989) support the AERO study findings. AERO describes case study reports as "arm chair farm tours" which provide farmers and researchers with examples of specific production practices and farming systems.

Several case study research projects in agricultural situations have focused on examining specific practices, problems, or situations. Examples of this type of case study research include decision case research (Stanford, et al., 1992), soil quality and financial performance examinations (Reganold, et al., 1993), and examination of integrated pest management strategies (Dlott and Masumoto, 1992; Miller, 1983). Other case studies describe specific farming systems and approaches designed to highlight issues of agricultural sustainability at individual farms (Matheson, et al., 1991; National Research Council, 1990). In California, a comparative on-farm case study of conventional and organic tomato production systems is underway that uses a combination of biological measurements and economic analysis (Shennan, et al., 1991). With few exceptions, these studies do not examine the inter-relations of the farm family and social interactions within the farming systems under study. However, separate studies examining issues of stress in farm families (Hedlund and Berkowitz, 1979; Hutson, 1987; Van Hook, 1987) and ownership transfer and succession issues (Heberer, 1990; Russell, et al. 1985) have been conducted.

Chapter 3

WHOLE FARM CASE STUDIES: A HOW-TO GUIDE

INTRODUCTION

Agricultural scientists recognize farmer knowledge and experience can provide important contributions to the development of new agricultural technologies. However, insufficient use has been made of this valuable resource because farmer knowledge and experience are difficult to collect, quantify, and evaluate. Some agricultural scientists argue that farmers' experiences and observations are unique to a specific site or situation and information learned is not be transferable to others. Scientists rely on research-based information derived from replicated experiments that are, for the most part, reductive in nature. Farmers, on the other hand, often question the relevance of small, controlled and replicated plot research conducted on research stations rather than farms under normal farm constraints (Rzewnicki, 1991; Watkins, 1990). The question about the relevance of scientific agricultural research and farmer knowledge quickly becomes complex.

How can scientists and farmers work together to incorporate their collective knowledge to make agricultural research more efficient and effective? One approach an interdisciplinary team of university personnel and farmers have investigated is using whole farm case studies (WFCS). Case studies offer a systematic means of compiling information in complicated areas of human endeavor, providing useful observations that go beyond the range of controlled experiments (National Resource Council, 1989). Whole farm case studies can be used as a complement to, not a replacement for, other methods of research. Whole farm case studies contribute the most when they are part of a larger research and education program.

Figure 3.1 (page 22) shows where WFCS fit within a program in western Oregon and Washington designed to increase farmer participation in research and education activities. This paper provides suggestions for design and management of whole farm case studies, using examples from a two-year study conducted in western Oregon and Washington.

WHAT ARE WHOLE FARM CASE STUDIES?

A whole farm case study is a systematic examination over time of the biological, social and economic factors of an entire farming system. The process is an examination of interactions among production practices, economic status, business management, and inter-relations of farmers and employees. Because WFCS are designed and conducted to understand entire systems, they are best conducted by interdisciplinary teams representing farmers and a diversity of fields within the biological and social sciences.

Whole farm case studies rely primarily, although not exclusively, on qualitative information not likely to be derived from controlled experiments. Case study research may reveal what traditional agricultural research cannot, and therefore is an excellent complement to quantitative research and economic analysis.

The case study approach has been used extensively in business, economics, and medicine (Stanford, et al., 1992). In agricultural situations, case studies can be conducted to develop a better understanding of a variety of production systems and human interactions within these systems. Whole farm case studies offer a means of understanding farming systems and their strengths and problems, and identifying research and education needs. The process can also serve as an important early step in forging new working relations among farmers, researchers, and extension personnel.

In April 1989 a case study of sixteen farms in western Oregon and Washington was initiated. The goal of the study was to develop a better understanding of farming systems, and to set directions for future research and educational activities in the region. The goal was not to compare farms within the study group. Instead, the team focused on different approaches to solving similar problems and farmer innovation. Small fruit and vegetable farms in western Oregon and Washington were selected for the study, and a variety of scientists representing a diversity of agricultural and social sciences to participate were invited to participate.

CONDUCTING THE STUDY

An advantage of the framework is the great flexibility within the process to address specific needs, interests and goals of the participants.

The overall framework includes the following steps:

1. develop an interdisciplinary team
2. design the study
3. collect and analyze the data
4. report results

DEVELOPING AN INTERDISCIPLINARY TEAM

Participation of biological and social scientists in the development and implementation of WFCS is critical to the success of a study. The interdisciplinary nature of the project requires a major time commitment by the individuals involved. The time commitment can be a serious limitation in recruiting individuals to participate. However, team members participating in the Oregon/Washington WFCS project stated, in spite of the time commitment, the interaction with other team members provided them with new perspectives and enabled them to better see how their disciplinary expertise fits within farming systems.

Forming a Core Group

It is difficult for a large group of people to make complex decisions about the directions and course of action for a whole farm case study. Instead, a smaller core group can establish the basic design and overall objectives of the study. The core group should be composed of biological and social scientists to frame the study and outline areas of expertise necessary to conduct the study. In the early stages of development, it is also appropriate to invite farmers to meetings to discuss goals, expected outcomes, and to provide direction for the study. Inviting farmers to participate during the early stages helps provide an integrated, farm-level perspective. The core group can then present a proposed outline for the study to the larger team for comments, suggestions, and refinement.

Areas of Expertise

The WFCS Team should include a wide range of disciplinary expertise to develop an understanding of the complex interactions of the farms in the study. The objectives and purpose of the study will determine the appropriate areas of expertise to include.

Because of the study goals, the Oregon and Washington WFCS team included individuals with expertise in agricultural economics, agronomy, anthropology, ecology, entomology, family studies, farming systems research & extension, home economics, horticulture, marketing, plant pathology, soil science, and weed science.

Coordination

Because of the complexity of the effort, the designation of a project coordinator is essential. If a single individual cannot be designated to fill this role, organizational tasks must be divided among team members. In the Oregon and Washington study one person, the author of this thesis, was designated to oversee the logistics of the study. The project coordinator was responsible for organizing meetings, making appointments, distributing project materials, arranging transportation, and carrying out other organizational tasks. The project coordinator for the Oregon/Washington committed approximately fifty percent of her time to the project for two years. It was a big time commitment, but the team felt a study of the size and duration described here would be difficult to conduct without this level of commitment.

Team Size

The size of the study team is an important decision. Too few people limits the available expertise, while too large a team may prove to be inefficient, frustrating for team members and farmers, and result in a lack of commitment to the project. In the Oregon/Washington study about 10 people worked on the WFCS in each state. Because the study was conducted in two states, a team in each state with similar areas of expertise was formed. A single team to conduct the study would have been preferable, but travel time and expense considerations ruled out this option. To assure continuity, the project coordinator made all visits to every farm. Three other team members visited all 16 farms at least once during the study. Based what was learned from this project, a team of 6 to 10 people seems to be an appropriate size.

Team Building

Team building is a continual process. At the beginning of the study, all team members should meet (one meeting or, ideally, a series of meetings) to identify team and individual goals and expectations. The early meetings allow team members to spend time getting to know each other and to understand other's areas of expertise. For example, a soil scientist may understand the role of entomology in agricultural systems, but may not understand what a sociologist contributes to the study. To be effective, team members need to understand what each discipline contributes to the understanding of the farms. Communication across disciplines helps team members gain new perspectives and insights into the farming systems under study.

Regular meetings to discuss findings, ideas, observations and areas requiring further inquiry are important. A record of interaction between team members can help identify important connections useful in the analysis of the farms. Several of the debriefing meetings after farm visits were tape recorded and transcribed. The transcripts allowed team members to review the information and discussion at a later time.

Sometimes, distance and time considerations do not allow the entire team to meet in person to work on and discuss the project. The team found telephone conference calls to be an effective way to meet, saving team member travel time and helped to lower the overall cost of conducting the study. Initially, telephone conferences were difficult to conduct, but gradually the team became more comfortable with the format and found them to be quite efficient.

DESIGNING THE STUDY

During the design phase it is important to clarify the purpose and anticipated outcomes of the study. The study design needs to be flexible enough to allow for modification as new information emerges. Few studies will be carried out exactly as planned. In some aspects, the process of conducting the study is one of the products of the exercise. It is important to have a plan, but it is equally important to recognize the plan will change over time. Flexibility is a key to success.

The Oregon/Washington study started with broadly-stated goals and objectives and became progressively more specific. The team wanted to identify sustainable production practices and cropping systems of small fruit and vegetable operations in western Oregon and Washington. Implementation team members decided to focus on pest and soil management strategies, and the social, biological and economic factors that influence decisions made by farmers.

Whole farm case studies generate a tremendous amount of information, most of it qualitative. While there is no standard format for designing and conducting WFCS, there are some important factors to consider:

1. purpose(s) of the study
2. available time and budget resources
3. expertise of team members
4. interdisciplinary goals and expectations
5. duration of the study

Table 3.1 (page 23) outlines the methodology used in the western Oregon and Washington case study project. Once the objectives of the study are delineated, it is helpful to outline procedures to obtain the information desired. For example, reviewing the literature, developing a time line, listing information needs and methods to obtain information can help clarify the process. Circulating the time line for conducting the study among team members for comment and review helps team members to know their role in the study.

Identifying Farmer Participants

The selection of the appropriate set of farms to study will depend on the goals of the effort. For example, if a team wanted to study a specific production constraint in a given cropping system, it might choose several farms of the same size, growing region, and crop mix. In the Western Oregon and Washington study, the goal was to examine a wide range of vegetable and small fruit farms with varying production practices, acreage, management styles, and economic status. Part of the identification process includes establishing a list of criteria for selection based on the goals of the study.

Methods of identifying farmer participants may include suggestions from team members, extension agents, farmers, farmer groups, or consultants. Before asking for names of farmers, it is important the purpose of the study be defined. In the Oregon and Washington study the goal was to find vegetable and small fruit operations where the principal operator had been involved with commercial farming for a minimum of three years. Additionally, the team was looking for farmers who (in the opinion of the individual suggesting the farmer as a participant) appeared to be using or attempting to adopt innovative agricultural practices, and would potentially be willing to cooperate in future project activities.

To gain an accurate view of the farming operation, it is necessary to talk with as many partners, key employees, and family members as possible. Everyone associated with a farm does not necessarily have the same perspective, views, or opinions about how the farm is run.

Once farmers potentially willing to participate were identified, visits to each farm were scheduled. The visits were made using a rapid appraisal technique known as a "sondeo." The sondeo method is commonly used in farming systems research and extension (FSR/E) programs (Hildebrand, 1981). Translated from Spanish, "sondeo" refers to the act of sounding, exploring, and fathoming. In a sondeo, interdisciplinary teams of social and agricultural scientists conduct informal, unstructured interviews with farmers. A sondeo can provide a rapid, preliminary sketch of the farm systems under study and does not seek to provide the same type of statistical data commonly reported from more conventional research methods.

The primary difference between a sondeo and a whole farm case study is duration and depth. Sondeos are conducted to obtain a quick overview of a variety of farms. Whole farm case studies are done to gain an in-depth understanding over a longer duration of time. A sondeo can be used to identify potential cooperators and to set in motion longer-term research and extension efforts that rely on direct farmer participation.

In the sondeo portion of the Oregon/Washington WFCS, people at 25 farms were interviewed (Brophy, et al., 1992). To standardize the data collection across farms, an instrument was constructed that had a list of questions or topics to be covered at each farm At each farm participants were asked to identify: problems and constraints; the role of family members in the operation; their opinions on research needs and environmental issues; and their response to change of agricultural policies and consumer preferences. The whole farm case study project was then described and farmers were asked if they would be willing to participate in a longer term study of their operation.

In the Oregon/Washington team's experience, the sondeo proved to be an effective method of collecting information and identifying farmer participants. The sondeo also served as an important first step in forging new relations among farmers, researchers, and extension personnel.

Data Collection

It is important for the team to list the primary data needs and to consider what will be done with the information once it is collected. After data needs are outlined, the team needs to identify the appropriate means of collecting the information. Using multiple methods and sources of obtaining information is a major strength of case study research. For example, data collection techniques might include observation, open-ended questions, structured interviews, or plant and soil analysis.

Taking accurate and copious notes is important to the process of documenting the farms. More than one person should be responsible for recording information. Differences in backgrounds, scholastic training, and areas of interest influence what individuals deem worthy of recording. When only one person takes notes, valuable information is lost. Ideally, all team members will record both information reported by the farmers and their observations of each farming operation. Copies of notes or reports should be given to the project coordinator for compilation and distribution to other team members.

In the Oregon and Washington study, the first two WFCS visits were fairly unstructured but focused primarily on production issues. Table 3.2 (page 24) outlines the general topics of discussion for these two visits. Questions about production practices such as row spacing, equipment, and pest problems were asked. For the production-focused questions note-taking forms listing specific topics to investigate were designed. The forms left plenty of room for note-taking by individual team members.

The Oregon and Washington team felt it was important to establish a rapport with the farmers before delving into some of the more personal aspects of the business structure and operation. Because farming is such an integrated process, much more than the team anticipated was learned about labor issues, marketing strategies, business organization, farm economics, and family involvement in the farming operation during the first two visits to the farms.

Later visits to the farms focused on the social and economic aspects of the operation including things such as the economic status of the operation, off-farm employment, insurance coverage, and family relationships. An open-ended questionnaire developed for this purpose was used to capture the intricacies of each farming operation. A list of potential topics to cover during the social and economic phase of the study is presented in Table 3.3 (page 25).

Data Analysis

Analyzing data collected should be an on-going process. Shortly after completing a cycle of farm visits, team members should prepare written reports and then meet to discuss the findings with the entire team. At this meeting, the interdisciplinary team shares observations and the group as a whole attempts to identify themes, trends, similarities and differences among the farms visited. For example, the team may discuss the association of farm size with risk aversion, or family involvement in the operation with cropping patterns. During debriefing sessions it is important to keep notes of associations identified. In the Oregon/Washington study, the debriefing process led to development of research hypotheses and helped provide ideas for educational activities. On-farm and experiment station trials identified during the WFCS are now being conducted. Examples include cover crop variety trials, rearing and releasing beneficial insects in the field, and crop rotation studies. Educational activities including workshops, conferences, and newsletters provide information on topics learned through the case study process. For example, workshops for farmers and other agriculturalists have focused on: production practices information; estate planning; family business management; a variety of marketing approaches; innovative labor management strategies; and food safety issues.

Analysis of qualitative information can be difficult and time consuming. Several good references are available to help determine how to accomplish your goals (Marshall and Rossman, 1989; Taylor and Bogdan, 1984; Yin, 1989). A key to conducting successful qualitative studies is keeping accurate notes and carefully recording information learned.

Reporting

Results can be shared in reports, newsletters, displays, presentations, and journal articles. Additionally, it can be effective to bring all of the participants together in a "Farmers' Forum" to share production, marketing, management ideas and experiences and to obtain reaction to preliminary findings and final results of the study. The forum can also be used to refine research and education proposals for future projects.

Mid-way through the Oregon/Washington study a half-day Farmers' Forum was scheduled, and participants from all 16 farms were invited to attend. During the forum, university team members presented an overview of preliminary findings from the whole farm case study visits. Some farmers participating in the study were asked to describe a unique aspect of their operation to the group. For example, several farmers employ innovative labor management strategies the team felt would be of interest to the other farmers. Farmers were asked to discuss their pest management or marketing strategies. And finally, university team members outlined some ideas for research and educational activities and farmers were asked for their opinions on the proposed topics, methods, and approaches.

PROS AND CONS OF THE CASE STUDY APPROACH

The logistics of conducting this type of research can be challenging. Merely scheduling a day when team members can visit farms at a time convenient for the farmers is a time-consuming job. WFCS research is also expensive, primarily because of time involved with planning, data collection, discussion of findings, analysis and reporting. The institutional "rewards" for conducting this type of research may be limited. Some people in the scientific community do not view case study research as a legitimate type of study because it is not entirely quantitative. However, many refereed journals are now beginning to accept articles on qualitative research and some institutions are now encouraging and rewarding interdisciplinary work.

The process of conducting WFCS improves communication among a wide group of people. Team members gain better understanding of the complexity of farms. A series of farm visits gives team members a chance to examine entire farming operations, not just components of agriculture within their area of expertise. Interdisciplinary teams increase awareness and bring new insights to farmers, researchers and extension personnel. And the process identifies farmer-developed innovations.

Whole farm case studies are most useful when conducted with other research and educational activities. For example, WFCS can help formulate hypotheses and identify research topics, but they cannot substitute for other forms of scientific research. When used as a single tool in a project their value diminishes because much of the information learned will not be put to use. They can, however, provide insights into how systems work and can help identify what is important to clientele. Most importantly, case study research provides an avenue for increasing farmer involvement in research and educational activities.

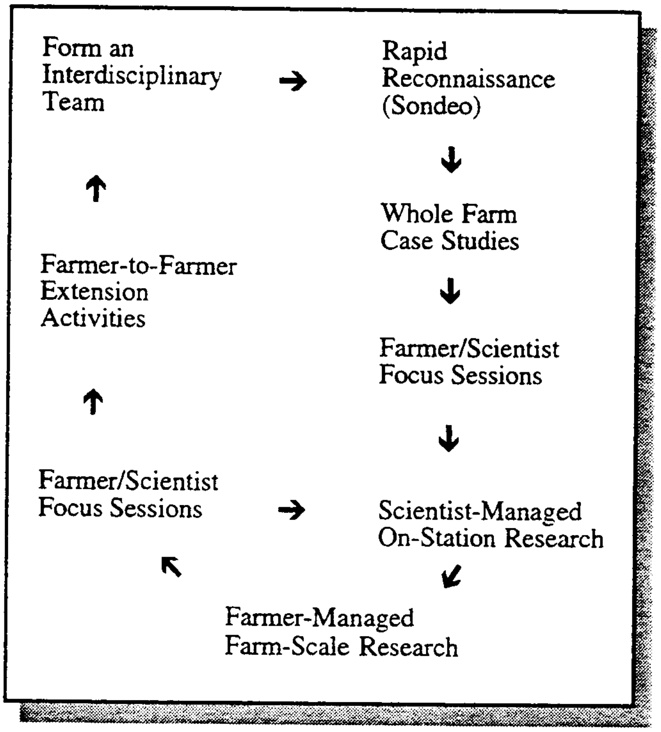

Figure 3.1. The western Oregon and Washington model for increasing farmer involvement in research and educational activities.

Table 3.1. An overview of the procedures used in the western Oregon and Washington whole farm case study (WFCS) project

Procedures

1. Form an interdisciplinary implementation team
2. Team agreement on overall study design
3. Conduct sondeo with potential farmer participants
4. Select farms for the WFCS
5. Plan information needs and determine appropriate methods to obtain the desired information
   - production system information
   - social and economic information
   - identify areas of expertise needed to analyze information collected
6. Schedule visits to farms
7. Preliminary data analysis
8. Conduct Farmers' Forum to present preliminary findings and solicit ideas and reactions to findings
9. Prepare written report
10. Determine whether to continue farm monitoring or to end project

Table 3.2. Suggested general information to collect about each farming operation

General Farm and Household Description

farm size
cropping mix and history
soil types and topography
marketing strategies
family profile
farming background
perceived strengths and weaknesses

Production Practices Information

cropping history and current mix
crop rotation strategies
livestock management
pest control measures and prevention mechanisms
sources of information
perceived problems and barriers
equipment access

Table 3.3. Suggested social and economic information to collect about each farming operation

roles of family members in the farming operation
off-farm employment of family members
changes in roles, responsibilities over time
commitment to and identity with farming as an occupation
sources of business management information
estate plans
personal and business goals
household management
food procurement, utilization and consumption habits
involvement in community and agricultural organizations
land holdings (leased, rented, owned)
equipment, building and land values
capital sources
labor
business organization - proprietorship, incorporated, etc.
insurance coverage
business record-keeping system

Chapter 4

WHOLE FARM CASE STUDIES OF HORTICULTURAL CROP PRODUCERS IN THE MARITIME PACIFIC NORTHWEST

INTRODUCTION

Deforestation, soil erosion, increased resistance to pesticides, accumulation of chemicals in soil and water supplies, and food safety issues are causing a re-examination of current farming systems in the United States. As a provision of the 1985 Farm Legislation, the United States Department of Agriculture (USDA) was instructed to pursue research and education activities in the area of low-input sustainable agriculture (LISA). Now known as the Sustainable Agriculture Research and Education (SARE) Program, it was designed to assist agricultural producers in the United States in providing an inexpensive, plentiful, and safe food supply while addressing some of the social, environmental, and economic concerns of producing agricultural commodities. One of the major goals of the SARE program has been to examine entire farming *systems*, not just problem-specific components such as weed or insect control. The justification for this approach is based on the knowledge that problems do not manifest themselves in isolation, and therefore understanding the system helps put complex interactions into context. To help accomplish this goal, one of the major emphases of the SARE program has been to increase farmer participation in technology development and transfer.

Agricultural scientists recognize farmer 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 the information is not transferable to others. Scientists rely on research-based information derived from replicated experiments that are, for the most part, reductive in nature. Farmers, on the other hand, often question the relevance of small, controlled and replicated research that is conducted on research stations rather than farms under normal farm constraints (Rzewnicki, 1991; Thornley, 1990; Watkins, 1990;).

How can scientists and farmers work together to 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. Case studies offer a systematic means of compiling information in complicated areas of human endeavor, providing useful observations that go beyond the range of controlled experiments (National Research Council, 1989).

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 inter-relations between farmers and farm employees are examined. Because WFCS are designed and conducted to understand entire systems, they are best conducted by interdisciplinary teams representing farmers and a diversity of fields within the biological and social sciences. Whole farm analysis acknowledges the interaction of the farm and farm family in the decision-making process and attempts to place the interactions into context 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 household (Madden and Dobbs, 1990). Case study research may reveal what traditional agricultural research cannot, and therefore is an excellent complement to quantitative research and economic analysis.

Several projects have been implemented to develop an understanding of the complex interactions of selected farming systems, including WFCS (Figure 4.1, page 80). This chapter provides an example of the WFCS approach described in Chapter 3 (*Whole Farm Case Studies: A how-to guide*, page 9).

Whole farm case studies were planned and conducted in western Oregon and Washington beginning in 1988. The objectives of the OSU/WSU whole farm case study research project were:

1. to develop a better understanding of vegetable and small fruit farming systems; and

2. to help set directions for future research and education activities in western Oregon and Washington.

The objective of the study was not to compare farms within the study group, but rather to identify different approaches to solving similar problems. Additionally, ideas and approaches to educational activities and areas requiring further research in western Oregon and Washington are discussed.

METHODOLOGY

The western Oregon/Washington study focused on 16 vegetable and small fruit farms. The farms are located between Skagit County, Washington and Lane County, Oregon. Eight of the participating farms are in Oregon, and eight are in Washington. The overall procedures used for the WFCS are shown in Table 4.1 (page 76). The methodology consisted of two main components: participant identification and data collection and analysis.

Participant Identification

Participant identification consisted of two components:

1. formation of an interdisciplinary team of scientists, the Implementation Team; and

2. identification of farmer participants.

The Implementation Team for the OSU/WSU project consisted of research and extension personnel in both states specializing 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. A wide range of disciplinary expertise was sought to gain a broad knowledge base to understand the complex interactions of diversified farming operations west of the Cascade Mountains. A total of 34 OSU/WSU personnel worked on the case study project. Because the study was conducted in two states, we chose to form a team in each state with similar areas of expertise represented.

A single team to conduct the study would have been preferable, but travel time and expense considerations ruled out this option.

A project coordinator was designated to oversee the logistics of the study, organize meetings, make appointments, distribute project materials, arrange transportation, and carry out other organizational tasks. Responsibilities of team members included:

1. design and implementation of the WFCS project and procedures;

2. selection of farms for the study; and

3 identification and coordination of data collection needs and analysis 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 (Beebe, 1985; Chambers, 1981; Hildebrand, 1981). The FSRE approach was developed to improve the focus and efficiency of agricultural research and extension activities (Byerlee, Harrington and Winkelmann, 1982). Although first employed in developing countries, FSRE methods have also gained favor in the United States. Several Implementation Team members have previous FSRE or other interdisciplinary 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 from more conventional research methods. For instance, rather than quantifying crop growth parameters and input use levels, the sondeo technique is used to identify broad categories of strategies and responses, and to classify respondents within these categories. Researchers have reported that no major results from rigorous sondeo-type surveys were contradicted by later, follow-up formal 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 and thus provides the expertise to deal with the complex issues facing farmers; and,

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

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 interviewed during the first telephone survey was conducted one year later (Cordray et al., 1992; Cordray et al., 1993). The western Oregon/Washington sondeo was followed by the 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 4.1, page 80).

The Implementation Team chose to select farmers to interview based on the following criteria:

1. crops grown must include caneberries (*Rubus* species, including raspberries and blackberries) or vegetables;

2. grower has been involved in production agriculture for a minimum of three years;

3. grower appears to be using or attempting to adopt innovative agricultural practices, in the opinion of the individual suggesting the grower as a participant; and,

4. grower is potentially willing to cooperate in future project activities.

Using the criteria outlined above, initial lists of farmers to interview during the sondeo were submitted by county extension agents and other agriculturalists. Farms for the sondeo were selected to include a broad range of crop management and marketing strategies. The group of farms selected for the sondeo 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-developed innovations.

The sondeo interview team, for most farms visited, included the local county extension agent, a social scientist, and one or more biological scientist(s).

Team size was kept to a minimum number to facilitate informal discussion. Each team member followed an outline of questions as a flexible guide to the interview process (Table 4.2, page 77). 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 was done to meet the following objectives:

1. to identify what factors are influencing farm management decisions among innovative farmers;

2. to examine how innovative farmers with farms of different sizes and production methods are responding to these challenges;

3. to examine the usefulness of the sondeo as a research and extension tool; and,

4. to identify collaborating farmers for longer-term project participation.

Twenty five farms were visited during the sondeo phase of the WFCS, and included organic and conventional farming operations in both states. For the purposes of this paper, "organic" farms are defined as those certified by Oregon Tilth or the Washington State Department of Agriculture, the organic certification agencies for the respective states. "Conventional" farms are those not adhering to these guidelines, and "combined" farms are those with a mix of organic and conventional production. The sondeo interviews lasted about two hours each. Farmers were asked to identify problems and constraints, the role of family members in the operation, their opinions on research needs and environmental issues, and their response to change of 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. Table 4.1 (page 76) gives an overview of the types of questions farmers were asked during the sondeo. Farmers were told if they agreed to participate in the WFCS, teams of university personnel would visit their farm 3-4 times during the course of a year for no more than four hours per visit. The purpose of the visits would be to observe 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, i.e., 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 the team members with a wide range of expertise, and would have the opportunity to give input into identifying areas requiring further research.

Of the 25 farms visited during the sondeo, all agreed to participate in the whole farm case study project. A summary of findings from the sondeo interviews is available (Brophy, et. al, 1991). Ultimately, the Implementation Team selected 16 of the 25 farms to study.

Data Collection and Analysis

After farms for the WFCS were identified, data collection was done using several approaches and methods. The Implementation Team relied on: informal interviews; in-depth structured interviews; observation; forms completed by both 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), contributed to the validity of the study.

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

The first two visits to each farm were made by an interdisciplinary team of social and biological researchers and extension personnel. The first visit to each of the 16 farms was made during June and July 1989. Topics discussed during the first meeting focused on production practices, equipment access, decision-making strategies, and sources of information. The primary focus of the second trip was to look at and discuss production practices and decision making strategies during the height of the growing season. The second visits were made in August and September 1989. Marketing approaches and strategies were also discussed during the first two visits. Data were recorded by team members as we toured the farm with the primary operator of the farm, or at least one member of the farm family.

The first two scheduled visits to each farm did not follow a fixed format. The purpose of the first two visits was to gain an understanding of the farming systems under study. Team members made a general list of information they wanted to examine and discuss at each farm during the first two visits (Table 4.3, page 78). The Implementation Team thought a more structured interview process might result in a loss of key information about each farm operation. The flexible interview process enabled team members to explore topics and ideas in depth, but helped prevent missing key information and discussion on topics not originally thought to be relevant to the study.

The household and business management interview (Visit 3) was more structured. Team members developed and used a questionnaire to gather specific information about management of each farm (Appendix A). Most questions asked during the third interview were "open-ended" questions. This format enabled respondents to elaborate on topics and allowed the interviewer to ask for clarification or more detail. The third visit to each farm focused on discussions about household management, economic status of the farm, labor issues and management, and other business and household issues. Visit 3 interviews were conducted by groups of two to three team members. At least one biological and one social scientist were present during the interview. At each farm, we interviewed the principal operator. If family members were involved in the farming operation, we also interviewed them when possible. Visit 3 interviews were conducted between November 1989 and February 1990.

The coordinator, sometimes accompanied by the local county extension agent or another team member, made additional trips to most farms in the study to collect soil or tissue samples, and to note production practices at various times during the study period.

Analysis of data collected during the interviews was done by team members throughout the duration of the study. Implementation Team members met after each series of farm visits to discuss findings, observations, impressions, and to identify themes and areas requiring clarification. In most cases team members met in person, although a few meetings were held as telephone conferences. These debriefing meetings were either tape-recorded and later transcribed, or detailed notes were taken to document the discussion.

In addition to the farm visits where team members collected information during interviews, data on farm labor was requested from participating farmers. Farmers were provided a form to fill out and return on a monthly basis (Appendix B). This form included questions about the number of labor hours (both paid and unpaid) on a monthly basis at each farm, and electricity and fuel usage figures. While all farmers in the study agreed to cooperate with this part of the study, not all of them returned the brief labor data questionnaires.

In total, 43 people were interviewed, formally or informally, during the course of the study at the 16 participating farms. Numbers of people we spoke with at each farm ranged from one to 10.

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 (Appendix C). Chapter 6 of this thesis describes the findings from the team survey.

A Farmers' Forum was held mid-way through the course of 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 in the study attended the Farmers' Forum, in addition to Implementation Team members, and university administrators interested in the progress of the WFCS. Forty people attended the half-day meeting. Topics discussed were: preliminary findings of the WFCS; specific labor management strategies and production practices used at some of the case study farms; and potential future research and educational activities. The Forum was successful in bringing farmers and university personnel together to discuss agricultural concerns and to share information. Overall, farmers supported the research identified through the WFCS and proposed by Implementation Team members. The group in attendance also expressed an interest in continued open communication. The farmers expressed a particular interest in sharing ideas with each other, and in continued involvement with shaping research priorities. The preliminary data analysis provided by the participants at the Farmers' Forum helped guide future research and extension activities and provided targeted ideas for work during the remainder of the WFCS project.

FINDINGS

Farm and Farmer Descriptions

The 16 vegetable and small fruit farms participating in the WFCS ranged in size from eight to 3,000 acres. The farms are representative of the diversity of Pacific Northwest maritime agriculture. The farms in the study produce small fruit crops (primarily caneberries and strawberries) and mixed vegetable crops. Seven of the farms in the study are certified organic farms, one farmer has both certified organic and conventional production, and the remaining eight are conventional farms. Gross sales for farms in the study range from $10,000 to $4 million annually. A brief profile of each farm is shown in Table 4.4 (page 79).

Three farms in the study are owned or managed by two generations of family members. The younger-generation growers at these farms say they investigated other options before committing to the family farm, and they feel good about their decision and the contributions they make to the operation.

Nine farms in the study are owned by married couples, but at three of these farms one spouse is not directly involved in agricultural production at the farm. In two of the three cases, the spouse provides record-keeping and book-keeping support. Six of the farms in the study are run by single, non-married individuals. Of the sixteen farms in the study, seven individuals at six farms have gone through divorce, and two of them have remarried. Five of the seven farmers in the study whose marriages ended in divorce are certified organic growers. Individuals in the study who have divorced state they attribute part of the blame for the break up of their marriage to the stress associated with farming. Two farmers in the study have never married.

Nine of the farms were started by the individual or family now operating the business. Six of these farms are owned by people with little farming background, although 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."

Farmers in the study 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 in study responded to the question. Answers ranged from 4 to 10. The average answer for the 23 farmers asked this question was 8.3. Farmers stating their commitment level was 4 to 5 had the following types of 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'd say 5, primarily because I don't know if I'll be 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 stating they rate 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 stated they had a "high" level of commitment to farming (responses were 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."

Farmers in the study consistently identified three "trade-offs" associated with farming, regardless of their self-identified commitment to farming: lack of financial security, limited social opportunities, and no opportunity to take time off during the summer.

"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."

"It [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 stated they enjoy the independence they feel by being a farmer, other growers 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 in the study state they have soil samples analyzed yearly. Four of the farmers say they take soil samples for testing "infrequently," while four growers say they haven't had a soil test done in many years. When asked why they don't 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 conventional farmers in the study appear to be over-fertilizing their crops. In some cases, this is because these farmers depend on a consultant to make fertilizer recommendations. In general, these rates are viewed as "insurance" to maximize yields. However, one farmer in the study emphatically stated "the ground is not your banker!"

Most growers in the study do not take tissue samples for nutrient analysis. Recommendations are not available for many crops grown in western Oregon and Washington, particularly vegetable crops. However, good tissue analysis information is available for testing potato petiole and caneberry tissue samples and a few growers in the study regularly send in samples for these crops.

Organic farmers, for the most part, depend on animal manures to supply nutrients to their crops. Three growers primarily use composted dairy manure, while three primarily use composted chicken manure. All growers in the study using manure purchase it from local sources, although one grower does have a few head of livestock that provides some of the manure he requires for crop fertilization. With the exception of one grower who stores the composted manure on a cement pad at his farm, all have the manure delivered and spread directly on the fields, and the grower then incorporates it. All of these growers noted that prices for manure are increasing. One organic grower in the study uses fish bones from a nearby fish processing plant to fertilize his raspberry crop. Another organic grower relies exclusively on commercially available organic sources of nutrients such as Chilean nitrate; his reasons for applying commercially available organic fertilizers include ease of application and more consistent, known nutrient content. Conventional farmers in the study primarily use commercially available, conventional sources of nutrients. One conventional grower has experimented with using composted grass straw on some fields, but he abandoned using it because of the expense.

No farmers in the study are using annual legume winter cover crops on extensive acreage, even though 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 [to the peas from the cover crop]."

Four farms in the study use some type of non-legume cover crop extensively, while 10 use cover crops on a limited number of acres. Two growers in the study never plant cover crops.

Of the four growers using cereal cover crops extensively, one farm has used wheat as their primary cover crop for several years. The growers using wheat cover crops acknowledged wheat does not provide an extensive root system (compared with other cover crops such as cereal rye), but they like to use it because it gives them flexibility. The growers' main crop at this farm is vegetable seed, and they are never exactly sure how many acres they will have in seed contracts from year-to-year. Therefore, they plant wheat and, depending on how many acres of seed they will grow, they either kill and incorporate the wheat crop or leave it in as a crop they can harvest. They also prefer wheat to other cover crops because they have several weed control options in wheat crops, and weed control is very important to maintaining quality seed crops. Over the past few years, these growers note many more farmers in their area are beginning to plant cover crops.

Another grower in the study has developed a system to overseed cereal rye into standing vegetable crops. In broccoli fields the grower overseeds cereal rye at a rate of 65-70 pounds per acre just prior to the last harvest. He notes that by overseeding, rather than waiting to incorporate the broccoli crop after harvest and preparing the land for planting the cover crop, he saves money, fuel, and gets an early start on establishment of his cover crop.

Several farmers in the study have 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 it 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."

Pest Management Strategies

Vegetation Management Strategies Weeds are clearly one of the major problems all farmers in the study face. Conventional farmers, for the most part, are able to control weeds with some degree of success, but the registration loss of some key herbicides (for example, dinitro) has caused a major problem for them. In some cases, farmers expressed dissatisfaction with herbicide results. For example, it is common for broccoli growers to use a pre-plant incorporated herbicide, usually trifluralin (Treflan) to help control weeds. Additionally, growers usually end up doing some hand-hoeing or cultivation to control weeds not killed by the herbicide. In some cases Treflan has been known to adversely affect crop growth and yield. To overcome this, one conventional grower in our study eliminated all use of herbicide in his broccoli crop and has substituted a combination of cultivation, hand weeding and winter cover crops. When he stopped using herbicides, he noticed a weed shift in some fields. Chickweed, *Stellaria media*, a winter annual that was normally suppressed by the Treflan began to appear in some of his fields about the time harvest began. He looked up information about the weed and determined that it wouldn't interfere with crop growth or harvest, and that it had potential to be a "free" winter annual cover crop. Since that time he has encouraged the chickweed to grow by timing the final cultivation to not interfere with the establishment of the weed. After the last crop harvest he mows the broccoli plants off just above the height of the chickweed, and allows the chickweed to become the dominant species in the field over the winter. The chickweed begins to die off as warmer weather arrives, and is easily disked into the soil in the spring while he prepares a seedbed for the following crop. The grower has expressed satisfaction with this system and intends to continue using it.

Broccoli growers in the study continuing to use Treflan note they also need to cultivate and hand-hoe to control weeds in their broccoli crops, as Treflan alone does not adequately control all the weeds in their fields.

Two broccoli growers in the study bring sheep into the field to graze after the last harvest. The broccoli provides food for the sheep while the grazing means the growers don't have to mow or incorporate the plant stalks after harvest, which have a tendency to harden over the winter making spring incorporation difficult.

Most organic farmers get good control of weeds by mechanical and hand weeding. Two growers use weeder geese. A few growers in the study have flame weeders, and farmers at two other farms noted they were considering using flaming to control weeds. Some farmers in the study, at both conventional and organic farms, indicate they are learning to become more weed tolerant.

However, growers that manage u-pick operations or have farm stands are very concerned about the appearance 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."

All growers in the study use a combination of measures to control weeds. Most conventional growers apply pre- and post-emergence herbicides, depending on the crop and weeds present, on the majority of their crops. Several growers in the study band herbicides where possible to reduce the quantity of herbicide they apply per acre. "Banding herbicide over the crop row enables us to use 1/3 the amount of herbicide we use when we broadcast [herbicide in a field]," according to growers at one of the farms in the study. Both conventional and organic growers also rely on crop rotation, cultivation and hand-hoeing. Because most farmers in the study use mechanical cultivation in most fields, crop row spacing options are dependent upon available equipment.

After establishment, caneberry growers reported great diversity in vegetation management practices between berry rows. Practices included no-till, which minimizes sucker development, or cultivation with a rototiller or disk. Growers reported individual systems that included mowing indigenous vegetation, managing a hard fescue (*Festuca longifolia*, cv. Aurora) or perennial ryegrass

(*Lolium perenne*, cv. Manhattan II) living mulch, applying herbicide, or mulching with black plastic. One grower is experimenting with planting an annual barley living mulch that can be cut and blown into the plant rows. The theory is the cut barley mulch will provide weed control in the plant rows, which will increase organic matter, and encourage earthworm activity.

Primocane suppression for caneberry growers is primarily through use of chemicals for conventional growers. However, growers in the study have found ways to lower the recommended rates by experimenting with spraying one side of the row, rather than both sides, to cut application rates in half. The growers using this system noted the technique misses 10-20% of the primocanes, but overall they are pleased with the results. Conventional growers who previously used dinitro to control primocanes and weeds expressed concern that slugs, weevils, and crown borer insects could become a problem once they stop using the herbicide which also kills the mentioned pests. One organic grower in the study uses weeder geese to control primocanes in his raspberry field. He keeps the geese in a given area of the field by placement of the watering trough. He has observed that the geese are effective in controlling primocanes up until they are three to four-inches tall, and after that the primocanes need to be removed by hand.

Insect Management Strategies Most farmers in the study are not fully utilizing an integrated pest management (IPM) approach, although a few report they use pheromone traps and field sweeping to monitor insects. Conventional farmers tend toward a prophylactic approach for insect control, spraying some specific pesticides on a calendar basis. Preventative spraying is more likely to be done by those growing for the processing market. Farmers cited lack of time to monitor traps, and ease and dependability of regular applications of insecticides as reasons for not fully adopting IPM practices.

Growers using synthetic pesticides either made the decision to use them on their own, or with the help of a field representative or by using a private consultant to determine if an insecticide application should be used to control a certain pest.

Organic farmers are using organic pesticides (pyrellin, rotenone, soaps, etc.), exclusion techniques (floating row covers), planting date manipulation and selected crop mixes or varieties to avoid insect infestation. The organic pesticides are limited in number and effectiveness, and can be very expensive. Continued use of these organic pesticides may cause pest resistance. For example, *Bacillus thuringiensis* (BT) is the only organic option for lepidopteran pest control, and at least one caterpillar pest has already developed resistance to this product already (Art Antonelli, 1990, personal communication). For aphid control organic growers use soap sprays. The organic growers indicated the growth habit of the varieties of cabbage chosen tend to choke out aphid populations.

A few organic growers use floating row covers for pest exclusion, primarily for cabbage root maggot. Control options for cabbage maggot by organic growers are mostly limited to floating row covers, planting date manipulations, and growing crops other than brassicas. The cost of material and labor to place and remove the row covers are a deterrent to its widespread use, according to growers in the study. Growers do note they can re-use the floating row covers for two to three years if they are handled carefully. On a commercial scale, row covers to prevent insect infestations on crops is a relatively new practice. Row covers change the micro-habitat, which may encourage some plant diseases. However, little is known at this time about these potential adverse affects.

One grower who used floating row covers on an extensive number of acres experienced severe weed problems because rains didn't allow crews to get into fields to remove it soon enough. One potato grower in the study noted he uses floating row covers to increase the heat units of his soil right after he plants potato tubers. Growers indicated row covers are difficult to use in areas subject to high winds.

Several growers said they use planting dates to minimize some insect pest problems. For example, cabbage maggot control was unnecessary for farmers who planted cole crops after May 15; this technique was used primarily by organic farmers. Although an effective method, farmers wishing to produce for an earlier market or farmers needing to meet processor schedules will need to use other control measures. Organic and conventional fresh market farmers indicated they often opt to plant varieties that are pest resistant, while farmers producing for the processing market tend to have little or no choice regarding the varieties they grow.

Growers using synthetic pesticides indicated good control of all pests that were controlled using insecticides. The organic growers indicated they were happy with the planting date as a way to avoid cabbage maggot, and that the growth habit of cabbage plants did indeed generally reduce aphid problems. If, we therefore judge effectiveness of practices being used by grower satisfaction of insect control, then the practices employed by all groups of farmers are effective.

Plant Disease Management Strategies While many growers state weeds are their number one problem, most growers in the study have elaborate systems to control a host of plant diseases. Growers in the study use a wide variety of approaches to disease control including: resistant varieties, crop rotation, irrigation timing, plant spacing, planting date, adjusting soil pH, chemical controls, and crop residue removal.

Crucifer crop growers have to contend with club root (*Plasmodiophora brassicae*), a widely distributed, persistent soil-borne disease found where plants of the mustard family grow. Club root causes serious damage and crop loss when varieties susceptible to infection are grown in infested fields. Affected plants show almost normal vigor at first, but gradually become stunted. Young plants may be killed by the disease within a short time after infection, while older plants may survive but fail to produce marketable heads (Agrios, 1978). Crop rotation and soil liming (to raise pH) are the primary means of controlling the disease. Nearly all growers in the study use crop rotation as the number one means of control, with most growers in the study using a rotation of 3-4 years. A few growers use a longer crop rotation (5-6 years) between crucifer crop plantings.

One broccoli grower in the study has limited crop rotation options because he also grows perennial berries (raspberries and strawberries), which can be in a given field from four years (strawberries) to 20 years or more (raspberries). He has developed a strong market for his crops and therefore is not interested in growing another crop mix. He knows that club root is not found in soils with a pH above 8, and tends not to be a major problem in fields with a pH of 6.8 or above. To help manage the club root he applies two tons of lime per acre per year. Soil liming to control of club root works because spores of the club root organism germinate poorly or not at all in alkaline media (Agrios, 1978). He also knows that saturated soil is required for the club root organism to germinate and has modified his irrigation system so that he now waters only when the soil is dry and at intervals of 1/2 hour on, 1/2 hour off until he has applied the amount of water he determines is necessary. The timed irrigation system he employs limits the amount of time standing water is in the field, subsequently limiting the opportunity for the club root organism to infect plants. The grower has used this liming and irrigation system for 5-6 years and has experienced no major losses of his broccoli crop, even when he has been growing it for 5 years on the same piece of land. When he removes a strawberry planting (typically a 4 year crop for him) he rotates the strawberry and broccoli fields. Incorporation at least six weeks prior to planting is critical to change the pH in time to have effect, and some growers in the study indicate they have had little success in altering pH with standard incorporation techniques.

A complex of soilborne organisms are responsible for the seedling disease known as damping off (*Phythium* species). Seed rot and collapse of young seedlings associated with this disease are responsible for poor and uneven stands. Historically, fungicides have been used by both conventional and organic growers to protect seed and seedlings from this problem. Beginning in 1990, organic growers were no longer allowed to use fungicides in certified organic seedling production, and unless alternative control measures are found, early planted crops could potentially suffer severe losses. Since early season crops generally bring higher prices, this loss could be significant. Methods to speed soil warming, use of pre-germinated seed or transplants, and biological protectants need to be evaluated for possible solutions to this problem (Ralph Byther, 1989, personal communication).

Root rots (*Phytophthora* species) of raspberry and strawberry are of concern to both conventional and organic growers. Limiting planting to only well-drained soils is essential. Most growers in the study use only certified planting stock to help limit root rots. Crop rotation and use of less susceptible varieties in marginal soils is also helpful. One grower in the study reports he will have to remove red raspberries from his u-pick operation because poor soil and a high water table are causing severe root rot problems. Conventional growers in the study report 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 has greatly limited the potential of this crop for organic growers. For conventional growers, fungicide applications offer some, but not 100%, relief. Proper use and timing of fertilizer applications, row spacing, and picking frequency help reduce disease pressure.

Downy mildew (*Peronospora parasitica*) disease was observed on several crops, including lettuce and broccoli. Growers report great losses on lettuce crops, particularly among the organic growers in the study. Organic growers use resistant or tolerant varieties to minimize the problem. Conventional growers use fungicide applications to keep losses to a minimum. Evaluation of additional resistant varieties needs to be made to examine their usefulness in western Oregon and Washington. In broccoli crops the greatest economic damage from downy mildew occurs when broccoli heads become infested. Use of resistant or tolerant varieties is the primary control measure taken by several growers.

Virus diseases also pose a threat to various vegetable and berry crops raised by growers in the study. The virus complex on strawberries is common and has been responsible for the need to eliminate plants from unproductive fields. Use of certified planting stock and aphid control are essential to prolonging the life of strawberry plantings. Rouging of virus-infected plants was done by one celery grower in the study in an attempt to contain a virus problem. Virus-resistant pea varieties are used by most pea growers in the study, as the pea virus complex can totally eliminate a susceptible crop. Conventional growers also use 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.

MANAGEMENT

Family Participation

Farms where multiple family members participate in the day-to-day farm operation have a variety of ways of approaching the management of the family business. Personal and business roles are merged in several of the operations, but other farmers prefer to keep roles separate. For example, one of the sons of a two-generation farming operation refers to his father by first name when conducting business, and calls him "Dad" when discussing family and personal matters. He stated it helps relay professionalism to clients and keeps some of the personal and historical issues between father and son to a minimum in the office or field. Several farmers in the study commented that while they try to keep personal and business roles separate, they do not always succeed as they would like. Some farmers try and keep a physical distance between home and work by having an office separate from their residence. Other farmers have an office in their home.

In farms owned by married couples, work tends to be divided along field and office responsibilities. Women at these farms tend to be responsible for managing the books, payroll, paperwork, and general organizational responsibilities, while the men are generally responsible for production management. However, these general responsibilities tend not to be strict divisions of responsibilities. Major decisions regarding the overall business tend to be made jointly. All farmers in the study (both women and men), regardless of marital status, report that as time goes on they spend less time in the field than they did previously, and they are spending more time on managerial matters.

Divorce in any family business is often a complex matter; however, as a team we discovered it is inappropriate to make assumptions about who does what in the business after a divorce. Ex-spouses continue to be involved in farm operations after a divorce in some instances, primarily because of monetary investment in the farm.

Three farm families in the study have their business organized as a corporation, while ten are proprietorships. Three farms have formal partnerships among family members. One of these farms has a set of rules regarding who, how, and when someone may become a partner in the farm. None of the farmers in the study said they have a succession plan for the farm to be implemented after they retire or die; however, one of the partnership agreements includes details about what happens to the shares when a partner dies.

Sources of Information

All but two growers in the study stated that "other growers" are a major source of information regarding farming practices and farm business management. Talking with and observing other farmers' practices provides farmers in the study with ideas to test out on their own farms, but nearly all noted that there are not many ideas or practices they can implement on their farm without modification. The two individuals who do not rely on other growers for information tend to rely on written materials and consultants.

Nearly all of the organic growers in the study said they find the extension Service to be of limited help. One grower stated he was reluctant to even be a part of the WFCS initially because of a lack of assistance from the university in the past. "Philosophically, though, I agree with the goals of the project [sustainable agriculture and increasing farmer input in research and extension activities]" and therefore he agreed to participate. 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 use extension services said they do so when they have specific, production-oriented questions.

Large-scale processing market growers in the study state they rely on consultants and field representatives for information. The growers who use consultants also say they also depend on their own experience to guide them in making pest management and fertilizer decisions. These same growers also tend to cooperate with university and private company field representatives conducting trials at their farms. The level of cooperation in the field trials primarily involves the farmer providing land or other physical resources to researchers conducting the trials.

Only two growers in the study state they consistently rely on crop production records as a source of information to plan and guide current field operations. "Records on each crop are critical to our operation. We use them for planning rotations, cultural practices, and to monitor pest problems," according to one grower. Several growers in the study say they always intend to keep better records, but other things on the farm usually take 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," said one grower.

Most WFCS participants attend some type of agricultural meeting each year. However, only four growers participating in the WFCS stated this was a primary source of information. Commodity Commission meetings are attended by many growers in the study. Organic growers tended not to attend commission meetings, but several are members of wholesale cooperatives and rely on meetings with other cooperative members for information. Regardless of the type of meeting growers attend, most said if they get just one piece of information they can use they consider the time well spent.

Several participants in the study have attended courses at community colleges or universities to learn computer and record-keeping skills. Five growers in the study have completed university degrees in agriculture, although several others have university degrees in non-agricultural fields.

Newsletters, newspapers, books, and journals are a primary source of information for the majority of growers in the study. Several growers stated they read "everything I can get my hands on" although one grower noted that scientifically-presented information is difficult to understand and therefore is of limited value to her.

Nearly all growers in the study commented on the difficulty of finding reliable information on farming practices and business management in an efficient manner and in a reasonable amount of time.

Labor Management Issues

Farm labor is a major issue at the farms in the study. The major concerns farmers expressed 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 say their need for labor has decreased slightly. Reasons for this included fewer acres under production or a change in crop mix. One farmer says the number of laborers he needs each year has decreased because he now hires professional farm laborers. Only one farmer in the study says his need for labor has remained the same. Other farmers have increased their need for farm laborers because they changed crop mixes or increased the number of acres they farm. Still others have expanded their operation to include packing lines or other forms of vertical integration. Universally, farmers in the study agree that labor is costing more than it did before. Hourly and piece rate has gone up, but more importantly according to growers in the study, the amount of time to confirm and document that they are hiring legal workers is taxing and expensive.

Only one large-scale farm in the study uses a labor contractor to hire skilled workers. During 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 primary reason he hired a labor contractor was to cut down on time he spent hiring and paying laborers, but he expressed concerns about the integrity of the contractor he hired, "I am not certain he handles the paper work 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 in the study hire workers directly. Approaches to assure the availability and quality of laborers differ depending on the scale of the operation. Learning another language or hiring someone fluent in another language to work with non-English speaking labor crews is done when necessary. If there are problems with getting paychecks out quickly, farmers look for alternatives. For example, at one farm laborers' piece work tallies are directly entered into hand-held field computers. This lessens the amount of time laborers spend waiting to get produce weighed and tallied, and makes the payroll process faster. Several farmers in the study provide laborers with food produced at the farm. A few farms provide housing or assist farm workers in finding housing. Some farmers provide what they describe as "personal support," i.e., helping workers to 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 provides a car and pays for the insurance so workers have transportation to and from work.

Several farmers in the study also try to provide a "fun" work atmosphere. Several growers say they buy pizza, soft drinks, or take crews out to dinner occasionally. One grower says he occasionally does impromptu contests, for example having the crew guess how many boxes of produce will be harvested off the field. He usually provides a small cash prize to the winner.

Farmers in the study also have major concerns about: labor availability and management, particularly worker documentation requirements; how to best incorporate computers into their management system and for information retrieval; 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 appear to be the driving factors in determining marketing strategies. Several farmers in the study are most knowledgeable about production and concentrate primarily on yield and quality. These farmers focus on producing the best crop that they can. The more production-oriented growers are concerned about marketing, but only to the extent that they find a niche for the good quality crops they produce. For example, when asked why they market the way they do, the more production-oriented growers answered with the following responses:

"It is easy [to market through a cooperative]."

"It is 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."

Some of the more market-oriented growers in the study tend to have crops that suffer because of the emphasis and time spent on marketing crops. For example, proper fertility management, pruning and training would likely make a phenomenal difference in yield and quality of raspberries and strawberries for one grower. Instead, he spends a tremendous amount of time and energy on marketing crops to local grocery stores, farm stands, and through the u-pick operation at his farm with great success.

The more market-oriented producers find marketing enjoyable. Their response to questions about why they market using the avenues they do included:

> "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 in the study use a single market outlet. Both are fresh-market growers. One is a small-scale grower (eight acres) who markets solely through his u-pick operation, and the other sells to a single fresh market organic produce cooperative. Both growers explained they market the way they do because it is easy.

All but one farm in the study grows some fresh market produce. Of the 15 that grow fresh market produce, eight grow primarily for the fresh market, while the other seven grow primarily for the processing market. The eight primarily fresh-market production farms range in size from eight to 85 acres. Five of these eight are certified organic farms. The seven farms that grow primarily for the processing market range in size from 22 to 3,000 acres; the 22 acre farm sells strictly to an organic processing firm. The 22 acre farm is the smallest of the nine farms, with the others ranging in size from 200 to 3,000 acres. The 11 farms in the study raising some or most of their production for the processing market range in size from 12 acres to 3,000 acres. Five of these 11 farms sell 75% or more of their production to processors.

Scale of operation also determines where and how farmers market their produce. The larger-scale farms in the study (100+ acres) tend to grow for the processing market. For example, one large-scale berry grower in the study notes that his operation is too large for the local strawberry market, yet they are not large enough to compete with California strawberry growers in the fresh market. As a result, nearly all of the strawberries they produce are destined for the processed market.

Crop acreage decisions, and subsequently marketing outlets, are made on a number of factors. Many growers in the study grow crops with a marginal profit return in order to extend employment for laborers throughout the growing season. Another grower is planning on adding nursery stock to his operation in order to keep his "best workers" employed throughout the year. One farm in the study continuously plants strawberries on a field near their farm market stand, which is adjacent to a major road. The growers at this farm noted they recognize the importance of crop rotation, but because it is such a boon to the marketing of their strawberries they haven't yet rotated the field to another crop.

Record-keeping Systems

Methods for keeping records of farm finances and production practices ranges from computers and fax machines, to hand-written notes, to "in head" types of systems. Ten of the 16 farms in the study use computers in some manner to manage finances or production information. Some have developed programs for their own use, while others use commercially-available agricultural software programs.

Very few growers in the study keep detailed production records, although several mentioned they have been planning to for some time. The primary reason for not documenting field-by-field or commodity inputs and yields is the time it takes, according to many growers in the study. One farmer in the study only keeps track of how much it costs to harvest each crop, to help calculate cost and return information. "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," according to the grower. Growers who are members of cooperatives say they receive yield information from processors or distributors.

One farm has incorporated use of hand-held computers to record picker tallies in the field. The computer-recorded harvest information helps keep track of yield and labor needs by crop and field.

Insurance Coverage

Life insurance was common among most married couples in the study, while unmarried farmers in the study did not have life insurance. Business property and business liability insurance was common. Disability insurance was held by only five growers in the study, three of whom had coverage through their spouses' employment. When asked if he had disability insurance, one farmer in the study replied, "No, that would be a luxury." A few farmers in the study have accident insurance, with the remaining farmers stating they would rely on workman's compensation to cover expenses if an accident happens at work. All but three farmers in the study have health insurance. One farmer in the study has no insurance of any kind, "I don't believe in it," he said. None of the farmers in the study have federal crop insurance.

Economics

Of the 16 farms in the study, 14 farm some leased or rented land. The two operations that farm exclusively on their own property are small farms, eight and 22 acres. Three growers in the study farm only leased or rented land, while another farm has over 95% of it's production on leased land; all four are certified organic farms. One of these growers expressed concern about the lack of "loyalty" to agriculture in his area. He says the land market where he farms is highly volatile with a "highest bidder mentality" prevalent. He also said he would like to buy some farmland, but hasn't been able to afford it until recently; if one of his neighbors decides to sell land he will try and purchase it. There are a number of advantages to renting or leasing land. It frees up operating capital and provides some flexibility. There is also some risk associated with leasing land, especially in areas where farmland is being sold and converted to non-agricultural uses.

Six farms in the study borrow capital from friends or family members; all six of these farms are less than 65 acres. Of the six farms, three don't borrow money from financial institutions, while the other three use a combination of bank loans and loans from friends or relatives. Two of the larger farms in the study use 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, rely on financial institutions for loans.

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

Equipment access and availability among the farms in the study varies a tremendous amount. Investment in equipment at farms in the study ranges from $10,000 to $600,000. With the exception of specific pieces of specialized equipment, growers in the study prefer to purchase equipment over leasing or shared ownership. The decision on whether to purchase new or used equipment varies. Some growers prefer to buy new tractors and used implements, while other growers prefer exactly the opposite. Decisions are made based on finances, mechanical repair skills, personal philosophy, and whether or not the choice of buying new or used is even an option. All of the growers in the study report they have modified pieces of equipment to meet a particular need on their farm. All of the small-scale growers expressed a desire to see equipment manufacturers produce equipment better adapted to small-scale operations.

Since the end of data collection phase of this study two of the participating farms have gone out of business. One described the farm as over-extended in terms of financing. "We made some mistakes and the market is not very forgiving. We were paying way too much interest [12-14%] to be able to stay in business." The other farmer could not be contacted after he went out of business. During the course of the study, he described his most significant problem as cash flow. He was also concerned about "low prices and the high cost of operation. I anticipate this to continue for the next five years. Farmers can't control the situation."

GENERAL FINDINGS

Problems and Challenges

Farmers in the study 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 that problems associated with hired labor concerned them most. Issues cited included: a lack of skilled laborers; expenses associated with hiring laborers including wages, FICA and workman's compensation expenses, and keeping track of piece work to insure that laborers receive at least minimum wage; the number of regulations associated with hiring laborers; the amount of paperwork associated with rules, regulations, and taxes (i.e., tax statements, Immigration and Naturalization Service paperwork, FICA, workman's compensation forms); labor crew management; or worker productivity. A few growers fear that labor issues will continue to get worse. Farmers are concerned that there will be increasing competition for fewer and fewer professional farm workers.

Farmers have responded to these challenges in a variety of ways. One farm family in the study has developed a hand-held, field computer system to keep track of piece work to insure laborers make at least minimum wage. The field computer system cuts down the amount of time laborers spend waiting for their totals to be recorded. The process decreases the amount of time payroll office employees spend making out pay checks because information is down-loaded to a computer in the office and checks are printed using the same program.

Also cited as concerns to farmers were issues such as: loss of registration for minor crop pesticides; production costs per acre are going up while farmgate prices are not; 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 are concerned about the weather. Excessively cold, hot, wet, or dry weather seems to cause a set of problems the farmers cannot 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 were also asked to identify the problem or problems they thought were least likely to be resolved. Several farmers are 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 [where he farms]." Another concern farmers expressed was agricultural-urban interface problems. As farming areas become increasingly urban and suburban, especially around the Portland, Seattle, and Olympia areas, farmers worry about neighbors complaining about agricultural practices such as noise, dust, and pesticides. Farmers producing for the organic market are also concerned about pesticide drift from conventional farms near the property they farm. If pesticides drift onto their crops they could potentially lose not only that year's crop, but possibly their organic certification status.

Other growers were concerned about specific pest management problems: "We'll never get the weed problems under control" said one grower, while another commented "There will always be disease problems." However, farmers in the study with more years of experience tended to be less concerned about production problems than those relatively new to farming.

IMPLICATIONS

As a team, we learned much about educational needs and specific areas of agricultural systems lacking a solid research base. The universities are ill-prepared to answer many production and marketing questions posed by organic growers. Some of this is because of a lack of scientifically-based information, but there is also a lack of exposure by university researchers and extension personnel to organic farming. The 1990 Farm Legislation outlined a process to provide monies for training extension agents on sustainable agriculture topics, including organic farming. The money for this program has 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 would help insure the training will be relevant to farms and farming communities.

Getting existing research-based information to farmers, not just to peer-reviewed journals, continues to be an important issue. Several researchers noted that if farmers understood specific biological interactions better, farmers could better deal with the problems they face. Information needs to be provided to farmers at all levels of knowledge. While many farmers today have agricultural college degrees, many are not college educated. 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 for owners of ranches and livestock operations rather than for vegetable and small fruit growers. The target audience for these existing programs could be enlarged to be more inclusive. Farming is a hazardous work environment and if serious accidents befall farmers, temporary or permanent problems for the entire operation could be the result. If the goal is to have the farm continue as a viable economic unit, farmers need to be sure they have adequate management and economic plans to continue after an accident or death of a family member.

Many farmers could benefit from enhanced record-keeping systems, both production and economic. There are courses at community colleges, through computer software companies, local consultants, and extension workshops where growers could learn different methods of recording information to use at a later time. Letting farmers know about various options may encourage them to take steps to improve their record-keeping system. Another concern expressed by several farmers in the study is a lack of familiarity with computers, and also the initial start-up costs to purchase a computer and necessary software. In terms of costs associated with computerizing their records, each farmer will need to determine the value of doing so to their operation. There are courses designed to teach computer skills that farmers can access. Computers with modems can also be used to access distant sources of information, which may increase the value of computers to farmers.

Farmers in 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 needed. A guide specifically for vegetable and small fruit producers could be developed to document the fundamentals of experimental design, analysis, and record-keeping would assist both farmers and extension agents.

Farmers expressed a strong interest in learning from other farmers. For example, conventional farmers are interested in learning how organic growers manage specific pest problems. Researchers and extension personnel can help to facilitate information exchange among farmers through conferences and farm tours.

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

Research needs were also identified through the case study process by farmers and Implementation Team members.

Universities need to assess why farmers do not more fully utilize diagnostic techniques such as integrated pest management (IPM), soil testing, and plant tissue analysis. Data from these analyses might help farmers' make better decisions in planning ways of reducing off-farm inputs. For example, 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 need to be convinced that these techniques do not increase their risk level.

Farmers and researchers expressed great interest in learning more about cover crops. Specifically, research needs to be done on appropriate species for western Oregon and Washington climatic conditions and specific growth characteristics. For both winter and summer cover crops, information is needed on: biomass accumulation characteristics; soil fertility interactions; the ability of different types of cover crops to capture residual soil nitrogen; nitrogen fixing rates of leguminous cover crops; planting techniques and seeding rates; insect pests and beneficial insect interactions; effects of cover crops on weed populations; and economic analysis of the affects of cover crops on farm income and environmental quality. Combinations of fall-planted, spring-grain plus clovers or vetches also deserve further evaluation.

There is considerable information in the scientific literature on the use of beneficial insects to control certain insect pests. However, information is needed on practical cost-effective means of augmenting beneficial insect populations on farms.

During the WFCS entomologists noted that in some organic fields where insecticides were not used, there appeared to be significantly higher numbers of some beneficial predator insects than in conventional fields. Farmers participating in the WFCS have 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 select cover crops, insect dynamics and interactions among predators and insect pests could be investigated to determine whether cover crops can decrease pest incidence in vegetable cropping systems. Other studies of host plants grown adjacent to vegetable crops to provide habitat for insect predators to control insect pests without the use of insecticides would also be useful to investigate.

There are few alternatives to chemical control of pests and some of the organic farming operations we studied have experienced significant decreases in yield or crop quality when chemical controls were not used. For example, many organic growers have completely quit growing strawberries because they cannot control fungi problems in their fields. Biological control offers a potential solution to these problems, but there is still much to be learned. Farmers and researchers participating in the study state there is a need for more research in integrated pest control methods. For example, using entomogenous nematodes for maggot control; new strains of BT for cucumber beetle control, and possibly for maggot control; an in-depth examination of pest-free planting dates for control of cabbage maggot and other pests is needed.

Conventional growers also 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, heavy reliance on pesticides is risky. To minimize this risk, growers need options that use integrated control measures. Merely doing without inputs such as fertilizers and pesticides is not an end in itself; the goal is to develop a system in which they would not be needed anyway. While a practice may be sustainable from an environmental and resource management perspective it might not be sustainable from an economic perspective. Or, in the words of a grower participating in our study, "it's not a question of feasibility, it's a question of cost" that dictates which practices can 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 have steady employment for workers throughout the growing season. Several growers stated that if they didn't have 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 on a single characteristic, for example, organic versus conventional farming techniques. In our experience, the production practices a farmer uses do not necessarily indicate a philosophical preference, marketing avenues, or economic return.

Ideally, there would have been money available to conduct more biological monitoring of the farming systems under study. For example, information obtained from detailed soil sampling and analysis, disease assessment, insect diversity, energy use, and water use and soil moisture profiles would have told us a tremendous amount about the affects of various production systems and practices. In future studies, money for more detailed biological monitoring should be incorporated into the budget. However, teams conducting WFCS will need to take steps to insure that an interdisciplinary approach is taken: when studies begin to focus on specific aspects of systems it is easy to allow the final product to become a summary of many disciplinary projects.

Sustainable agriculture offers no magic formula for overcoming problems associated with farming. But it points to possible ways of doing so including substituting skilled management, labor, and on-farm resources for off-farm inputs - using known technologies such as crop rotations, cultural controls, IPM, and best management practices.

Increased public concern regarding the affects of agriculture on the environment and the long-term viability of the natural resource base is causing a re-examination of the present agricultural system by private and public institutions. There is an overwhelming political base in urban areas who lack an understanding or concern about where and how food is produced. Can farmers become more efficient? Of course they can - this has, in fact, been one of the highlights of American agriculture. It is why we have so few farmers 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 interested participants can work together to address the issues of agricultural sustainability.

Table 4.1. Overview of general areas of questioning during sondeo visits in March and April 1989 to farmers at 25 farms in western Oregon and Washington.

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

1. What crops are grown? e.g., types & acreage, livestock, other enterprises (such as processing), general production history, length of time in agriculture. What approach is taken to pest problems (to help determine the spectrum of production practices in use).

2. Is farming a full time, year round occupation for primary operator or other household members? (obtain profile of household members and involvement in operation and off-farm activities). Hired labor? seasonal labor changes? off farm employment?

3. Some of the following questions were used to get an idea of how the farmer is coping with change:

   Have production practices changed in the past 5 years? What new practices have been tried and are in continued use? What practices were tried and not found useful? (One approach to get the above information was to ask what major factors have impacted the way the farming operation is run.)

   How have production practices changed in relation to neighbors' practices?

4. How is produce marketed? e.g., fresh market, direct, processed?

5. Involvement in grower organizations or community activities?

6. What is the greatest problem in the operation?

7. How are records kept? computer, hand ledger system?

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

9. Any additional questions or comments?

Table 4.2. An overview of the procedures used in the western Oregon and Washington whole farm case study (WFCS) project

<u>Procedures</u>

1. Form an interdisciplinary implementation team

2. Team agreement on overall study design

3. Conduct sondeo to identify farmer participants

4. Select farms for the WFCS

5. Plan information needs and determine appropriate methods to obtain the desired information
   - Production system information
   - Social and economic information
   - Identify areas of expertise needed to analyze information collected

6. Schedule visits to farms

7. Preliminary data analysis

8. Conduct Farmers' Forum to present preliminary findings and solicit ideas and reactions to findings

9. Prepare written report

10. Determine whether to continue farm monitoring or to end project

Table 4.3. Information collected about each farm during the course of the study.

Farm and Household Description

farm size
cropping mix and history
soil types and topography
marketing strategies
family profile
farming background
perceived strengths and weaknesses

Production Practices Information

cropping history and current mix
crop rotation strategies
livestock management
pest control measures and prevention mechanisms
sources of information
perceived problems and barriers
equipment access

Social and Economic Information Collected About Each Farming Operation

roles of family members in the farming operation
off-farm employment of family members
changes in roles, responsibilities over time
commitment to and identity with farming as an occupation
sources of business management information
personal and business goals
household management
food procurement, utilization and consumption habits
involvement in community and agricultural organizations
land holdings (leased, rented, owned)
equipment, building and land values
capital sources
labor
business organization - proprietorship, incorporated, etc.
business record-keeping system
insurance coverage
estate plans

Table 4.4. Descriptions of farms participating in the western Oregon/Washington whole farm case study.

Size	Primary Crops	Primary Market(s)	No. of Adult Family Members	Primary Method of Production	Typical Rotation
675 acres	vegetable crops	procesing market	hubsand & wife + adult son	conventional	No "typical" rotation. Keeps crucifers out of a field for 3-4 years
500 acres	vegetable crops	processing market, some fresh marketing	husband & wife	conventional	broccoli...corn...beans...wheat...grass seed.... broccoli
100 acres	small fruit production, vegetable crops	fresh market, some direct marketing	single operator, wife works off farm	conventional	4-5 years broccoli, 4 years strawberries, 8 years raspberries
500 acres	small fruit production	processing market	father, 2 adult sons	conventional	2 years cucumbers...2-3 years strawberries... 8+ years in raspberries
3,000 acres	vegetable crops, small fruit, Christmas trees, livestock	processing market	2 generations of family (14 adults)	conventional	No "typical" rotation. Keeps crucifers out of a field for 4-5 years
60 acres	vegetable crops	fresh market	single operator, wife works off farm	certified organic	No "typical" rotation. Keeps crucifers out of a field for 3-4 years
13 acres	market garden, small fruit production	direct marketing, processing market for berries	husband & wife	conventional	No "typical" rotation
22 acres	small fruit production	processing market	single operator	certified organic	No "typical" rotation
850 acres	vegetable crops	processing market	single operator, wife works off farm	conventional & certified organic	No "typical" rotation. Keep crucifers out of a field for 4 years
250 acres	vegetable seed, small fruit production	seed contracts, processing market, some direct marketing	husband & wife	conventional	5-6 year plan, depends on field and crop. No "typical" rotation. Keeps crucifers out of a field for 5-6 years
250 acres	small fruit production, potatoes	processing market, some direct marketing	single operator	certified organic	No "typical" rotation
30 acres	vegetable crops, orchard crops	fresh market, some direct marketing	single operator	certified organic	No "typical" rotation
8 acres in production, plus 18 acres in woodland	small fruit production, sweet corn	direct marketing	husband & wife, wife also works off farm	conventional	No "typical rotation
70 acres	vegetable crops	fresh market, some direct marketing	husband & wife; unrelated partner	certified organic	No "typical" rotation. Keeps crucifers out of a field for 4 years
40 acres	vegetable crops	fresh market	single operator	certified organic	No "typical" rotation
20 acres	vegetable crops	fresh market, some direct marketing	single operator	certified organic	No "typical" rotation. Keep potatoes out of a field for 4 years

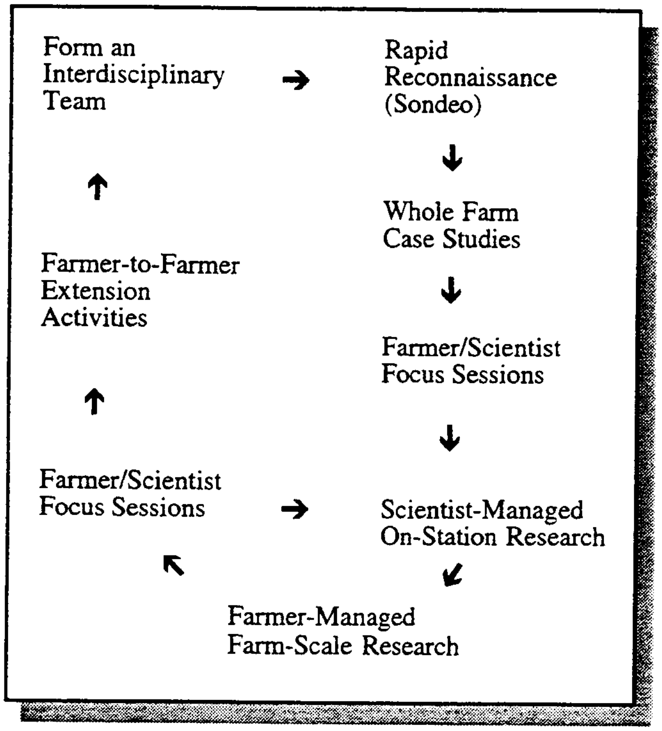

Figure 4.1. The western Oregon and Washington model for increasing farmer involvement in research and educational activities.

Chapter 5

FARM PROFILE: THOMPSON FARMS

FARM DESCRIPTION

On a farm east of Portland, Oregon, Larry Thompson is encouraging weeds to grow in his broccoli fields and spending hundreds of dollars on lime each year. Larry, co-owner of Thompson Farms along with his mother Betty, raises fresh market broccoli, strawberries, and caneberries on their 100 acre farm. Having attractive, fresh produce for sale to local markets and at their own fresh market produce stands is important. So why would they want to encourage weeds and spend money on lime?

The crop mix at Thompson Farms limits rotation options. Raspberry crops can be in a field for 20 years or more, while strawberries are grown for four years before yields drop to an unprofitable level. Over the years, Thompson Farms has developed a strong local market for their produce and Larry searched for management options that would enable him to continue to supply the local markets with the crops traditionally raised at the farm. Larry began managing the farm after his father died in 1983. Since then, he has implemented a strong cover cropping and vegetation management program to enhance soil quality and tilth, and to minimize erosion. Additionally he developed an innovative disease management program for his broccoli fields.

VEGETATION MANAGEMENT STRATEGIES

In the Willamette Valley, it is common for farmers to use a pre-plant incorporated herbicide, usually trifluralin (Treflan) to help control weeds in broccoli fields. Additionally, growers usually end up doing some hand-hoeing or cultivation to control weeds not killed by the herbicide. In some cases, Treflan has been known to adversely affect crop growth and yield. Because of this, in 1985, Larry made the decision to change from a primarily herbicide-oriented weed control program to one that relies primarily on cultivation to control weeds between rows. He direct seeds all of his broccoli, and in-row weed control is done while plants are being thinned. Larry experimented with different row spacings and arrived at a 38-34-34-38 system: two rows planted 34-inches apart, with 38-inches between the next set of rows. This system is based on the wheel base of his tractors (Allis-Chalmers D-14 tractors, numbers 5050 and 6080). When he first implemented this system, he used an in-row spacing of 10-inches between plants. However, Larry notes consumer preferences are changing and smaller broccoli stalks are desired. To accommodate this change in the marketplace, he now thins to 6.25-inches between plants to get smaller-stalked broccoli.

He avoids plowing unless there is lots of "trash" on the field. Field operations for his broccoli fields are generally as follows: (1) in the early spring he subsoils 18 to 24-inches deep in two directions, then allows the soil to settle for a few days; (2) he then disks twice; (3) then disks again with a level (floats); (4) rototills ahead of the seeder while planting; (5) after first true leaf emergence, he cultivates with a reversed disk which cuts soil away from plants leaving the row elevated; (6) he then rototills as necessary between rows to control weeds. In later cultivations, the disks are reversed and soil is thrown back around plants.

When he stopped using herbicide on his broccoli plantings, Larry noticed a weed shift in some fields. Chickweed, *Stellaria media*, a winter annual that was normally suppressed by the Treflan began to grow aggressively in some of his fields about the time harvest began. He looked up information about the weed and determined that it wouldn't interfere with crop growth or harvest, and that it had potential to be a "free" winter annual cover crop. Since that time he has encouraged the chickweed to grow by timing the final cultivation to not interfere with the establishment of the weed (Figure 5.1, page 88). After the last crop harvest he mows the broccoli plants off just above the height of the chickweed, and allows the chickweed to become the dominant species in the field over the winter. The chickweed begins to die off as warmer weather arrives and is easily disked into the soil in the spring when he prepares a seedbed for the following crop.

Larry, long an advocate of cover cropping, has developed a system to overseed cereal rye into standing broccoli in fields where the chickweed does not grow. In his broccoli fields, he overseeds cereal rye at a rate of 65-70 pounds per acre just prior to the last harvest (Figure 5.2, page 89). He notes that by overseeding, rather than waiting to incorporate the broccoli crop and preparing the land for planting the cover crop, he saves money, fuel, and gets an early start on establishment of his cover crop.

Larry recently purchased a 17 acre parcel of land adjacent to his main farm. The land had been used for nursery crops for 23 years. While he hasn't tried to quantify differences, he notes a striking visible difference between the soil on the new parcel and his land that has been under a cover cropping system since 1983. According to Larry, the soils that have been cover cropped for the last several years have a much higher organic matter content and considerably more earthworm activity.

DISEASE CONTROL STRATEGIES

Cruciferous crop growers have to contend with club root (*Plasmodiophora brassicae*), a widely distributed, persistent soil-borne fungus found where plants of the mustard family grow. Crop rotation and soil liming (to raise soil pH) are the primary means of controlling the disease. Most growers in the Willamette Valley use crop rotation as the number one means of control, most using a four year minimum crop rotation. Larry's lack of crop rotation options caused him to look for alternatives. Larry knows that club root's development is completely checked at a pH of 7.8 or above, and tends not to be a major problem in fields with a pH of 6.8 or above. To help manage club root, he applies two tons of lime per acre per year to his broccoli fields. Larry applies the lime after most of the field preparation is done, just before he disks with the floats. "The idea is to keep the lime concentrated in the top few inches of soil, and applied just prior to seeding," says Larry. Soil liming to control club root works because spores of the club root organism germinate poorly or not at all in alkaline media (Agrios, 1978). The pH of the broccoli fields at Thompson Farms averages 7.1. Larry is also aware that water is required for the club root organism to germinate, and about six years ago he modified his irrigation system so that he now waters only when the soil is dry and at intervals of 1/2 hour on, 1/2 hour off until he has applied the amount of water he determines is necessary. He arrived at this approach based on experience and observation. Larry noticed that in areas of the field where water from sprinkler heads overlapped, or in areas that received excess water because of wind drift, the club root problem was more severe than in drier areas of the field. Knowing the spores require excess water to germinate, he decided it made sense to decrease the amount of irrigation applied at one time. Larry reports he has experienced no major losses of his broccoli crop since he implemented this system, even when he has been growing broccoli for 5 years on the same piece of land. Because plants in the seedling stage are more susceptible than mature plants to club root, for the past two years he has been irrigating fields prior to tilling and seeding, and then not applying additional water until the plants are about six-inches high.

When he removes a strawberry planting, typically a four year crop for him, Larry usually rotates the next planting of strawberries to a field where broccoli has been grown. Because Larry crops broccoli on the same field for about four years the club root problem is potentially huge. Plant pathologists note that Larry's club root management system makes sense, but have expressed concern because club root can persist in the soil for many years, even in the absence of a host plant. The search for and development of varieties resistant to club root has been only partially successful. However, at Thompson Farms Larry conducts variety trials on a small scale almost yearly to see how well different varieties grow under his farming conditions. Larry is especially concerned about varietal resistance to diseases such as head rot (*Erwinia caratovara*) and downy mildew (*Peronospora parasitica*), both potentially serious problems in broccoli fields. During the 1993 growing season, they planted seven varieties to compare with the two main varieties currently grown at the farm.

APPLICABILITY OF THE SYSTEM TO OTHER GROWERS

While not all broccoli growers can, or should, adopt the production system described here, several of the practices and approaches employed at Thompson

Farms may be useful to other growers. In terms of determining whether or not to use cover crops, growers need to find answers to many questions to determine appropriate species and varieties. Additionally, if a weed is being considered for use as a cover crop, growers also need to consider the long-term implications of increasing the seed bank in the soil. The questions listed in Table 5.1 (page 90) outline some of the questions growers will need to consider. There will likely be more questions than there are answers. Experimenting on a small scale with several different practices is a good idea before attempting whole-field or farm cover crop usage.

In terms of disease control, growers need to understand the life cycle of the disease, what conditions exacerbate problems, and to look for ways to protect plants through resistant varieties, cultural practices, or other measures. Larry's system of club root control is based on a solid understanding of the disease, his soil conditions, and of broccoli production. He is aware that there is potentially a long-term adverse affect on subsequent crucifer crops, but he is comfortable that he is doing the right thing for his conditions.

Figure 5.1. Chickweed (*Stellaria media*) cover crop in broccoli field.

Figure 5.2. Overseeding a cereal rye cover crop in broccoli field.

Table 5.1. Questions to ask about cover crops before planting.

1. What is the main reason for growing a cover crop?
Production of biomass?
Erosion control?
Nitrogen production?
Nitrogen scavenging?
Pest suppression? *(weeds, insects, nematodes, diseases)*

2. When will I be able to plant?
Into a standing crop?
After harvest?
Late in the growing season?
What seeding rate?

3. What type of seed bed does the cover crop need?
Can it be broadcast seeded?
Will shallow incorporation be effective?
Does it need to be incorporated?
Is it an easy crop to establish?
Have herbicides been applied to the field that will affect the cover crop?

4. How available is seed?
How much does the seed cost?
Is seed supply consistent?
Are there guarantees of seed quality?
Are seed stocks variety identified?

5. How readily do crop residues decompose?
When will nitrogen be released?
Are persistent fibers present?
Are there allelopathic materials present?

6. When will the cover crop be incorporated?
What kind of growth can be expected?
What factors affect cover crop growth?
Will the crop winter kill?
How, or will, the residue be incorporated?
How big is the "window of opportunity" for working in the crop?

7. Does this crop have the potential to become a weed?
Are there hard seeds?
Does it produce rhizomes or other persistent structures?

8. Could this crop carry diseases that might affect the primary crop?

9. Are there diseases that will affect the cover crop?

10. Will the cover crop attract pests?
Gophers?
Insect pests?

11. Will the cover crop attract beneficial insects?

Chapter 6

SUMMARY AND CONCLUSIONS

The work in this thesis describes using whole farm case studies as a means of incorporating farmer knowledge into research and education projects using an interdisciplinary team approach. The process of conducting WFCS successfully brought together a team to address issues of agricultural sustainability for vegetable and small fruit producers in western Oregon and Washington. In terms of interdisciplinary work, there were both positive and negative experiences that will affect individual team members' future work.

Initially we experienced difficulty in developing an interdisciplinary team. Some of the early problems were in identifying individuals who:

1. could foresee adequate rewards for their efforts;
2. were willing to commit time to, what was at that time, a controversial program (sustainable agriculture);
3. perceived they had sufficient administrative support to participate;
4. were willing to relate their expertise to an interdisciplinary sustainable agriculture project; and,
5. were willing to work with scientists and extension personnel across disciplines, state lines, institutions, and commodities.

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 (Appendix C). In response to the question about the usefulness of interdisciplinary team input during farm visits, on average team members rated it as "very useful." Of the 17 surveys returned, on a scale of 1 to 5 (1 = non-productive, 5 = 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 s/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 (i.e., weed science) practices on another discipline's problems (i.e., 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 state time was the biggest constraint, some commented about the lack of direction of the project, and expressed frustration with participating in a study where little institutional rewards are 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 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 of all faculty who could have potentially contributed to the project. In general, researchers were more resistant to becoming involved than were extension personnel. Some researchers viewed this project as being redundant with what extension agents are 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; as one stated, "I know what the problems are, so why should I waste time going to farmers' fields?" For some, project methodology essentially advocated an approach that was 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 rewards did not coincide with the project; they perceived no administrative support; they perceived it as an additional project for which they had no time; no money for station or lab research in the case study process was initially available; or because the project didn't focus on individual's 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 going up for tenure in two years, and I need to get refereed publications in my field."

Several team members felt we attempted to do too much for the first time we tried this type of study. The team selected the 16 farms for the study because they represented a broad spectrum of production practices, scale, marketing approaches, family involvement, opinions, and attitudes. However, the time commitment was the number one disadvantage cited by nearly all team members. The number of farms, team members, and distance between farms resulted in a lack of uniformity on visits to each farm and subsequently to the types of information collected at each farm. Team members indicated that fewer people, both team members and farmers, participating in the study would have increased uniformity of data collection across farms, while enabling team members, collectively and individually, to gain a better understanding of the systems under study. The amount of time required to visit each farm limited the number of visits and farms individual team members could commit to attending. However, 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 is important to understand farmers' motivation for action before evaluating whether or not the action "makes 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, pasture unavailability, lack of adequate fencing, and serious predator problems. To add to the problem, not everyone on the farm even likes sheep: "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," according to one partner. The family recently built an expensive lambing barn, so it appears the sheep will remain part of the operation for awhile. Another farm family began growing broccoli several years ago in order to provide employment for teenagers in their rural area. They currently employ about 30 local high school kids to harvest broccoli from early July until the time school starts in the fall. These examples emphasize the importance of talking with as many family members and other key people at each farm: not everyone perceives problems or motivation for actions in the same light. In the beginning of a study it is difficult to know who to talk with until you've been to the farm a few times.

Implementation Team participants broadened their views of other disciplines, and gained valuable insights into the ways one discipline can complement the other. During the grant writing process, sondeo study, and the WFCS there was a level of interaction among disciplines that is unusual among the various biological and social science fields represented in this project. For example, some team members have been working in their area of expertise for 10 to 20 years, and yet through the WFCS approach they were exposed to many new ideas and components of farming or marketing systems. The previous lack of direct exposure and involvement in interdisciplinary work can partially be attributed to the fact that if university personnel visit farms it is usually to solve a specific production problem or to disseminate information. Some faculty may never visit a farm if their discipline is not perceived to be related to agricultural production. Home economists, for example, working in commercial or home food processing rarely visit farms. With an interdisciplinary approach, however the objective is to understand the system, not to solve a particular problem, through group interaction. For those primarily involved in laboratory research, the case study provided a valuable opportunity for researchers to see the complexity of whole farm systems. For example, to find out that some farmers with less than 50 acres of arable land may have 100 or more plantings per season was a revelation to some team members.

Although team members experienced significant benefits from being involved in an interdisciplinary dual state project there have been 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 is time consuming, and requires 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. As independent scientists, there is much less of this type of interdisciplinary interaction. However, the team approach, and the necessary meetings associated with it, made it difficult to schedule meeting times so all participants could attend. Scheduling meetings was especially difficult because the project was conducted in two states. On a joint state project such as the OSU/WSU whole farm case study, travel time and cost were expensive. 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 as the team became better acquainted the telephone calls became easier.

In later phases of the project, interdisciplinary research techniques were promoted through conferences and in-service workshops. Team members relayed their experiences in conducting WFCS, and encouraged other university personnel to use this approach to better understand problems and constraints at farms, and to better understand why and how to involve clientele in programs. The how-to guide (Chapter 3 of this thesis) was developed to assist other persons interested in conducting WFCS.

One of the objectives of the work described in this thesis was to increase farmer involvement in research and extension programs. The process of conducting WFCS strengthened ties between university personnel and farmers. While the 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 are working with farmers on jointly identified applied research questions. For example, several on-farm and research station experiments are underway that examine cover cropping systems. Farmer participation is a key element of the research projects. Farmers and researchers jointly identify projects, plan work, collect, and analyze information collected. 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 Washington and Oregon the SARE projects have been augmented by private and governmental sources of funding that have greatly increased the scope and amount of work being conducted.

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

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APPENDICES

APPENDIX A

<u>Whole Farm Case Studies: Visit 3</u>

Interview with Primary Operator and Household Manager

A. ROLES AND RESPONSIBILITIES

1. Verification of HOUSEHOLD/FAMILY profile (Skip to Q.2 if known)
   (a) Current Situation
   ____ Adults (Note M/F)

   ____ Children
   Age 15 or over (Note M/F)

   (b) 5 Years Ago (1984):
   _____ Same, except 5 yrs. younger

   Others:

2. How is each INDIVIDUAL INVOLVED in the farm or household operation? (Probe with examples as needed.) What is their financial interest or degree of dependence on the farm business?

Household	Name of Person	Farm Activity	PT/FT Activity

3. Is anyone EMPLOYED OFF THE FARM either part or full time? How does off-farm employment contribute to the family and/or business? (additional income, employee benefit programs, professional challenge, etc.)

Name of Person	Activity/Job	PT/FT

4. Generally, has there been any CHANGE in these roles or responsibilities (or jobs), either on the farm, in the house or on the job in the past 5 years? What are future plans for these roles?

5. What are your PRIMARY ROLES and RESPONSIBILITIES? (Do not read list. Probe as needed). (Note particular domains of responsibility if evident).

_____ LABORER, WORKER	_____ BOOKKEEPER, ACCOUNTANT
_____ FARM REPAIR & MAINTENANCE	_____ INPUT PURCHASER
_____ LABOR SUPERVISOR	_____ BUSINESS MANAGER
_____ FOOD PREPARER	_____ CHILD CARE
_____ HOUSE CLEANER	_____ OTHER (LIST)
_____ HOUSEHOLD MAINTENANCE	_____

6. Have there been any changes in your roles and responsibilities in the past 5 years?

7. Do you anticipate any CHANGES in your roles and responsibilities in the future?

8. What farm activities do you consider "FAMILY EVENTS?" (e.g., picking, harvesting, marketing/selling, preservation, visitor tours).

Changes in the past 5 years?

B. FARMING EXPERIENCE/HISTORY

9. How did you get into farming? Describe events important to your current involvement in agriculture.

10. What SOURCES OF INFORMATION, TRAINING, OR EXPERIENCE have been valuable in managing your household and/or farm business?

C. COMMITMENT TO/IDENTITY WITH FARMING

11a. How do you feel about being a farmer? How has it affected you? (Possible response dimensions)

_____ LIFESTYLE/QUALITY OF LIFE _____ FINANCIAL SECURITY

_____ REQUIRED TRADE-OFFS _____ INCOME LEVEL

11b. Are there any personal trade-off associated with being a farmer?

11c. Would you recommend farming to your children or non-farm friends?

11d. How would you rate your IDENTITY WITH OR COMMITMENT TO FARMING.

0 1 2 3 4 5 6 7 8 9 10
(LOW) (HIGH)

11e. How do you think (spouse's name, if applicable) would respond to these questions?

12. Do you have any plans to pass you farm business on to a family member, or to keep your business in the family?

D. FARM PROBLEMS AND GOALS

13a. What have been your most significant FARM BUSINESS MANAGEMENT PRODUCTION or MARKETING PROBLEMS over the past 3-5 years? (Do not read list. Probe as needed.)

_____ LABOR
_____ FERTILITY
_____ PEST MANAGEMENT
_____ MARKETS
_____ PROFITABILITY
_____ OTHER (EXPLAIN)

_____ ADAPTING TO NEW PRACTICES e.g., manures, cover crops non-synthetic chemicals, lower inputs, rotations
_____ FINANCES, CREDIT
_____ WITHDRAWAL OF CHEMICALS

13b. What do you anticipate in the next 5 years?

14. What is YOUR PERCEPTION of the PRIMARY CAUSES of these problems? [Probe to determine if causes tend to be viewed as "external" (harder to control), or "internal" (easier to control). Do not read list.]

_____ External: weather, interest rates, markets, demand, government policy, technology

_____ Internal: skills, knowledge, timing, planning, personal energy, health, family, management

15. Your feeling regarding the ODDS OF SOLVING THESE PROBLEMS.

Problems LEAST LIKELY to be resolved:

16. Who do you TALK TO and/or LISTEN to when faced with problems?

17. What are your LONG TERM GOALS:
(a) FARM BUSINESS
(b) FAMILY (CHILDREN'S EDUCATION)
(c) PERSONAL
(d) COMMUNITY SERVICE/PUBLIC AFFAIRS

17e. What do you think (spouse's name, if applicable) long-term goals are?

18. Have your goals changed?

HOUSEHOLD MANAGEMENT
FOOD AND HOUSEHOLD SUPPLIES

1. What factors influence your selection of foods and other household supplies. (Do not read list. Probe as needed.)

Food

_____ PRODUCT COMPOSITION
(e.g. Label contents
_____ ADDITIVE FREE
_____ NATURAL/NON-SYNTHETIC
_____ ORGANIC
_____ PACKAGING
_____ APPEARANCE
_____ EASE OF PREPARATION
_____ AVAILABILITY
_____ LOCALLY PRODUCED
_____ NUTRIENT VALUE
_____ SPECIAL DIET NEEDS

Other:

Household Supplies

_____ PRODUCT COMPOSITION
(e.g., Label contents)
_____ BIODEGRADABLE
_____ RECYCLABLE
_____ COST
_____ PACKAGING
_____ AVAILABILITY

Other:

2a. Have you preserved food this year? _____ NO

_____ YES (If YES, what: ______________________

Has this changed in the past 5 years?

3. Do you recycle or compost? Explain.

SOCIAL NETWORKS

4. Are you satisfied with your current level of participation in COMMUNITY ACTIVITIES?

5. Any future plans or goals regarding special interest groups or leadership?

WHOLE FARM CASE STUDIES: VISIT 3
PRIMARY OPERATOR INTERVIEW

1. First, let's talk about LAND. I believe you said you farm ______________ (verify total) acres.

	1989 (acres)	1984 (acres
LAND INVENTORY		
a. OWNED	___________	___________
b. LEASED Or RENTED	___________	___________
TERMS: ANNUAL	___________	___________
MULTI-YEAR	___________	___________
c. LAND USE FALLOW	___________	___________
GREEN MANURE	___________	___________
FOOD CROPS	___________	___________
WOODLAND or NON-FOOD CROPS	___________	___________
PASTURE	___________	___________
IDLE (WILDLIFE)	___________	___________
OTHER (explain)	___________	___________

2. (If some land is/was left IDLE) Why is/was some of your land left idle?

3. What do you think your land base will be 5 years from now?

4. What is the approximate market value of your FARM MACHINERY and EQUIPMENT today, compared to 5 years ago?

Approximate Investment

1989	1984
FARM MACHINERY/EQUIPMENT	FARM MACHINERY/EQUIPMENT
________________	________________
VEHICLES	VEHICLES
________________	________________

5. Equipment Access and Age

Percent

(a)	MACHINERY ACCESS	Owned	Leased	Shared
(b)	EQUIPMENT AGE WHEN ACQUIRED	New	Used	

6. What is the APPROXIMATE VALUE OF YOUR HOME AND FARM RELATED BUILDINGS?

1989	1984
________________	________________

7. If and when you borrow, what are your SOURCES?

CAPITAL PERCENT FROM SOURCE	1989	1984	EACH SOURCE
FAMILY	______	______	______
FINANCIAL INSTITUTIONS	______	______	______
PARTNERSHIPS	______	______	______
OTHER (Explain)	______	______	______

8. Where does your operating capital come from? (Operating capital is used for annual operating expense such as rent, seed, taxes, labor, etc.)

9. How much equity do you have in your farm assets?

In general, do you feel you are earning enough money to live comfortably?

10. What are your LABOR needs now, compared to 5 years ago? Has your need for labor...

_______ INCREASED SIGNIFICANTLY

_______ INCREASED A LITTLE

_______ REMAINED ABOUT THE SAME

_______ DECREASED A LITTLE

_______ DECREASED SIGNIFICANTLY

11. If your labor needs have changed, why is this?

12. What do you do to assure the AVAILABILITY and QUALITY of your labor? DO NOT READ LIST, probe as needed.

_____ Provide housing
_____ Personal support

_____ Provide food
_____

_____ Incentives
_____

13. Any other GENERAL CHANGES in your farm labor situation compared to 5 years ago?

_____ sources, availability
_____ quality, skills
_____ management needs
_____ training needs
_____ purposes
_____ gender
_____ wages, demands
_____ regulations

14. What future changes do you anticipate regarding farm labor? Your needs, expected supply, costs, etc.

15. What marketing channels do you use? List percentage of total volume.

____ Cooperative

____ direct marketing (farmer's market, farm stand, direct to supermarkets etc.)

____ processor

____ other ______________________

16. For your farm, what volume of sales would optimize your profit from each marketing method?

17. What changes do you foresee in how you market and what you grow? What percentage of you production will be organic in 1990?

18a. Who in your family/staff is primarily responsible for managing your marketing? Who actually does the selling?

b. Are there some non-monetary reasons for the types of marketing you do?

19. How is your business currently ORGANIZED?

	1989	1984
PROPRIETORSHIP	______	______
CORPORATION	______	______
PARTNERSHIP (formal, written, signed, etc.)	______	______
PARTNERSHIP (informal)	______	______
COOPERATIVE (formal, written, signed, etc.)	______	______
COOPERATIVE (informal)	______	______

20. What INSURANCE coverage do you carry for you and your family?
    ______ BUSINESS PROPERTY
    ______ BUSINESS LIABILITY
    ______ PERSONAL (FAMILY) LIABILITY
    ______ LIFE INSURANCE
    ______ HEALTH INSURANCE
    ______ FEDERAL CROP INSURANCE
    ______ DISABILITY

21. How are your BUSINESS RECORDS kept? Note if off-farm income/employment contributes and it's importance to business.
    ______ SEPARATE BUSINESS CHECKBOOK
    ______ HAND LEDGER SYSTEM
    ______ COMPUTER BASED SYSTEM
    ______ OTHER, EXPLAIN

22. What kinds of records do you keep
    ______ TAXES
    ______ PRODUCTION

23. RECORD ANALYSIS: Do you prepare financial statements and/or tax returns or do you hire professionals?

    ______ PREPARE STATEMENTS
    ______ HIRE PROFESSIONALS

Interview date:

APPENDIX B

Monthly Labor Profile

Farm identification number: ________________________

Month: ______________

Please estimate the total number of labor hours, both paid and unpaid, for your farm during _________________ month.

____
(family member's name)

Percentage or number of hours of total work time:

Machine Operations _______

Hand Labor _______

Planning/ Supervising _______

Other (________) _______

Family / Partner:______
# of people

Percentage or number of hours of total work time:
______ total hours

Machine Operations _______

Hand Labor _______

Planning/ Supervising _______

Other (________) _______

Hired laborers: _______
# of people

Percentage or number of hours of total work time:
_______ total hours

Machine Operations _______

Hand Labor _______

Planning/ Supervising _______

Other (________) _______

Custom Operators: _______ # of people

_______ total hours

Machine Operations _______

Hand Labor _______

Planning/ Supervising _______

Other (________) _______

Consultants: __________________ # of people

__________________ total hours

Type of consulting work: ________________________________

APPENDIX C

WFCS Team Survey

We would like your assessment of the use of the interdisciplinary research team used in the Whole Farm Case Studies (WFCS). Please take a few minutes to complete this form and return it by December 1, 1990. Send to:

Helene Murray
Dept. of Crop and Soil Science
Strand Ag Hall 202
Oregon State University
Corvallis, OR 97331
(503) 737-5731

1. Usefulness of interdisciplinary team to you during:

	Non-productive		Useful		Very useful	N/A
Biological Visits	1	2	3	4	5	
Farm/Household Management	1	2	3	4	5	

Please list advantages of the interdisciplinary team approach

Please list disadvantages of the interdisciplinary team approach

2. What is your perception of the usefulness of the interdisciplinary team approach to the growers visited?

Non-productive		Useful		Very useful	N/A
1	2	3	4	5	

Comments:

3. Would you use the concept of a team case study again in your work?
Comments:

Would you suggest the team case study approach to co-workers?

Why or why not?

4. How many farms did you visit during:

Farm Name(s) or Number

Biological Visit I: ______________________

Biological Visit II: ______________________

Farm/Household Management Visit: ______________________