The Development of a Research and Extension Program for Sustainable Agriculture in Western Washington

Carol A. Miles

ADDITIONAL INDEX WORDS. sustainable, organic, alternative production, on-farm research

SUMMARY. Sales of organic foods are one of the fastest growing segments of Washington state's food industry. In response to grower demand for information on organic and sustainable production practices, Washington State University (WSU) created an Extension Agricultural Systems position. This position has been instrumental in helping WSU gain the trust and recognition of organic growers. The position enabled WSU to demonstrate that it has a commitment to organic and sustainable research and extension activities. This paper describes the key activities of this position: 1) finding out research needs, 2) on-farm research approaches, 3) formation of regional research programs, and 4) creation of the WSU Food and Farm Connections Team. Grant funded on-farm research, interdisciplinary teams, and extension publications have been major emphases of the position.

National sales of organic foods are increasing 20% to 30% annually, making organic food the fastest growing segment of the food industry (Miles et al., 2000b). In 1998, Washington state's food industry sold over $70 million in organic food. With this increase in production, there is increasing demand from organic growers for universities to provide research-based information suitable for organic production systems. Organizations such as Washington Tilth Association (association of organic growers, Seattle, Wash.) and the Washington Sustainable Food and Farm Network (Bellingham, Wash.) have been gaining a greater political voice in Washington and are making their needs known to legislators and the leadership at Washington State University (WSU). In response, WSU has increased research and extension programming targeted towards organic and sustainable producers.

Washington State University Cooperative Extension, 360 NW North Street, Chehalis WA 98532.

The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

Extension agricultural systems program

In 1994, WSU created an Extension Agricultural Systems position in response to requests from growers in southwest Washington. Position responsibilities included working with organic and conventional commercial agricultural producers, conducting on-farm research, investigating alternative pest control strategies, and developing viable alternative crops. These responsibilities were carried out by 1) assessing research and extension priorities in the region through a survey of small farms; 2) conducting on-farm trials with alternative crops and pest control strategies; 3) targeting extension education towards organic and sustainable growers by forming interdisciplinary regional research and extension programs; and 4) participating in the *WSU Food and Farm Connections Team* (FFCT). This paper will discuss these four program areas.

IDENTIFYING RESEARCH AND EXTENSION PRIORITIES. In 1996, a small farm survey was distributed to 800 farmers in the Pacific northwestern U.S. (Washington, Oregon, and Idaho). Mailing lists for regional extension and small farm newsletters and state organic farmers were used for survey distribution. Of the surveys distributed, 193 (24%) were returned; 50% of respondents were from Washington and 25% were each from Oregon and Idaho. Of the respondents, 138 (71%) represented farms, 10 were farm businesses, 17 were agricultural agencies, and 28 specified themselves as "other". Of the farmer respondents, 71% were organic.

Survey participants were asked to identify pest management and soil fertility research and extension priorities. Respondents identified biological controls, beneficial insects, crop management, cultivation, companion planting, and cover crops as the most important pest management research and extension priorities (Table 1). Cover crops, compost, rotation, intercropping, manure, and microbial conditioners were the most important soil fertility priorities (Table 2).

In 1997, participants at the session entitled *Identifying Research Priorities* at the Washington State Tilth Conference identified potato flea beetles (*Epitrix cucumeris* Harris), potato scab (*Streptomyces scabies* Thaxt.), potato late blight (*Phytophthora infestans* Mont.), cabbage root maggot (*Delia radicum* L.), symphylids (*Scutigerella*

Table 1. The three most important pest management practices identified for research, and the number of respondents (NR) for each.

1st choice	NR	2nd choice	NR	3rd choice	NR
Crop management	32	Beneficial insects	27	Biological controls	30
Biological controls	29	Biological controls	20	Beneficial insects	24
Beneficial insects	18	Crop management	19	Cultivation	15
Cultivation	17	Cover crops	18	Companion planting	15
Companion planting	14	Companion planting	16	Cover crops	14
Cover crops	12	Traps / pheromones	13	Botanical pesticides	14
Botanical pesticides	12	Cultivation	10	Crop management	10
Traps / pheromones	9	Herbicides	10	Traps / pheromones	10
Herbicides	8	Botanical pesticides	10	Trap crops	8
Chemical pesticides	7	Chemical pesticides	8	Chemical pesticides	7
Flaming	4	Row covers	7	Herbicides	4
Trap crops	3	Trap crops	5	Flaming	3
Row covers	2	Flaming	4	Fallow systems	3
Fallow systems	1	Fallow systems	2	Row covers	3
Other	14	Other	4	Other	5
No response	11	No response	20	No response	28

Table 2. The three most important soil fertility practices identified for research, and the number of respondents (NR) for each.

1st choice	NR	2nd choice	NR	3rd choice	NR
Cover crops	38	Rotation	26	Cover crops	25
Compost	37	Cover crops	25	Compost	21
Rotation	20	Compost	25	Intercropping	17
Chemical fertilizers	17	Manure	19	Microbial conditioners	15
Intercropping	13	Intercropping	17	Rotation	14
Microbial conditioners	13	Kelp / seaweed	13	Manure	14
Manure	12	Microbial conditioners	8	Plant / Animal by-products	10
Plant / Animal by-products	6	Chemical fertilizers	7	Kelp / seaweed	9
Biosolids	3	Rock powder	5	Biosolids	8
Rock powder	3	Plant / animal by-products	5	Lime	6
Kelp / seaweed	3	Biosolids	4	Rock powder	4
Lime	0	Lime	4	Chemical fertilizers	4
Other	11	Other	3	Other	5
No response	17	No response	32	No response	41

immaculata Newp.), gray mold (*Botrytis cinerea* Per. ex Fr.), carrot rust fly (*Psila rosae* Fabr.), and western spotted cucumber beetle (*Diabrotica undecimpunctata* Mann.) as the most important pests to study. Pollinators, multicropping, compost production, disease suppressive soils, beneficial organisms, and avian habitat were also identified as important study issues. Findings from the small farm survey and the tilth conference session were used to establish research and extension priorities for organic and sustainable agriculture in Washington.

ON-FARM RESEARCH. An on-farm research program was initiated in 1996 to begin study of alternative pest control strategies, alternative crops, and manure management. A successful on-farm research program is a well-coordinated team effort among growers, industry representatives, and researchers. Growers and industry representatives identify key research issues and collaborate with researchers to design, conduct, and evaluate experiments. A multidisciplinary research team is the ideal working group for on-farm trials as in many cases the research issues involve complex systems that are interrelated and interdependent. Grant funding is critical to the success of on-farm research trials as extra field labor is needed to plant, maintain, and harvest plots. Data collection must be well coordinated with farm timelines in order to preserve the marketability of crops. Treatments must be appropriate to ensure that organic certification of a host farm is not jeopardized. The following studies outline some of the research activities conducted on alternative pest, crop, and soil fertility management.

ALTERNATIVE PEST CONTROL. In 1995, an organic grower identified carrot rust fly as the most significant pest affecting her carrot (*Daucus carota* L. Ann) crop. With the assistance of a Grower / Rancher Sustainable Agriculture Research and Education (SARE) research grant, a medic (*Medicago litoralis* L.) intercrop was assessed as a potential control option (Rämert, 1993). When carrot rust fly damage was measured at harvest, marketable yield in the medic intercrop plots was about 20% greater than in plots that had no intercrop (Miles et al., 1996). The grower, however, decided not to utilize an intercrop because it interfered with mechanical weed management.

In 1996, an on-farm study was initiated to investigate pea root damage on a large, conventional farm growing green peas (*Pisum sativum* L.) for processing. Corn root worm, the larval stage of western spotted cucumber beetle, was identified as the primary cause of root damage in pea (Miles and Amrhein, 1999). This was the first time corn root worm was documented damaging green peas (Miles et al., 1998). In collaboration with pea farmers and processing industry representatives, chemical and biological control options for corn root worm were investigated in processing green peas. The study included three species of entomopathogenic nematodes in addition to several chemical treatments. In this study, the biological control options were as effective as the best chemical control options (Miles et al., 2000a). As a result of this work, an extension publication on the use of entomopathogenic nematodes as biological control organisms is being developed.

Raspberries (*Rubus idaeus* L.) are a high-value crop in western Washington, and root rot (*Phytophthora fragaria* var. *rubi* Hickman) is a severe disease common to both organic and conventional farms. At this time, organic growers have no control options for raspberry root rot, and the current chemical controls for conventional growers are not adequate (Bristow, 1999). In 1999, an organic farmer expressed an interest in testing *Trichoderma harzianum* Rifai and several other products for control of raspberry root rot (Harman, 1996; C. K. Hayes, personal communication). Other treatments included in the study were gypsum (M.P. Pritts, personal communication; Bristow, 1999) and composted manures (Hoitink et al., 1991). The grower regularly applies composted manure to raspberries as an in-row nutrient mulch and was interested in exploring this amendment as a disease control strategy. This study was the first organic research funded by the newly expanded mandate of the Washington State Commission on Pesticide Registration. The new mandate allows commission funds to be used to investigate organic controls and integrated pest management strategies (Schreiber, 1998). Obtaining this funding and carrying out this and similar studies have done much to boost the confidence and support of the organic community towards WSU's research and extension programs.

ALTERNATIVE CROPS. Rapid urbanization of western Washington has resulted in high land values as well as complaints by new neighbors against many common farming practices (e.g., dust, odors, perceived health risks from pesticide applications, etc.). The low market values of conventional bulk-commodity crops along with an increase in the number of small-acreage farms has resulted in increased grower demand for high-value crops. Alterna-

Fig. 1. Hmong farmer selling pea vines, an alternative vegetable crop, at the Pike Place Market, Seattle, Wash.

tive high-value crops investigated in western Washington include edamame (*Glycine max* L.), baby corn (*Zea mays* L.), pea shoots, wasabi (*Wasabi japonica* Miq.), and bamboo (Bambusoideae). On-farm variety trials have been conducted to monitor performance, yield, agronomic and pest issues, and marketing potentials of these crops (Fig. 1). Extension publications have been developed to provide growers with production information. A collaborative effort is underway with a local commercial laboratory to initiate wasabi tissue culture because affordable, disease-free plant material limits wasabi production in the United States. A bamboo variety trial is being conducted in collaboration with the American Bamboo Society (Albany, N.Y.) and the Thurston Conservation District (Olympia, Wash.). The conservation district is interested in the high nitrogen uptake potential of bamboo. If it shows promise, they are potentially interested in promoting bamboo as a manure management tool.

MANURE MANAGEMENT. Most organic growers in western Washington utilize dairy and poultry manure as a nutrient source for vegetable and fruit production. However, many growers are not familiar with the nutrient values of the manure, how to calculate application rates, or how and when to best apply manure. In 1997 and 1998, WSU Cooperative Extension and the Thurston Conservation District conducted an on-farm manure utilization study and published a manure resource guide. The on-farm study included four types of manure (fresh dairy screenings, composted dairy screenings, fresh poultry fryer, and fresh poultry layer) applied at agronomic rates to an organic pumpkin (*Cucurbita pepo* L. 'New England Pie') field. It was demonstrated that pumpkin yields were equivalent in all plots which received manure as compared to plots which received commercial organic fertilizer. The *Manure Resource Guide* (Miles et al., 1999) provides growers with manure nutrient analysis information, examples of how to calculate agronomic rates, guidelines for appropriate manure application, information regarding water quality and food safety issues, and contact information for manure producers in the region. Additionally, on-farm workshops and field events were held for growers, students, and the general public.

Washington State University Food and Farm Connections Team

Formed in 1997, the FFCT is a self-directed regional team of about 25 extension and research faculty that has been supported by the WSU Center for Sustaining Agriculture and Natural Resources. The team was formed to increase interdisciplinary collaboration, to extend faculty's individual expertise throughout the region, and to respond to demands from clientele for information and programming on sustainable food systems. By forming a team, faculty have been able to share resources and expertise where funding, staff reductions, or heavy workloads limit programming opportunities. The mission of the FFCT is to promote sustainable, community-based agricultural systems and provide research and extension programs for growers, consumers, decisionmakers, and others involved in local food systems. Five FFCT members volunteer as executive committee members and meet monthly to discuss program updates, budgets, tasks, and issues. Core team programs include conferences and workshops, a new series of extension publications entitled *Farming West of the Cascades*, a World Wide Web (web) site, and the Urban Community-Based Food Systems Degree / Certificate.

CONFERENCES AND WORKSHOPS. In 1997, the *WSU Small Farm Conference* drew about 500 participants, making this the largest gathering of organic, alternative, and small producers in the state. Conference organizers and many of the presenters were FFCT members. The FFCT is partnered with community groups and agencies to plan and coordinate the 2000 conference, *Farm to Table: Growing Healthy Foodsheds and Communities*. This conference drew about 350 participants, including state and county political leaders, restauranteurs, public health workers, produce buyers, farmers, university faculty and staff, and general consumers.

FARMING WEST OF THE CASCADES. This new series of WSU extension publications is being authored by team members. These publications are targeted towards small growers in western Washington and address organic and alternative production issues. Farm management publications in the series include manure applications, soil management, and record keeping. Crop production publications include edamame, baby corn, pea shoots, wasabi, pastures, and haymaking. Other publications include organic certification, building trust with consumers, value-added on the farm, and nematodes as biological control organisms.

WEBSITE. In 1998, the FFC Team created a Web site (Kropf et al., 1998) as a virtual center for organic and sustainable crop production in Washington. Though this site is still in the development stages, the FFCT strives to provide online information regarding crop and livestock production, publications, a calendar of events, and links to other institutions around the country with the focus on sustainable agriculture issues.

COMMUNITY-BASED URBAN FOOD SYSTEMS. In 1999, a collaborative effort between WSU and The Evergreen State College resulted in a joint course, Community-Based Urban Food Systems. The Evergreen State College is a 4-year institution in western Washington with a focus on sustainable agriculture. The course was advertised jointly and course outlines were posted on the Web (Michael-Butler et al., 1999). Faculty from the FFCT lectured and led field trips that focused on small, organic, and sustainable farms in urbanized communities.

Organic agriculture issues

Similar to other areas of the United States, in Washington state there has been a lack of understanding and trust between organic growers and the land grant university. Growers have complained that extension agents and researchers did not provide information relevant to organic growers. For their part, many organic growers lack an understanding about research, that funding is needed to conduct trials, and that it requires years of testing to draw scientifically valid conclusions. Also, within the organic community in Washington state, there has been little or no consensus regarding where and how to start an organic research program.

At the university level, professors, researchers, and extension agents at land grant universities have been perceived as insensitive and unhelpful regarding the needs of organic growers. Historically, there has been very limited support for organic and sustain-

able education and research at many universities. Core undergraduate curricula generally have not provided significant information about organic and sustainable agriculture or have not provided this information in a positive light. Although elective classes on organic and sustainable agriculture may exist, many students are not encouraged to take these classes. Most faculty at land grant institutions do not have significant amounts of training in organic or sustainable agriculture and are not encouraged to seek training in these areas. Additionally, when many new faculty are hired, often little emphasis is placed on awareness, experience, and implementation of organic and sustainable agriculture. It is encouraging to see state and federal initiatives supporting these issues, but significant funding for organic and sustainable agriculture are urgently needed and will benefit all food production systems.

At the regulatory level, many organic pesticides lack sufficient efficacy data, thus preventing their registration with the state department of agriculture pesticide division. A valuable service that university researchers could provide to organic growers is the inclusion of organic products in standard pesticide trials and the provision of efficacy data to support registration where appropriate. Another issue is that some product formulations prevent the product from being certified organic. An example is biological control substrates, which include greater than the allowable level of synthetic urea. Regulatory agencies could provide companies with formulation limitations and regulations for organic certification.

Maximizing university efforts

Organic farmers need sound research-based information on which to base production decisions. Researchers need to test and study organic pest control and soil fertility options along with conventional options. Research stations need to consider devoting a section of land as organic or sustainable to enable faculty to conduct meaningful studies. University leadership needs to acknowledge and support faculty who are striving to create organic and sustainable programs. In this time of budget constraints and demands for new information, faculty must develop partnerships with other institutions, agencies, organizations, communities, and farmers, and obtain funding for organic and sustainable programs, trials, and publications. Perhaps the biggest challenge of all is that all this must be done while continuing to provide ongoing support to conventional growers. Faculty have a unique opportunity and challenge to develop and promote new information which will have positive impacts on organic as well as conventional agricultural systems. This process will bring together two groups of agricultural professionals who are often seen as dissimilar, though both desire to produce high quality food products while maintaining good stewardship of their land.

Conclusions

The Agricultural Systems Program and the FFCT have helped WSU gain the recognition and support of many organic growers throughout the state. Today, WSU is recognized as striving to support organic and sustainable research and extension activities. The needs of organic farmers in Washington state are being incorporated into a university-based research program and partnerships are being formed among university faculty and organic and sustainable agriculture organizations. These partnerships are perceived as essential for the continuation and further development of university programs for organic and sustainable agriculture. Finally, funding strategies must be developed to enable all university faculty to participate and provide science-based leadership in organic and sustainable agricultural issues.

Literature cited

Bristow, P. 1999. Controlling *Phytophthora* root rot of red raspberry: An integrated approach. Wash. State Univ. Coop. Ext. Pacific Northwest Sust. Agr. Nwslt. 10(4):4–5.

Harman, G. 1996. *Trichoderma* for biocontrol of plant pathogens: From basic research to commercialized products. Cornell Comm. Conf. Biol. Control, 11–13 Apr. 1996. 20 Apr. 2000. http://www.nysaes.cornell.edu/ent/bcconf/talks/harman.html.

Hoitink, H.A.J., Y. Inbar, and M.J. Boehm. 1991. Compost can suppress soilborne diseases in container media. Amer. Nurseryman. 15 Sept.:91–94.

Kropf, J, S. Maier, and C. Miles. 1998. Wash. State Univ. Coop. Ext. Food and Farm Connection. 20 Apr. 2000. http://foodfarm.wsu.edu.

Michael-Butler, L., M. Henderson, and L. Gray. 1999. New community based urban foods systems course. Wash. State Univ. Coop. Ext. Food and Farm Connection. 20 Apr. 2000. http://foodfarm.wsu.edu/foodcourse.

Miles, C., L. Zenz, B. DeWreede, and J. Puhich. 1996. On-farm research: Intercropping in carrots for rust fly control. Grower/rancher Sustainable Agr. Res. Educ. grant final report. 20 Apr. 2000. http://agsyst.wsu.edu/carrot.htm.

Miles, C, T. Wright, and M. Amhrein. 1998. Corn root worm video clips. Wash. State Univ. Coop. Ext. 20 Apr. 2000. http://agsyst.wsu.edu/crw.

Miles, C. and M. Amrhein. 1999. Corn root worm in green peas. Agronomy Abstracts, p. 111.

Miles, C, T. Cheeke, T. Flores, W. Matthews, and J. Clougherty. 1999. From end to beginning: a manure resource guide for farmers and gardeners in western Washington. Wash. State Univ. Coop. Ext. Lewis County Publ. 20 Apr. 2000. http://agsyst.wsu.edu/manure.htm.

Miles, C., C. Chen, C. Blethen, R. Carr, and M. Amhrein. 2000a. Control of corn root worm in green peas. Proc. W. Wash. Hort. Assn. Conv., SeaTac, Wash., p. 35–37.

Miles, C., T. Flores, and M. McEvoy. 2000b. Organic food production and certification in Washington state. Wash. State Univ. Ext. Bul. EB 1888.

Rämert, B. 1993. Mulching with grass and bark and intercropping with *Medicago litoralis* against carrot fly (*Psila rosae* F.). Biol. Agr. Hort. 9(2):125–133.

Schreiber, Allen. 1998. Washington State Commission on Pesticide Registration response to the Food Quality Protection Act. 20 Apr. 2000. http://www.wscpr.org/foodqual.html.