Certified Organic Farming Principles and Practices: A Course Linking Farmers and University Students

Victoria Mundy Bhavsar*

ABSTRACT

Certified organic food and fiber production is an important part of the agricultural economy. A course at the University of Kentucky was developed and focused specifically on organic farming. Course goals included increasing students' agronomic knowledge and their ability to consider farms as ecosystems, and fostering respect for farmers. The course sought to balance the personal, holistic methods of thinking used by alternative agriculture practitioners and the formal, objective approach of the land-grant university. Farmer expertise was essential. Students read case studies of organic farms, spoke with farmers by conference call, and visited local organic farmers. As they learned from farmers, students also considered information from the formal scientific literature to strengthen their understanding of ecological and social interactions in organic farming. Students visited local organic farmers and presented their own farm case studies to the class. Students wrote papers recommending research-based solutions to production problems faced by their farmers. Students reported that they learned about diverse agricultural techniques, found that many farm systems fall under the organic umbrella, and learned that farmers have many motivations for using organic practices. Some students stated intentions to try organic methods on their own gardens, buy more organic food, work in urban gardens, educate people about organic farming, and support sustainable agriculture in careers as agricultural professionals. Students reported new appreciation for nonquantifiable *quality of life* issues such as how people spend time, new awareness of humans' interaction with the natural environment, and new recognition of their responsibility for their actions.

CERTIFIED ORGANIC[1] food and fiber production is an increasingly important part of the world agricultural economy. Certified organic farming requires the use of practices that protect on-site and off-site environmental quality and create favorable conditions for biological activity on the farm. The use of most synthetic agricultural chemicals is prohibited. In the USA, organic farming contributed approximately $4 billion to the agricultural economy in 1997 and has grown about 20% annually thereafter, reaching $7.8 billion in 2000 (Greene et al., 2000). Organic land area in the USA has doubled in the 1990s, reaching 538 623 ha (1 346 558 acres) in 1997, or 0.2% of total U.S. cropland (Greene, 2000). At least 5024 U.S. farmers were certified organic in 1996 to 1997 (OFRF, 1999), with more farmers probably using organic methods but choosing not to certify. Organic farming is more prevalent in Europe and Australia; 1.5% of European cropland is organic, while 10% of farmers in Australia are certified organic (Greene et al., 2000).

Because of the growing importance of organic farming, faculty in the curriculum committee for the plant and soil science major at the University of Kentucky (UK) decided that a class on the topic was needed. At the time of this writing, less than 10 other semester-length, student-oriented courses on certified organic agriculture exist in colleges of agriculture at American land-grant universities (LGUs) (OFRF, 2001), although many full-length courses focus on agroecology or sustainability and many short workshops about organic farming exist for agricultural professionals or community members. Several LGUs have student gardens that may or may not be certified organic (OFRF, 2001). This class is unusual among LGU course offerings and is the first class at UK to focus specifically on organic farming methods. This paper describes the course objectives, methods, student response, and learning results.

STUDENT AND INSTRUCTOR DEMOGRAPHICS

The course, PLS 597 Certified Organic Agriculture Principles and Practices, is designated as a senior undergraduate and junior graduate elective course (500 level). The *97 number denotes a new or experimental course that has not yet been internally reviewed. The course was first taught in spring 1999 and repeated in spring 2001. Enrollment was 50 to 60% of other 500- level agronomy courses, probably because it was a purely elective course. Table 1 presents student demographics. The instructor is currently a Ph.D. candidate in soil science, with background in international agricultural development, forage systems, teaching, and cooperative extension.

ORGANIC FARMER CHARACTERISTICS

Farmer expertise was a fundamental aspect of the course. We spoke by teleconference with 11 farmers in 1999 and 8 in 2001. Table 2 presents farmer demographics. Cooperator farmers were located through sustainable agriculture websites, listserves, publications, and personal contacts. A variety of farm enterprises from as wide a region as possible were included. Far western states were not included because personal farmer contacts in that region were limited. In 2001 the class met at 0800 h Eastern time so we could not easily speak to producers in the Mountain and Pacific time zones.

Organic farmers report that their main sources of information, data, and encouragement are other farmers. Because organic farmers depend on one another for expertise and mentoring, and because farmers are the true experts about farm systems, our class followed suit. This class gave some organic

[1] In this entire paper, *organic* means farms, farming practices, farmers, and soils that occur on these farms, that follow national standards for certified organic production as legislated by the 1990 Federal Organic Foods Production Act.

Department of Agronomy, N122 Agricultural Sciences North, Univ. of Kentucky, Lexington, KY 40546-0091. Received 6 July 2001. *Corresponding author (toria@uky.edu).

Published in J. Nat. Resour. Life Sci. Educ. 31:20–24 (2002).
http://www.JNRLSE.org

Abbreviations: UK, University of Kentucky; LGUs, land-grant universities; CSA, community supported agriculture.

Table 1. Student demographics.

Year	Level	Major/career	Credit	Interest in class
1999	Junior	NRC†	A–F	Commitment to environmental health
	Junior	NRC	A–F	Commitment to environmental health
	Senior	NRC	A–F	Commitment to environmental health
	Senior	NRC	A–F	Commitment to environmental health
	Senior	NRC	A–F	General interest in new topic
	Senior	NRC	A–F	General interest in new topic
	Senior	English	A–F	Personal commitment to organic foods
	M.S.	Crop science	A–F	General interest in new topic
2001	Junior	Animal science	A–F	General interest in new topic
	Senior	NRC	A–F	Interest in organic techniques for family farm
	Senior	NRC	A–F	Commitment to environmental health
	Senior	NRC	Sit-in	Commitment to environmental health
	Senior	NRC	Sit-in	Commitment to environmental health
	M.S.	Soil science	Audit	Interest in organic techniques for family farm
	M.S.	Soil science	Sit-in	General interest in new topic
	Post-bac.	German	Sit-in	Personal commitment to organic foods
	Post-bac.	Massage	A–F	Personal commitment to organic foods

† NRC, Natural Resource Conservation curriculum.

Table 2. Farmer demographics.

Year	State	Organic hectarage†	Main crops	Topic covered
1999	KY	120	Various crop research	General organic production
	KY	3.1	Vegetables	Managing a CSA‡
	KY	1.2	Vegetables	Soil improvement
	VA	480	Soybean‡, strawberry, vegetables, grains	Soil improvement
	TN	92	Cotton, grains, pecan	Cotton production
	AR	1.8	Flowers, vegetables	General production methods
	MO	240	Grains and cotton	Weed control methods
	NC	52	Vegetables, soybean	General production methods, social capital
	ND	1200	Grains	General production methods, social and political issues
	NE	600	Grains	Dryland production
	NE	64	Grains, livestock	Crop rotations
2001	KY	2	Vegetables, greenhouse	CSA management
	KY	0.8	Vegetables, greenhouse	Unheated greenhouse production, direct marketing
	GA	~16	Vegetables	Soil improvement
	MI	10	Vegetables and poultry	Social and political issues
	NE	64	Grains and livestock	Crop rotation, rotational grazing
	NE	~120	Grains and livestock	Social and political issues
	TX	2	Vegetables and flowers	Urban farming and marketing
	VA	16.4	Vegetables and livestock	Organic plant disease control

† Includes actively farmed land and managed pasture. In 2001, hectarages of the Georgia farm and one Nebraska farm were not recorded; hectarage given is estimated.
‡ CSA, community supported agriculture, community subscription farms, or community gardens.
§ Soybean [*Glycine max* (L.) Merr.], cotton (*Gossypium hirsutum* L.), strawberry (*Fragaria* sp.), and pecan [*Carya illinoensis* (Wangenh.) K. Koch].

farmers an opportunity to explain how their values and ideals affect the farming practices they choose.

Beus and Dunlap (1990) first articulated several key elements of the *alternative agriculture paradigm*. These include independence, decentralization, community, harmony with nature, diversity, and restraint. Chiappe and Flora's (1998) interviews with women in alternative agriculture added spiritual and familial elements to the original list.

Farmers who identify themselves as *alternative* or *sustainable*, including many organic farmers, generally prefer to be independent of outside inputs. They replace purchased products, borrowed money, and government programs with personal knowledge and skills. No farmer we spoke with participated in commodity support programs. Decentralization leads to developments such as direct marketing to customers and is often hand-in-hand with community-building enterprises such as subscription farms (community supported agriculture, CSA) or community gardens. We spoke with several farmers who participated in such activities. Harmony with nature implies minimizing adverse environmental impact, specifically by limiting the use of harmful substances and deliberately encouraging soil improvement, a priority of every farmer we interviewed. An attitude of restraint requires that all external costs of production be considered, including the possible off-farm impact of farming practices, and encourages the use of renewable energy sources. The spiritual aspect, if it exists with a particular farmer, tends to be expressed in the attitude that good land stewardship is integral to one's spiritual practice. At least two farmers we talked with were very open about how their religious convictions affect their farming choices.

Profitability and productivity are also critical to organic farmers. The farmers we interviewed constantly cited cost-minimization, yield enhancement, and price enhancement as reasons for their agronomic and marketing choices.

COURSE GOAL AND OBJECTIVES

The course goal in both 1999 and 2001 was to "foster agronomic disciplinary knowledge, encourage ability to consider a farm as an ecosystem, encourage respect for practitioners of organic and conventional farming, and foster creativity."

Specific content objectives included:
- Name and describe a wide variety of organic production practices.
- Relate production practices to ecological principles (water, energy, nutrient cycles, and succession).
- Discuss socio-political factors (e.g., available markets, access to information and credit, and social pressures) involved in organic farming.

Skills objectives included:
- Analysis of farming systems by tracing energy, nutrient, and water cycles.
- Critique of research related to organic farming.
- Interviewing, public presentation, teamwork, and library and Internet research.

COURSE METHODS, GRADING, AND ASSIGNMENTS

The class followed a similar, general pattern in both years, but was more fully developed in 2001. The main issues in organic production chosen for lecture were based on data reported from organic farmers themselves and published by the Organic Farming Research Foundation (OFRF, 1999). Table 3 gives a simplified list of topics covered in 2001. Lectures on each issue were used to provide background. Students read case studies of organic farms or other materials and then talked to selected farmers by teleconference during class time. Students searched out, critiqued, and applied formal scientific research literature to specific topics raised by conversations and readings. Although organic farmers were the primary source of information about organic farming practices, we

Table 3. Topics in PLS 597: Certified Organic Agriculture Practices and Principles.

History and definitions of certified organic agriculture
Agroecosystem processes and overview of organic farming techniques
Soil organic matter management and quality
Composting, cover cropping, manure, mulch, microbial inoculants
Organically certified soil fertility sources
Hydroponic vegetable production with organic nitrogen sources
Integration of livestock—rotational grazing, pastured poultry
Weed control techniques
Rotation, smother crops, planting date
Mechanical control, weeder animals, flaming
Biological pest control
Conservation of habitat, beneficial organism releases, trap cropping
Bacillus thuringiensis, insecticidal soaps, organic insecticides, pheromones
Biodynamic agriculture
Philosophy, biodynamic preparations, Demeter certification
Organic certification process and USDA new rules
Marketing and economics
Community supported agriculture, farmers' markets, wholesaling
Social issues in organic farming
Beginning farmers, barriers to organic farming
Local food security, consumer connection with food, urban farming

used scientific literature because such work does in fact have a great deal to offer organic farmers.

In 1999 we met for 3 h once a week, whereas in 2001 we met for 75 min twice a week. The second format was preferable for maintaining classroom energy and we scheduled field trips on weekends. In 1999, we took three field trips to nearby Kentucky organic farms; in 2001 we took two field trips. In both years we also visited the local natural foods store, a good outlet for regional organic produce. In 1999, the class went on a 7-d field trip after the semester ended, visiting organic and sustainable farms from Lexington, KY, to Kutztown, PA, the site of the Rodale Institute Experimental Farm. Students received one extra credit hour for completing this trip. We were unable to travel in 2001 due to students' time constraints.

Course assignments were similar in both years, but grade increments changed and assignments were more clearly described in 2001. Students read extensively outside class. Readings included Internet sites, formal journal articles, some popular periodical articles, and book chapters. Two or three readings were assigned per class session. Students read ahead of time and wrote questions or reactions to the materials. This written work accounted for 16% of their grade. Grade credit provided incentive for students to learn more material than could be covered in lecture and encouraged class preparation. There were no problems with students coming unprepared or being unwilling to participate. The grade increment for this activity will be lowered next time the course is taught. Although this tactic worked well, 500-level students do not need that much credit incentive to read outside class.

Approximately 2 h were spent each week electronically responding to student comments, concerns, and questions. All remarks were sent via email to the entire class. We rarely discussed specific readings in class, but readings reinforced lecture material or considered it from different angles.

Short, informal writing assignments accounted for 12% of the grade. These quickly graded papers helped students develop the course skill objectives described above. Assignments required students to consider data from various sources and make decisions on different issues. For example, one assignment asked them to discuss the strengths and weaknesses of a particular research project. A second assignment required them to articulate the difference (if any) they saw between *sustainable* farms and *organic* farms. Students were not required to fulfill the assignments in writing if they would rather communicate in other ways such as oral presentations, posters, or photo-essays. All students did choose essays for all assignments, probably due to the familiarity of such work. When the course is taught again, students may be required to complete at least one assignment without writing essays.

For a second 12% increment of the grade, students located at least three papers from formal, peer-reviewed scientific literature. Papers had to address a question raised in class. If a popular press article piqued a student's interest, the student had to find a related journal article. Each journal article had to be approved by the instructor. Each student chose one journal article to present to the class. This presentation included a summary of objectives, methods, and results; critique of the research quality; discussion of the relevance of the research to organic farmers; and discussion of potential future questions. The other two journal papers were photocopied and provided as extra materials for the class's information, sometimes with a few sentences of commentary from the student or instructor.

The main part of the grade in both years (e.g., 56% in 2001) included two parts: a farm visit and case study and a research paper suggesting solutions to a problem occurring on that farm. For the case study, the farm system had to be described carefully, including physical features and resources, crops produced, soil and pest management methods, and marketing strategies. Next, the farmer's reasons for some significant choices had to be explained; for example, if an organic dairy farmer chose to have cows (*Bos taurus*) graze alfalfa (*Medicago sativa* L.) rather than to cut the forage for hay, students would describe why the farmer felt this choice contributed to the efficiency of the whole system. Finally, students chose one issue—such as cultivation for broadleaf weed control or pheromone traps for insect pests—for detailed consideration. They found relevant information in the scientific literature and wrote a short literature review. The purpose for the review was not to prove the farmer right or wrong, but to put his or her work in perspective. Students presented their case studies orally to the class and were graded together. Grades were based on quality of presentation and quality of information (completeness and research basis).

For the second part of this major assignment, each student identified a production or marketing problem that his or her farmer faced. Partners could choose different farm issues or the same one, including the issue considered in the literature review described above. Each student researched the problem and made recommendations for solutions, evaluating the suggestions for impact on the farm system. For example, if flaming was suggested for a weed problem, one consequence might be the need to buy new equipment. When acceptable to the instructor, students' papers were sent to the farmers for potential use. Papers were graded on writing quality, quality of information, and discussion of pros and cons of the proposed solution.

In both years the remainder of the grade (e.g., 4% in 2001) was given by peer grading. Students anonymously evaluated one another's contributions to the class as a whole. This fraction of the grade was small but had an impact if a student was

Table 4. Selected course evaluation questions and mean student ratings.

	Organic agriculture		Other PLS 597 courses		Other PLS 500 level courses	
	1999 $n = 8$†	2001 $n = 8$	1999 $n = 8$	2000 $n = 55$	1999 $n = 39$	2000 $n = 27$
Rate the overall value of this course. ‡	3.1	3.7	3.5	2.5	3.4	3.0
I gained an understanding of concepts and principles in this field.§	3.3	4.0	3.5	3.0	3.4	3.2
The course strengthened my ability to analyze and evaluate information. §	2.9	3.6	3.4	2.8	3.3	3.1
The course helped me to develop the ability to solve problems. §	2.7	3.3	3.2	2.8	3.3	3.1
I learned to respect viewpoints different from my own. §	3.3	3.6	3.2	2.9	3.3	3.0
The assignments helped me to understand the subject. §	3.6	3.9	3.4	2.6	3.4	3.1

† n, Total number of students responding.
‡ Students answer poor, fair, good, or excellent, corresponding to a 4-point scale where 1 is poor and 4 is excellent.
§ Students answer strongly disagree, disagree, agree, or strongly agree, corresponding to a 4- point scale where 1 is strongly disagree and 4 is strongly agree.

near a grade cutoff. Peer grading was used because the class was so participatory in other ways that for the instructor to retain sole control of grading would be inconsistent.

STUDENT RESPONSE AND LEARNING RESULTS

Table 4 presents selected course evaluation questions from the standard university course evaluation form. Data is given for this course for spring 1999 and spring 2001, for all other PLS 597 courses taught in spring 1999 and spring 2000, and for all other PLS 500-level courses in spring 1999 and spring 2000. Course evaluations for spring 2001 were not available at the time of this writing for other classes, so spring 2000 is substituted. For each evaluation question, this course scored higher in 2001 than in 1999, partly due to course development and partly to the different student group. Table 5 presents written student comments, coded by category, from the university course evaluation form for this course.

Using open-ended questionnaires, students in 2001 reported what content was most significant. These comments are not coded because they were very individual, and cannot be attributed to specific students because questionnaires were anonymous. Selected comments follow and are chosen to give a broad range of student responses. Statements are edited for clarity.

- Learned specifics about different farming practices.
- Learned about unconventional marketing methods, i.e., direct marketing.
- Gained perspective about organic farming economics, both farm-level and global.
- Learned that many different farm systems fall under the organic umbrella.
- Learned farmers have many motivations, including spiritual, for using organic practices.
- Realized the importance of soil and methods of soil building.
- Realized that *food* and *agriculture* are different issues.
- Learned how animals are incorporated into systems.
- Learned that USDA draws distinctions between *food marketing* and *food quality*.

Table 5. Student comments.

Year	Comment	No. of students agreeing
1999	More science and data needed.	1
	Meet more than once weekly.	2
	Clarify and organize assignments better.	2
	Hands-on activities, promote group discussion.	2
	Ease up on grading.	2
	Field trips and farmer interviews were a good learning tool.	4
	Course was enjoyable, will be better next time.	5
2001	I learned how to find research and view questions in terms of science.	1
	Too many/too large reading assignments.	2
	More hands-on activities.	2
	No need for tests and quizzes; reading and writing assignments are appropriate.	2
	Timely; wish more people were interested.	2
	Field trips and farmer interviews were a good learning tool.	3
	Course was enjoyable, learned a lot.	5

The most successfully met course skill objective was learning to find quality research papers. One undergraduate student wrote that she "had never learned" to locate research for herself before. Two students commented that they especially valued learning to find and interpret science-based information for themselves, a skill they will be able to use in other areas. Students' selections for papers to present to the class were appropriate. No proposed paper has been rejected, although students were encouraged to seek papers outside their particular interest areas.

The least successfully met course skill objective was analysis of farming systems. In farm case study presentations, students tended to limit their discussion to one or two issues, such as an interesting enterprise or a particular lifestyle choice. Students did not demonstrate how farm enterprises fit together or how farm physical resources might make lifestyle choices possible. When recommending solutions for farm problems, only one or two students each year managed to explore the impact of a proposed solution thoroughly. Most papers explained one consequence in detail while ignoring other potential impacts. For example, one paper recommended neem (*Azadirachta indica* A. Juss.) oil for cucumber beetle (*Acalymma vittatum* and *Diabrotica undecimpunctata howardi*) control, but never mentioned that neem oil is a disease control agent. This was an important omission since we had discussed neem oil use several times. When the course is taught again, more attention will be paid to developing this skill objective.

CRITICAL EVALUATION

One purpose for this course was to create a bridge between the university community and the organic farming community. The organic farmers we spoke with in Kentucky were pleased to learn that UK students are interested in their work since some organic farmers have felt excluded by UK (personal communication with farmers, 2001) and organic farm research has not been a priority in the national LGUs realm (OFRF, 1997). One farming couple sent emails asking us to keep in touch and saying how encouraged they felt after talking with us.

A second purpose for the course was to encourage respect for practitioners of farming. Students valued farmer contact more than any other part of the class, since this provided "the

best insight into the reality of organic farming" and they could "take ideas home to [their own] farm." The emphasis on farmer expertise was educationally appropriate. Farmers are the true experts in organic farming, with day-to-day experience that these students found compelling. Farmer expertise was critical for the students to learn practical information, especially in the absence of a university garden for hands-on experience.

Using farmers as experts in this class was also appropriate to the alternative agriculture paradigm, which emphasizes personal experience and farmer-to-farmer education. Organic farmers obtain much production information from their own experience with their farms, investigating different practices and observing events on their land. Farmers are considered critical actors and creators of information in the alternative system, not passive recipients of knowledge from outside (Lockeretz and Anderson, 1993).

The university community values experimentation nearly to the exclusion of personal experience. Anecdotal information is suspect. This course attempted to help students to bridge the university paradigm and the alternative paradigm for information. Since organic farm systems are very site specific, personal experience and interpretation of data are imperative. Carefully designed studies can provide objective information upon which to base personal interpretation of site-specific occurrences.

Students dealt with both types of knowledge and used them to complement one another. Students began by listening to farmers' experience and knowledge, then searched the formal scientific literature for relevant information. This ensured that the science-based information they found focused upon questions important to the farmers they learned from.

Responding to farmers' actual, expressed needs was an important learning experience for students. They were asked to learn information for a purpose beyond their own benefit. They had no tests or exams that required them to assimilate information for the sake of doing so; instead, the information they sought was useful to the class as a whole and to the farmers they visited. Because the university is a service institution to the farmers of the state, the students participated in the purpose of the university when they provided information to their farmers.

In 2001, students reported steps they might take in their personal or professional lives after the class and what they learned in areas other than farming. These comments are not coded due to individuality and cannot be attributed to specific students due to anonymity.

- Grow food at home, compost, and complete the cycle.
- Go to a school with more focus on organic methods.
- Was up-front about support for alternative farming methods in an interview for a cooperative extension position.
- Be more cautious using chemicals [on the farm].
- Try to eat more organic.
- Diversify farm.
- Work on an urban garden and with children.
- Learn different options to help small farmers; community awareness is key.
- Better appreciation for quality of life issues.
- More responsibility for [personal] actions.

Although most students already embraced the alternative agriculture paradigm, their responses indicate that this course stimulated them to consider new activities or ideas.

CONCLUSION

This course fulfilled its main goals of fostering disciplinary knowledge and encouraging respect for farmers. The goal of helping students consider farms as complex ecosystems needs further time and development. Students bridged the gap between the university and the organic farming community as they provided scientific information to farmers from whom they learned practical details of organic farming. Agriculture students considered the course an enjoyable addition to their curricula, while nonagriculture students appreciated learning more about the organic food that they are committed to eating. Future plans for this course include sending it through official university review channels so that it may be listed as a regular course offering in the university catalogue.

The course provided a balance between the very different modes of thinking between alternative agriculture practitioners and land-grant university researchers. After hearing directly from farmers, students used the formal scientific research of the university community to strengthen their understanding of the complex ecological and social interactions of the organic farms they studied.

REFERENCES

Beus, C.E., and R.E. Dunlap. 1990. Conventional versus alternative agriculture: The paradigmatic roots of the debate. Rural Soc. 55:590–616.

Chiappe, M.B, and C.B. Flora. 1998. Gendered elements of the alternative agriculture paradigm. Rural Soc. 63:372–393.

Greene, C. 2000. U.S. organic agriculture gaining ground. Agric. Outlook 270:9–14.

Greene, C., C. Dimitri, and N. Richman. 2000. Organic marketing features fresh foods and direct exchange. Food Rev. 24(1):31–37.

Lockeretz, W., and M.D. Anderson. 1993. Agricultural research alternatives. Univ. of Nebraska Press, Lincoln, NE.

Organic Farming Research Foundation. 1997. Searching for the "O" word: Analyzing the USDA Current Research Information System for pertinence to organic farming. OFRF, Santa Cruz, CA.

Organic Farming Research Foundation. 1999. Final results of the third biennial national organic farmers' survey. OFRF, Santa Cruz, CA.

Organic Farming Research Foundation. 2001. State of the states: Organic farming systems research at land grant institutions 2000–2001. OFRF, Santa Cruz, CA.