Integrating environmental awareness and sustainability issues in a beginning agronomy course

Richard E. Mullen
Iowa State University, remullen@iastate.edu

Robert B. Lindemeyer
Iowa State University

David L. Graf
Iowa State University

Follow this and additional works at: http://lib.dr.iastate.edu/leopold_grantreports

Part of the Agricultural Science Commons, Agriculture Commons, Agronomy and Crop Sciences Commons, and the Scholarship of Teaching and Learning Commons

Recommended Citation
Mullen, Richard E.; Lindemeyer, Robert B.; and Graf, David L., "Integrating environmental awareness and sustainability issues in a beginning agronomy course" (1995). Leopold Center Completed Grant Reports. 71.
http://lib.dr.iastate.edu/leopold_grantreports/71
Integrating environmental awareness and sustainability issues in a beginning agronomy course

Abstract
Agriculture in the United States is a science-based, highly technical field that has significant impact on society and the larger ecosystem, both nationally and internationally. As new technologies and challenges continually emerge, educational and research efforts in agriculture have been and will continue to be key to the success of agronomic systems. At the same time, human labor in U.S. agriculture has decreased rapidly; less than 2% of the population is directly involved in agricultural production. Rapid technological change and declining farm populations suggest that we are becoming a nation largely illiterate in agricultural and sustainable production issues.

Keywords
Agronomy, Human systems, demographics and beginning farmer programs

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences | Scholarship of Teaching and Learning

This article is available at Iowa State University Digital Repository: http://lib.dr.iastate.edu/leopold_grantreports/71
Integrating environmental awareness and sustainability issues in a beginning agronomy course

Background

Agriculture in the United States is a science-based, highly technical field that has significant impact on society and the larger ecosystem, both nationally and internationally. As new technologies and challenges continually emerge, educational and research efforts in agriculture have been and will continue to be key to the success of agronomic systems. At the same time, human labor in U.S. agriculture has decreased rapidly; less than 2% of the population is directly involved in agricultural production. Rapid technological change and declining farm populations suggest that we are becoming a nation largely illiterate in agricultural and sustainable production issues.

The success of future efforts in agricultural education will depend on the development of new emphases, learning environments, and methodologies. Trends in the last decade indicate that (1) environmental concerns and sustainability issues will become increasingly important in maintaining a viable and productive agricultural food system for the future; (2) agriculture will rely on an increasing portion of urban students enrolling in agricultural curricula to meet the needs of the agricultural industry; (3) the varied backgrounds of incoming students and the explosion of technological knowledge will require more advanced, efficient methods of instructional delivery and learning than traditional college instructional methods; and (4) educational opportunities need to be expanded to off-campus audiences to upgrade and maintain a critical level of agricultural competence among the work force.

Current college-level instruction in agriculture relies heavily on traditional lecture-laboratory method and emphasizes industrial agricultural technologies that lack sensitivity to environmental concerns. Traditional methods are geared for on-campus students and students with conventional agricultural backgrounds and learning needs. Course material is generally inaccessible to nontraditional students. Thus, agricultural universities have a unique opportunity—and responsibility—to adapt new methods of agricultural topics to the contexts of environmental awareness and sustainable practices.

Past efforts to sensitize students to environmental issues and sustainable agricultural practices have resulted in courses concentrating specifically on these issues. Such courses primarily attract and serve students already aware of the issues being addressed. Introductory agricultural courses and textual material that are developed with traditional emphasis on conventional agricultural technologies seldom address environmental issues and sustainability concepts. This project integrated environmental issues and sustainable concepts into an existing introductory course using video-enhanced learning modules. The objectives were

1. to expose a large number of agricultural students, ranging from the environmentally sensitive to environmentally nonsensitive, to sustainability concepts;
2. to promote sustainable practices and concepts as an integral part of existing agricultural systems, rather than as separate and parallel issues; and
3. to develop educational materials, such as posters, displays, video footage and video-enhanced learning modules, that will be useful both for an introductory class audience and for the educational efforts of the Leopold Center and other institutions that target a wide range of public audiences.
Approach and methods
This project redesigned all of the components of an introductory agronomy course, "Principles of Crop Production." Extensive revisions that incorporated environmental issues and sustainable practices were integrated into the textbook, lecture material, and lab displays and readings, as well as the videos. The following chart details the changes in focus and the environmental issues and sustainability concerns that were addressed in each chapter.

Agronomy 114, Principles of Crop Production
Chapter and changes, issues, and concerns addressed

1. **Crop plant anatomy**—Basic terminology—essentially unchanged

2. **Crop plant classification/identification**—"Indigenous" and "exotic" in terms of plant species; genetic diversity; agronomic uses of crops in sustainable systems (cover and companion crops); concerns about dependence on annual crops vs. perennials; crop selection for environmentally stressed areas, erosion control, rotations to reduce chemical use

3. **Crop physiology**—Physiological concepts that encourage application of sound management practices

4. **Climate**—Ecosystems and the impact of agronomic systems on larger ecosystems, especially in terms of micro and macro climate changes, including global warming, ozone depletion, acid rain, desertification

5. **Soils**—Soil tilth and conservation; soil as a dynamic system; biological components and structure; how management practices improve, maintain, or destroy soil structure and tilth; agronomic practices that maintain soil health and diversity in micro and macro organisms; fertility management that improves crop utilization of soil nutrients and minimizes nitrate contamination of fresh water; importance of soil as an essential resource

6. **Soil water**—Scarcity and importance of water as a natural resource; need for conservation; irrigation issues; implications of aquifer depletion, salination; groundwater contamination; tiling; wetlands

7. **Tillage and seeding**—Conservation tillage to reduce soil, water loss (including minimum, ridge, and no till); how to reduce tillage, erosion; residue management to improve water conservation and control weeds; setting and meeting production goals in environmentally responsible manner

8. **Plant breeding**—Contributions of indigenous farmers; breeding for disease tolerance and adaptation to low input crop production systems; preserving genetic diversity; intellectual property rights and ethics

9. **Seed and grain quality**—Seed coatings to reduce environmental hazards of traditional seed treatments; management factors to maintain grain quality without chemical use; seed quality to reduce weed pressure and chemical control

10. **Weeds**—Role of weeds as plants with important contributions to ecosystem; harboring germplasm for the future; herbicides and sustainable crop production; tolerance levels and integrated pest management as part of overall management system; biological, cultural, and mechanical methods, including preventive strategies; reducing/localizing chemical use; weed species

11. **Insects**—As part of an ecosystem, both beneficial and pest status; as pollinators, nutrient recyclers, predators, parasites; chemical insecticide issues; integrated pest management, including cultural, biological, preventative strategies for control in crops; common crop insect pests and management strategies

12. **Crop diseases**—Microorganisms as decomposers in nutrition, nitrogen cycles; difference between pathogenic and beneficial microorganisms and impact of control strategies on non-targeted microorganisms; agro-ecosystem management to reduce chemical use, pathogens; decreasing the need for chemical control

13. **Crop harvesting and storage**—Grazing, rangeland, pasture systems that balance land resources, plant diversity, animal numbers; consequences of exceeding land's grazing capacity; maintaining crop harvesting and storage quality without chemicals
Evaluation

Project investigators surveyed some 70 students to evaluate the effectiveness of this redesigned course. A questionnaire was developed and administered in spring 1994; follow-up is planned during the coming year once the revised textbook and video set are completed. The questionnaire was designed to assess the impact of the course on awareness and changes in attitudes toward the environment.

The following criteria were established to gauge project success:

- 75% of the students will increase their awareness of environmental concerns and sustainability issues in crop production.
- 50% of the students will have changed their perception of sustainability in agriculture.
- 80% of the students will value course materials revision for developing greater understanding of environmental and sustainability issues in agriculture.

The survey questions and results follow:

1. Has this course increased your awareness of environmental concerns related to agriculture? **89% reported an increase in awareness of environmental concerns.**
2. Has this course increased your awareness of practices that help and hinder the long-term sustainability of agriculture? **93% reported an increase in awareness of practices that help and hinder long-term sustainability.**
3. Has this course changed or modified your perceptions of environmental and sustainable agriculture concerns? In what way? **71% reported a change in their perception of environmental and sustainable agriculture concerns.**
4. How would you rate the attitude of the course toward environmental concerns and sustainable agriculture practices? The instructor's attitude? **90% rated the instructor's attitude as having a positive and embracing attitude toward environmental concerns and sustainable agriculture.**
5. Have the completed video units been useful learning materials for you? **93% reported that the video units were useful learning materials.**
6. How would you rate the completed videos in terms of the attitude they convey toward environmental concerns and sustainable agriculture practices? **85% rated the videos as having a positive and embracing attitude toward environmental concerns and sustainable agriculture.**

Students also provided numerous comments to augment their numerical ratings.

Evaluation results clearly indicate that the course revision efforts have successfully integrated environmental and sustainability issues into a previously conventional crop production course. Three groups of students were identified through student response analysis: (1) environmentally sensitive students; (2) environmentally uninformed students; and (3) students with a production-oriented view of agriculture. (Students were grouped into these categories based on their written statements and their own perceptions of their attitudes coming into the course. If there was no indication of their prior attitude, they were not included in group comparisons.) Students in all groups indicated positive attitudes toward the project's integration of environmental issues and sustainable practices. These results indicate that the model of integration outlined in this project did not alienate students with different backgrounds and viewpoints, but in fact developed understanding among groups. This approach may be an effective tool to educate agricultural and non-agricultural personnel in identifying and responding to the challenges of a sustainable agriculture.

Implications

Agronomy 114 at Iowa State University has an annual enrollment of 500 students, making it one of the largest agronomy classes in the United States. The course is required by most majors in the College of Agriculture, so it has significant potential to instill in students an appreciation for the environment in the con-
The videotapes produced as part of this curriculum are available to universities and community colleges.

For more information contact E. Mullen, Agronomy, Iowa State University, Ames, Iowa, 50011, (515)294-3271.

This course is also being converted to video-enhanced teaching. The video tapes will be made available to community colleges and other major universities for teaching introductory principles in agronomy. In fact, Northeast Iowa Community College has already adopted the complete video series; they began incorporating the videos into their introductory agronomy course in fall 1994. In addition, American Cyanamid of Des Moines is beginning an in-house education program for employees using the video tapes. Several universities are using the Agronomy 114 textbook for their introductory courses as well; thus, this project's impact in sensitizing students to environmental issues and sustainable practices extends beyond ISU. In addition, a "bank" of video footage is now available for use in a range of educational programs.

This project enjoyed cooperation among Extension, several ISU departments, the National Soil Tilth Laboratory—USDA-ARS, and the Soil Conservation Service. Three of the textbook chapters—crop plant anatomy, soil water, and crop physiology—received awards from the American Society of Agronomy educational materials contest and from the Agricultural Communicators in Education.