Engaging Agriculture and Non-Agriculture Students in an Interdisciplinary Curriculum for Sustainable Agriculture

Mark Keating[1], Victoria Bhavsar, Herbert Strobel, Larry Grabau, Michael Mullen[2], and Mark Williams[3]
University of Kentucky
Lexington, KY 40546

Abstract

Interest in curricula addressing alternative agricultural production and marketing systems has grown among students and faculty at post-secondary institutions. In 2005, an interdisciplinary team from the University of Kentucky (UK) received a USDA Higher Education Challenge Grant to establish a curriculum in sustainable agriculture. In doing so, UK sought to join the growing number of post-secondary institutions with courses, concentrations and majors in alternative agricultural production and marketing systems. Some of these academic offerings arose as areas of specialized study within production-oriented agricultural science disciplines. More recent courses and programs tend to reflect a more holistic approach that incorporates social, economic, and natural resource management considerations. The UK team blended these approaches to produce a curriculum that would appeal to students within and beyond the College of Agriculture and support the transition of the state's small farmers to a post-tobacco economy. Combining the core elements of an agricultural science degree with requirements in the cultural dimensions of sustainability demanded clear definitions and priorities. The UK team adopted the USDA Sustainable Agriculture Research and Education Program's definition of sustainability as a management system that optimizes environmental, economic, and social resources to improve a farm's performance over time. Introduced in 2007, the curriculum combined requirements in agricultural, natural, and social sciences with an apprenticeship on an organically managed community supported agriculture project.

Introduction

Consumer demand for alternatively produced agricultural goods variously described as natural, organic, sustainable and/or local, has grown unabated for several decades. Today, the market for these products represents a growth category for specialty stores, food cooperatives, grocery chains, box outlets and direct marketing ventures such as farmers markets and subscription sales. For example, there were 5,274 farmers markets in the United States in 2009, nearly triple the number from 15 years earlier and a 13% increase since 2008 alone (USDA, 2009). Similarly, domestic organic food sales reached $22.9 billion in 2006, representing a 15.8% increase from the previous year (Organic Trade Association, 2009). Consumer research consistently identifies personal health and environmental protection as the primary incentives for purchasing alternatively produced foods (Gold, 2008). With the increasing public attention directed at these concerns, consumer demand for alternatively produced foods seems likely to continue.

Emerging social and economic trends provide fertile ground for new educational opportunities. As the early demand for natural and organic foods gained momentum after the 1960s, the opportunity arose to train farmers and other agricultural professionals to manage alternative production systems. By the late 1980s, a number of post-secondary agricultural educational institutions were adapting existing courses and curricula to reflect alternative principles and practices (Rodale Institute, 2009; Thompson, 2009). These initiatives typically evolved within one or more production-oriented departments such as soil and/or plant science, horticulture and agronomy that were simultaneously researching field application of alternative production systems. The pioneers behind these efforts commonly collaborated with peers departments including entomology and microbiology that were integral to their field research. The resulting academic offerings had a topical focus such as integrated/ecological pest management and biological/low-input soil management. While more interdisciplinary than traditional agricultural science classes and curricula, some programs retained a relatively narrow focus on production itself, albeit in an alternative system. Course content and curricula requirements focused almost exclusively on the core agricultural and natural sciences

The maturation of the alternatively produced

[1]Lecturer University of Kentucky College of Agriculture between January 2006 and May 2009; currently Agricultural Marketing Specialist, USDA National Organic Program, 1400 Independence Ave SW, Washington D.C. 20250; E-mail: mark.keating@ams.usda.gov
[2]Associate Provost, Office of Undergraduate Education
[3]Corresponding Author: Associate Professor, Department of Horticulture, N-322D Agricultural Science North; Phone: 859-257-2638; E-mail: mawillia@uky.edu

foods market in the new millennium has fostered a growing appreciation for a systems approach to agriculture highlighting the connections between farmers, the environment, and society. Rather than seeing farming as an isolated specialization reserved for a dwindling percentage of the population, this new model assigns agriculture a central role in addressing significant economic, resource conservation and human health concerns. The principles of the Sustainable Agriculture Research and Education (SARE) Program, established in the 1990 Farm Bill, reflected this broader understanding of agriculture as a focal point for social organization. SARE defines the goals of sustainable agriculture as providing more profitable farm incomes, promoting environmental stewardship, and promoting stable, prosperous farm families and communities (SARE, 2005). Through this more holistic understanding, a host of disciplines that had previously been considered tangential to commercial agriculture became integral. Educational institutions responded by incorporating requirements including sociology, health and nutrition, rural development and agricultural or environmental policy into the study of sustainable agriculture (Anon., 2006). Though rich in agricultural heritage and resources, the agricultural sector in Kentucky was relatively slow in responding to the economic opportunities presented by alternatively produced foods. This record may be attributable to the federal tobacco program which provided the majority of the state's small farmers with a stable return on investment and a familiar set of production challenges. However, finalization of the tobacco buyout in 2004 ushered in a new era in which Kentucky's small farmers would increasingly need to look to other crops for revenue, or quit farming. While partially offset by buyout payments, revenue from the sale tobacco in Kentucky dropped by $150 million in the first year of the settlement (Snell, 2005). As a result, tens of thousands of Kentucky farmers, especially smaller producers in the eastern and central regions of the state, could no longer raise tobacco profitably and ceased doing so.

The search for economically viable alternatives to tobacco production prompted a team of UK faculty to propose the creation of a new curriculum in sustainable agriculture that would capitalize on the rapidly expanding market for foods characterized as natural, organic, sustainable, and /or local. The team also established three criteria that would ultimately differentiate their results from the more production-centered courses and curricula offered at other institutions. Specifically, the curriculum should (i) extend beyond production practices related to the field and barn and incorporate significant requirements in the social sciences, including economics; (ii) the curriculum should attract a substantial number of students from non-agricultural backgrounds whose involvement would mirror a broader commitment from the state's urban and suburban populations to support agriculture; and (iii) require students to gain hands-on experience in the practical application of alternative production practices.

Methods

A USDA Higher Education Challenge Grant (HECG) awarded in June 2005 enabled the UK faculty team to bring their sustainable agriculture curriculum initiative to fruition. The core group that wrote the grant expanded to form the Sustainable Agriculture Curriculum Committee (SACC) that included faculty members from six departments from the College of Agriculture (Agricultural Economics, Animal and Food Sciences, Entomology Forestry, Horticulture, Plant and Soil Science) and two from outside (Sociology and English). A staff member with expertise in pedagogical practice from the University's Teaching and Academic Support Center had been the lead author on the HECG grant and stayed on as a member of the SACC. The Committee began meeting regularly in early 2006 to determine which existing courses to include in the new curriculum and how to structure the new courses needed to fill in the gaps.

The SACC's first undertaking was to resolve the uncertainty associated with the relatively new term "sustainable agriculture." Some proponents of change in agriculture portray the concept of sustainability as a significant departure in our approach to keeping farming viable (National Research Council, 1989). Others from a more conventional background often wonder what farmer wouldn't plan on being "sustainable," if that meant being able to farm in the future. Without a clear, widely applicable, and readily recognizable definition for "sustainable agriculture," designing a coherent and comprehensive curriculum for the subject would be problematic. The SACC determined that using the SARE model of sustainable agriculture would maximize interest in the curriculum and foster the consensus on agriculture's role in the community that they sought to promote.

One significant benefit of defining sustainable agriculture as a voluntary management system is avoiding the judgmental premise that a particular farm either is or is not sustainable. Instead, sustainable agriculture is presented as a tool for measuring whether or not a farm is progressing towards the economic, environmental, and social goals identified by the farmer. Applying a consistent yardstick over an extended period of time provides a clearer understanding of what works for farmers and what doesn't. This approach makes sustainable agriculture relevant to all farmers because it can be applied to farms of every size and design. It also explicitly acknowledges the critical role on the non-farming community as an integral partner in the long-term viability of individual farms as well as agriculture's contribution to society as a whole.

At the same time, the SACC was concerned that making the curriculum's focus too narrow would impede desirable cross-pollination with other academic disciplines. They sought to avoid the specialization found in agricultural education that has distanced many non-agricultural students, staff and faculty from the land grant mission (Karsten and O'Connor, 2002; Karsten and Risius, 2004). As a result, the committee sought to incorporate what have come to be seen as non-agricultural perspectives and pursuits into the curriculum (Parr and Van Horn, 2006; Parr et al., 2007). This approach was designed to expand and enrich the curriculum while building "agro-literacy" among UK community members who might not otherwise connect with the offerings in the College of Agriculture. The SACC also felt that this inclusive approach would contribute to broad-based community support for alternative agriculture that would be an important component of strengthening markets for the state's farmers.

The SACC also formalized the proposal from the HECG grant to require curriculum majors and minors to complete a two semester apprenticeship for credit at an organically managed community supported agriculture (CSA) project. The Sustainable Agriculture CSA would make an ideal tool for taking students deeper into sustainable agriculture while building new relationships across the campus and community (Falk et al., 2005). Part of operating a CSA is planning, planting, tending, and harvesting the produce, flowers, and herbs. To handle this work, students who complete the introductory courses in the curriculum move into organic horticultural production through a season long apprenticeship with experienced practitioners on the UK Department of Horticulture Research Farm. The farm would serve as a living laboratory for apprentices to synthesize their training in soil science, entomology, plant pathology, and other disciplines. Distribution is another part of a CSA and it provides ongoing opportunities to connect with student, staff, and faculty shareholders and, through the ripple effect, their lives beyond UK. The contents of the weekly share becomes its own kind of living laboratory, demonstrating just how flavorful, nutritious and diverse seasonally grown Kentucky produce, herbs, and flowers can be.

Results and Discussion

The SACC's core task was to devise a coherent and rigorous course of study providing a comprehensive understanding of sustainable agriculture that would culminate in a B.S. degree. The SACC elected to postpone the establishment of an independent major and instead utilized the College's Individualized Program option to expedite the launch of the program. This option allows students who receive approval from the Associate Dean for Instruction to design and complete a unique course to satisfy the College's B.S. degree requirements. While not formally establishing Sustainable Agriculture as a major, this approach would enable students to complete the designated coursework and graduate with a B.S. in Sustainable Agriculture. This approach would also allow the SACC or its successor to evaluate and potentially modify the curriculum's requirements before pursuing recognition as a discrete major. An interdisciplinary major established several years earlier in the College named Natural Resource Conservation and Management had been similarly introduced through the Individualized Program option.

Seventeen majors existed within the UK College of Agriculture when the SACC went to work on the Sustainable Agriculture curriculum. Students in each of the existing programs were required to complete GEN 100 "Issues in Agriculture" as well as the pre-major and major requirements specific to their major. In establishing its own set of pre-major and major requirements, the SACC began with fundamental coursework common to other programs including GEN 100, chemistry, and biology with their respective laboratories and mathematics. The additional pre-major and major requirements – Introductory Nutrition, Principles of Economics I and The Dynamics of Rural Social Life or Introduction to Sociology – reflected the new direction that the SACC was proposing. Other majors in the College included one of the Nutrition, Economics, or Sociology courses as requirements, but none included any two, much less all three (Table 1).

The SARE-inspired focus on integrating the economic, environmental, and social components of sustainable agriculture is most clearly reflected in the core course requirements (Table 2). Grouped into three clusters, these courses represent the upper level understanding of the diverse subject matter deemed essential to all Sustainable Agriculture majors. As a result, this is where decisions regarding the trade-off between depth and breadth that are implicit in designing an interdisciplinary B.S. degree played out. The Environmental Stewardship Cluster with its emphasis on production-oriented agricultural sciences contains the greatest number of required courses and credit hours. Whittling this group down to five courses involved the most difficult winnowing decisions involved in designing the curriculum. For example, the SACC considered but declined to include a Forestry course in this cluster. Another course that would naturally fit within this cluster, BIO 360 Introduction to Ecology, was instead designated as a Specialty Support requirement. In most other majors, students select 18 credits of Specialty Support with the consent of their faculty advisor. The SACC determined that its best option for satisfying the rigor threshold without raising the total number of required credits to an unacceptable level would be to infringe modestly on students' Specialty Support selections by making BIO 325 a requirement within this category.

Table 1. Pre-major and Major Requirements for the Sustainable Agriculture Major

Issues in Agriculture	Elementary Calculus and its Applications
General College Chemistry I	General Chemistry Laboratory I
General College Chemistry II	General Chemistry Laboratory II
Principles of Biology I	Principles of Biology II
Principles of Economics I	The Dynamics of Rural Social Life **OR** Introduction to Sociology
Introductory Nutrition	

Table 2. Cluster Approach to Course Requirements for Sustainable Agriculture Major

Environmental Stewardship Cluster*	Animal Science 382	Principles of Livestock Management
	Entomology 300	General Entomology
	Plant Science 366	Fundamentals of Soil Science
	Plant Science 404	Integrated Weed Management
	Plant Pathology 404G	Principles of Plant Pathology
Economic Profitability Cluster	Ag Economics 302	Agricultural Management Principles
	Ag Economics 305	Food and Agricultural Marketing Principles
	Ag Economics 445G	Intro to Resource & Environmental Economies
Social Responsibility Cluster	General Education 500	Agricultural and Environmental Ethics
	Sociology 360	Environmental Sociology
	Sociology 420 **OR** 517	Community Analysis **OR** Rural Sociology

*Biology 325 Introduction to Ecology is a required course closely related to the Environmental Stewardship Cluster that SAG majors must take to partially fulfill their Specialty Support requirements.

Taken separately, the Economic Profitability and Social Responsibility Clusters contain fewer courses and credit hours than the Environmental Stewardship Cluster. However, when combined they actually exceed those in the production-oriented cluster by both measures. This strong focus on the economic management and social connectivity embedded in the concept of sustainability made the overall curriculum genuinely interdisciplinary. No other B.S. program in the country oriented towards alternative systems requires a comparable quantity or high level of coursework outside of the traditional production-oriented departments. The SACC felt strongly that such an integrated approach would uniquely serve the small to medium-sized family farms across Kentucky in search of new ways to compete in a post-tobacco program world.

The SACC identified one existing and four new courses as additional requirements of the major (Table 3). The existing course, PLS 386 Plant Production Systems offered by the Plant and Soil Sciences Department was re-designed to incorporate alternative (generally non-chemical) weed management practices and was cross listed as SAG 386. Introduction to Sustainable Agriculture, SAG 101, was developed as an interdisciplinary course that provided a firm and clear foundation in the synergy between economic, environmental, and social conditions that drives the sustainability model. The SACC's intentions for SAG 201 Cultural Perspectives on Sustainability reflect the Committee's ambitious vision of the new curriculum as a bridge between, not just disciplines, but colleges. The course was designed to examine cultural dimensions within the concept of sustainability through a close reading of texts that address the relationship between people and nature. The course would explore the works of noted writers such Henry Thoreau, Rachel Carson, and Barbara Kingsolver on environmental themes addressing the interdependence between individuals, civilizations, and nature. SAG 201 had added importance since it was chosen to satisfy the Undergraduate Writing Initiative demonstrating proficiency in written language skills that every UK undergraduate had to complete successfully.

Apprenticeship in Sustainable Agriculture, SAG 397, represented another novel requirement of the major that linked production and marketing considerations. Students in this course work a minimum of 250 hours on a certified organic CSA operated by the Horticulture Department. Students are required to spread their hours over the spring and summer or summer and fall semesters to insure that they experienced a broad range of on-farm responsibilities. These responsibilities include all aspects of production as well as engagement with the CSA shareholders at the weekly distribution. The CSA model is recognized as growing in popularity in Kentucky with more than fifty such operations in business in 2009 and, along with other forms of direct marketing, provides a viable opportunity for many of Kentucky's family farms (Anon., 2009). Integration of Sustainable Agriculture Principles, SAG 490, was developed as a capstone course to bring together soon-to-graduate majors for a collaborative research or service-oriented project.

Table 3. Required Courses in Sustainable Agriculture

SAG 101 Introduction to Sustainable Agriculture
SAG 201 Cultural Perspectives on Sustainability
SAG 386 Plant Production Systems
SAG 397 Apprenticeship in Sustainable Agriculture
SAG 490 Integration of Sustainable Agriculture Principles

Table 4. Distribution of Credits within the Sustainable Agriculture Major

University Study Requirements	34
College of Agriculture Requirements	3
Pre-Major Requirements	6
Major Requirements	36
Sustainable Agriculture Core	16
Specialty Support	18
Free Electives	9
Total Credits for B.S. degree	**122**

Table 5. Course Requirements for the Minor in Sustainable Agriculture

Sustainable Agriculture Core	SAG 101 Introduction to Sustainable Agriculture	3
	SAG 201 Cultural Perspectives on Sustainability	3
	SAG 397 Apprenticeship in Sustainable Agriculture	3
Environmental Stewardship Cluster *Select One*	GEO 210 Pollution & Env. Management	3
	GLY 210 Habitable Planet	3
	ASC 382 Principles of Livestock Production	3
	PLS 210 The Life Processes of Plants	3
	PLS 366 Fundamentals of Soil Science	4
Economic Profitability Cluster *Select One*	AEC 302 Agricultural Management Principles	4
	AEC 305 Food & Agricultural Marketing Principles	3
	AEC 445G Introduction to Resource & Environmental Economics	3
Social Responsibility Cluster	SOC 360 Environmental Sociology **OR**	3
	GEN 501 Agricultural and Environmental Ethics	3
Total Credits for Minor		**21-23**

The complete listing of College and University credits needed to receive a B.S. in Sustainable Agriculture through the Individualized Program includes the Specialty Support credits that students select with the agreement of their faculty advisor to complement a subject area of particular interest (Table 4). These courses are chosen to provide expertise in a sub-specialization within the broader parameters of the major. After fulfilling their requirements to both their major and the University Studies Program, students have a minimum of 15 credits with which to select courses of their choosing. In an effort to make this subject of study available to a larger number of students, the SACC also designed a Sustainable Agriculture minor (Table 5). In addition to three required courses from the Sustainable Agriculture core, students in the minor must select one appropriate course from an Environmental Responsibility Cluster and an Economic Profitability Cluster. The requirement that minors in Sustainable Agriculture complete the time and energy intensive on-farm apprenticeship course significantly increased their exposure to and involvement in the community building exercise that the curriculum was intended to achieve.

Summary

Growing consumer demand for alternatively produced agricultural products and the economic vacuum resulting from the phase out of the federal tobacco support program prompted an interdisciplinary faculty team at the University of Kentucky to develop an undergraduate curriculum in sustainable agriculture. The new program was intended to expand opportunities for existing and new entry farmers by providing comprehensive training in alternative production and marketing practices. Additionally, the program was designed to prepare students including those from non-agricultural backgrounds for a variety of careers in which they would work to preserve farming's vital role in the state's economic and cultural life. The faculty team worked with the model of sustainability pioneered by the USDA's Sustainable Agriculture Research and Education Program that works by strengthening the connections between agricultural productivity, economic development, and environmental protection. The faculty team developed proposals for a broadly interdisciplinary major and minor in Sustainable Agriculture which required students to complete a two semester apprenticeship on the University's organically managed farm. On May 1, 2007, the UK University Senate approved the new Sustainable Agriculture core courses as well as the Sustainable Agriculture minor. Approval of the courses enabled students to receive a B.S. in Sustainable Agriculture through the Individualized Curriculum opportunity beginning in the fall 2007 semester.

Literature Cited

Anon. 2006. Facilitating sustainable agriculture: A participatory national conference on post-secondary education. http://casfs.ucsc.edu/education/conference/index.html#execsum.The Center for Agroecology and Sustainable Food Systems, University of California – Santa Cruz. Accessed November 25, 2009.

Anon. 2009. Directory of CSAs in Kentucky. http://www.localharvest.org/search-csa.jsp?st=19&ty=6&nm=. Local Harvest. Accessed December 6, 2009.

Falk, C.L., P. Pao, and C. Cramer. 2005. Teaching diversified organic crop production using the community supported agriculture farming system model. Jour. of Natural Resources and Life Science Education 34: 8-12.

Gold, Mary. 2008. Guide to organic market: Consumer and industry studies (2004-2008). http://www.nal.usda.gov/afsic/pubs/OAP/OAPGuide6.shtml#_Toc191694961.Alternative Farming System Information Center. Accessed November 25, 2009.

Karsten, H.D. and M.L. Risius. 2004. Development of an interdisciplinary agroecology major with input from surveys of students, graduates, and employers. NACTA Journal 48(1): 58-64.

Karsten, H.D. and R.E. O'Connor. 2002. Lessons learned from teaching an interdisciplinary undergraduate course on sustainable agriculture science and policy. Journal of Natural Resources and Life Science Education 31:111-116.

National Research Council. 1989. Alternative agriculture. Committee on the Role of Alternative Farming Methods in Modern Production Agriculture. Washington, D.C.: National Academy Press.

Organic Trade Association. 2009. Organic Trade Association's 2009 Organic Industry Survey. http://www.ota.com/pics/documents/01a_OTAExecutiveSummary.pdf. Accessed November 25, 2009.

Parr, D.M., C.J. Trexler, N.R. Khanna, and B.T. Battisti. 2007. Designing sustainable agriculture education: Academics' suggestions for an undergraduate curriculum at a land-grant university. Jour. of Food, Agriculture, and Human Values 24(4): 523-533.

Parr, D. and M. Van Horn. 2006. Development of organic and sustainable agricultural education at the University of California, Davis: A closer look at practice and theory. HortTechnology 16(3): 426-431.

Rodale Institute. 2009. Farming for Credit Directory. http://www.newfarm.org/depts/student-farm/directory.shtml. Accessed November 25, 2009.

Sustainable Agriculture Research and Education. 2005. What is sustainable agriculture? www.sare.org/publications/explore/index.htm. Accessed November 25, 2009.

Snell, W. 2005. Kentucky's Tobacco Economy – An Industry in Transition. http://www.uky.edu/Ag/AgriculturalEconomics/pubssearch.php?subtitle=Word%20Search&searcharea1=grouptype&searcharea2=title&searcharea3=keywords&searcharea4=alt_group&orderbywhat=nosort. University of Kentucky Department of Agricultural Economics. Accessed November 25, 2009.

Thompson, B. 2009. Educational and training opportunities in sustainable agriculture. http://www.nal.usda.gov/afsic/pubs/edtr/EDTR2009.shtml. Alternative Farming System Information Center. Accessed November 25, 2009.

USDA. 2009. Farmers Market Growth: 1994-2009. http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateS&navID=WholesaleandFarmersMarkets&leftNav=WholesaleandFarmersMarkets&page=WFMFarmersMarketGrowth&description=Farmers%20Market%20Growth&acct=frmrdirmkt. Accessed November 25, 2009.